Innovation Systems, Policy and Management

Innovation is a systemic phenomenon in which institutions, such as firms, government entities and public policy incentives, interact in complex ways. Targeting specific sectors of an economy in order to improve the competitiveness and capabilities of domestic firms, interventionist innovation policies can result in the structural transformation of host economies. Numerous examples exist of such policies working successfully in emerging economies and they can be applied to any economic sector, although they are commonly associated with highly innovative industries such as ICT, biotechnology and nanotechnology. 

Innovation Systems, Policy and Management describes how institutions and markets can best be structured in order to promote innovation in key economic sectors. Bringing together some of the leading figures in industrial policy and the economics of innovation and entrepreneurship, this book encourages the reader to think in terms of systems and business dynamics when analysing innovation behaviour, providing an approach useful to policy makers, business leaders and scholars of evolutionary economics.

Jorge Niosi is Professor Emeritus at the School of Management, University of Quebec at Montreal (UQAM), where he has been a professor since 1970. He was Canada Research Chair on the Management of Technology between 2001 and 2015 and has previously been director of CREDIT (Center for Research on Industrial and Technological Development) and CIRST (Centre for Inter-University Research on Science and Technology). He is the author, co-author, editor or co-editor of sixteen books, most recently Building National and Regional Innovation Systems (2010).
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Contributors

Fiorenza Belussi is Professor of Management at the Università di Padova, Italy. She completed her PhD in economics at the SPRU, in the United Kingdom, and has published in the Cambridge Journal of Economics, European Planning Studies, Industry and Innovation, Regional Studies and Research Policy among other journals. Her books include The Technological Evolution of Industrial Districts (2003). Her work has received over 1000 citations in SCOPUS and over 3000 in Google Scholar as of December 2016.

Gabriela Dutrénit obtained her PhD at SPRU (UK) and teaches at the Universidad Autónoma Metropolitana in Mexico. Her articles have appeared in Economics of Innovation and New Technology, Journal of Technology Transfer, Research Policy and Science and Public Policy. She is also the author of several books on the economics of innovation. Her work has received over 2000 citations in Google Scholar and close to 200 in SCOPUS. She has mostly studied innovation in developing countries.

Jan Fagerberg is Professor, both at the University of Oslo, Norway, where he is affiliated with the Centre for Technology, Innovation and Culture (TIK), and at Aalborg University, Denmark, where he is associated with the IKE Research Group (Department of Business and Management). He also has an affiliation with the Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE) at Lund University. Previous affiliations include the Norwegian Ministry of Finance and the Norwegian Institute for Foreign Affairs (NUPI). Fagerberg studied history, political science and economics before he graduated from the University of Bergen in 1980 with a degree in economics. He holds a D. Phil. from the University of Sussex (1989), where he was at the Science Policy Research Unit (SPRU). His research focused on the relationship
between technology innovation and diffusion on the one hand and competitiveness, economic growth and development on the other. He has also worked on innovation theory, innovation systems and innovation policy. His books include: *Innovation A Guide to the Literature* (2004), as well as *The Economic Challenge for Europe* (1999, with P. Guerrieri and B. Verspagen). He has published in the *Journal of Economic Geography, Journal of Evolutionary Economic, Research Policy* and *World Development*, among other journals.

Chris Forman is the Brady Family Term Professor at the Scheller College of Business, Georgia Institute of Technology, in the USA. He obtained his PhD at Northwestern University in 2002. His articles have appeared in *Journal of Urban Economics* *Information Economics and Policy*, *Information Systems Research*, *Journal of Urban Economics*, *Management Science* and *MIS Quarterly* and received over 2800 citations in Google Scholar and over 1000 in SCOPUS.

Andrea Ganzaroli is a researcher at the Università degli studi di Milano in the fields of economics and management of the firm. He has published over a dozen articles in refereed journals such as the *European Journal of Innovation Management, Technology Analysis and Strategic Management* and *Technological Forecasting and Social Change*.

Avi Goldfarb is Professor at the Rotman School of Management, University of Toronto, Canada. His articles have appeared in the *American Economic Review*, *California Management Review, Management Science, Journal of Economics and Management Strategy, Innovation Policy and the Economy* and the *Review of Industrial Organization*. His work received over 1000 citations in SCOPUS and over 4000 in Google Scholar.

Russell Golman is a professor at the Department of Social and Decision Sciences, Carnegie Mellon University, USA. He completed his PhD at the University of Michigan in 2014, and his research interests include game theory, decision theory, behavioural economics, mathematical modeling and complex adaptive systems. He has published articles in *Theory and Decision, RAND Journal of Economics, Journal of Evolutionary Economics, Journal of Economic Behaviour and Organization* and *Public Choice*. 
List of Contributors

Shane Greenstein is the Martin Marshall Professor of Business Administration at the Harvard Business School, Boston, MA, USA, and co-chair of the HBS Digital Initiative. He teaches in the Technology, Operations and Management Unit. Professor Greenstein is also co-director of the program on the economics of digitization at The National Bureau of Economic Research. He has published nine books and some 64 articles in refereed journals, such as *Industrial and Corporate Change, Journal of Law, Economics, and Organizations, Rand Journal of Economics* and *Review of Economics and Statistics*. He has received over 900 citations in SCOPUS.

Markus Grillitsch received his PhD from the Vienna University of Economics and Business. He teaches and conducts research at the Centre for Innovation at Lund University, Sweden, where he is an associate senior lecturer. He has published in *Annals of Regional Science, Economic Geography, European Planning Studies, Industry and Innovation, The Journal of the Knowledge Economy* and *Regional Studies*. His research areas are economic geography and innovation studies.

Alenka Guzmán completed her PhD in economics at Université Paris 3, France. She is a professor of economics at the Universidad Autónoma Metropolitana, México, Iztapalapa campus, and works in the area of economics of innovation and technological change. She has published several books on intellectual property and the pharmaceutical industry, as well as articles in *Comercio Exterior*, and other Spanish-language journals.

Martin Karlsson is a doctoral student at Linköping University, Sweden.

Steven Klepper was the Arthur Arton Hamerschlag Professor of Economics and Social Science at Carnegie Mellon University (CMU) in Pittsburgh, Pennsylvania. He has published numerous articles on strategy, innovation, entrepreneurship and industry evolution.

Staffan Laestadius is a professor at the KTH (Royal Institute of Technology, Sweden) in the field of industrial organisation.

Keun Lee is Professor at the Department of Economics at Seoul National University. His work has been published in the *Cambridge Journal of Economics, Industrial and Corporate Change, Research*
List of Contributors

Policy, Science, Technology Analysis and Strategic Management and World Development, and has received over 1200 citations in SCOPUS as of December 2016. Dr Lee is editor of Research Policy.

Ignacio Llamas-Huitrón completed his PhD in economics at Stanford University, and became a professor in the Department of Economics at the Universidad Autónoma de México, Iztapalapa campus. He is the author, co-author, editor or co-editor of ten books, and has authored over 40 articles in refereed journals, mostly in Latin America. He works on labour economics and the economics of education.

Edward Lorenz is Professor of Economics at the University of Nice Sophia Antipolis, France. He completed his PhD at the University of Cambridge and has published articles in Cambridge Journal of Economics, Industrial and Corporate Change, Industrial Relations and Politics and Society, as well as numerous book chapters and working papers. His work has received over 1000 citations in Google Scholar.

Franco Malerba is Full Professor of Applied Economics at the Department of Management and Technology at the Università Luigi Bocconi, Milan, Italy. He obtained his PhD in economics at Yale University. He is president of ICRIOS, Bocconi University, editor of the journal Industrial and Corporate Change, advisory editor of Research Policy and associate editor of the Journal of Evolutionary Economics. He has been president of EARIE (European Association of Research in Industrial Economics) and of the International Schumpeter Society. He has sat on the advisory board of Max Planck Institute of Economics-Jena, SPRU-Sussex University, CRIC-Manchester University, EU High-Level Panels for ‘New Innovation Indicators for Europe’ and for ‘A New European Innovation Policy’. He has been a visiting scholar at the Department of Economics, CEPR and SIEPR, Stanford University; Max Plank Institute-Jena; University of Queensland; University of Stellenbosch and Louis Pasteur University-Strasbourg. He has close to 4000 citations in over 110 articles in SCOPUS. Dr Malerba is among the editors of Research Policy.

Ben R. Martin is Professor of Science and Technology Policy Studies at the Science Policy Research Unit (SPRU) University of Sussex. He has carried out research on science policy for some 35 years. His work has appeared in Research Evaluation, Research Policy, Scientometrics,
List of Contributors

Technological Forecasting and Social Change and Technology Analysis and Strategic Management, among other journals. It has received over 10,000 citations in Google Scholar, and over 3400 in SCOPUS as of December 2016. He was Director of SPRU from 1997 to 2004. Since 2004 he has been the editor of Research Policy.

Mariana Mazzucato received her PhD in economics at the New School for Social Research in 1999, and is Professor at SPRU, the University of Sussex. She has published in Industrial and Corporate Change, Industry and Innovation, International Journal of Industrial Organization, The Journal of Evolutionary Economics and Small Business Economics. Her work has received over 260 citations in SCOPUS. Her authored books include The Entrepreneurial State (2013) and Firm Size, Innovation and Market Structure (2000).

Maureen McKelvey is a professor at the Department of Economy and Society, the University of Gothenburg, Sweden. Professor McKelvey’s research addresses innovation and entrepreneurship. Her work has appeared in Industry and Innovation, the Journal of Evolutionary Economics, R&D Management, Research Policy, Small Business Economics and Technovation and has received close to 4000 citations in Google Scholar and over 700 in SCOPUS as of December 2016.

Pierre Mohnen is a professor of economics of innovation at Maastricht University, The Netherlands. His research deals mainly with the measurement, the determinants, the effects and the interrelationships of R&D, innovation, ICT, competition and productivity. He has published numerous articles in American Economic Review, Industrial and Corporate Change, Industry and Innovation, Research Policy, Review of Economics and Statistics, Technology Analysis and Strategic Management and Technovation, among other journals.

José Miguel Natera, Universidad Autónoma Metropolitana, Mexico, is a young scholar who completed his PhD in the field of economics and management of innovation, and is a CONACYT Research Fellow in Mexico City. He has published in CEPAL Review, Research Policy and Structural Change and Economic Dynamics.
Jorge Niosi has been Emeritus Professor at the Department of Management and Technology, Université du Québec à Montréal, Canada, since 2016, where he has taught for some 45 years. He received his doctorate at the Ecole Pratique des Hautes Études in Paris in 1973. He is the author, co-author, editor or co-editor of 15 books, as well as some 60 articles in refereed journals including the *Cambridge Journal of Economics, Industrial and Corporate Change, Journal of Business Research, Journal of Development Studies, Journal of Evolutionary Economics, Journal of Technology Transfer, Research Policy, R&D Management, Small Business Economics, Technovation and World Development*. Among his books are *Building National and Regional Innovation Systems* (2010), as well as two books on *Canada's National System of Innovation*, and *Canada's Regional Innovation Systems* (2000 and 2005, respectively). His work had received over 1200 citations in SCOPUS and over 5000 in Google Scholar by December 2016. He has been president of the International Schumpeter Society (2014–16), visiting scholar at the Center for Economic Policy Research Stanford University (1995–96), as well as an invited professor in different universities in Finland, France, Italy and Spain since 1990.

Luigi Orsi, a professor of economics at the Università degli Studi di Milano, Italy, has published in *Research Policy, Technological Forecasting and Social Change, Technology Analysis and Strategic Management* and *Technovation*, among other refereed journals.

Sophie Pommet is Maître de Conférences in Economics at the University of Nice Sophia Antipolis. She specialises in new firms and venture capital. She has published in *Economic Letters*, the *Revue d'économie industrielle*, *Revue d'économie politique* and other French economic journals.

Martin Puchet Anyul is a professor of economics at Universidad Nacional Autónoma de México (UNAM), Mexico. He has published in *Structural Change and Economic Dynamics* and *Trimestre Económico*, among other SCOPUS journals.
List of Contributors xix

Sanika Sulochani Ramanayake is a doctor in economics from Seoul National University, works at the Indira Ghandi Institute of Development Research in India and is currently a post-doctoral fellow at the Department of Economics, Seoul National University, South Korea. She works with Dr Keun Lee, and has published in the Journal of the Asia Pacific Economy and the Millennial Asia Journal.

Fernando Santiago is an industrial policy officer at the United Nations Industrial Development Organization in Vienna. He has published on science, technology and innovation policy; the management of human resources for R&D in Mexico; linkages between academia-industry and industrial development. Santiago holds an MSc in Science and Technology Policy from SPRU, University of Sussex and a PhD in economics and Policy Studies of Technical Change from UNU-MERIT/University of Maastricht.

Michaela Trippl is Professor of Economic Geography at the University of Vienna, Austria. She received her PhD from the Vienna University of Economics and Business (Austria) in 2004. She has published in such journals as Economic Geography, European Planning Studies, Industry and Innovation, Regional Studies, Research Policy and Urban Studies. Her research and teaching have been dedicated to fields in economic geography, innovation studies and regional science with a focus on regional clusters, the geography of innovation, long-term regional structural change, labour mobility and regional development, spatial patterns and institutional foundations of the knowledge economy and regional innovation policies. Her work has received over 1000 citations in Scopus and over 3700 in Google Scholar as of December 2016.

Masaru Yarime received a BEng in Chemical Engineering from the University of Tokyo, an MS in Chemical Engineering from the California Institute of Technology and a PhD in economics and policy studies of technological change from Maastricht University in the Netherlands. Previously he worked as Senior Research Fellow at the National Institute of Science and Technology Policy (NISTEP) of the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). His visiting professorships include Groupe de Recherche en Économie Théorique et Appliquée (GREThA) of the
List of Contributors

University of Bordeaux IV in France and the Department of Science and Technology Studies of the University of Malaya in Malaysia. His work has been published in Science and Public Policy, Sustainability Science, Technological Forecasting and Social Change and other journals. His publications have received around 1000 citations in Google Scholar.
Preface

In the last quarter century, innovation has consolidated its role as the main factor behind economic growth, and innovation policy as the critical set of incentives that nurtures innovation. Also, the systemic approach, where economic agents have only partial and imperfect knowledge, has gained relevance as opposed to the neoclassical perspective that sees the economy and society as an aggregate of rational individuals maximising their personal welfare. The systemic perspective has flourished on the basis of the work of scholars from different disciplines that analyse the economy as a set of complex adaptive systems. Modelling and simulation replace the approach based on simple equations of known variables. Also in the complex-adaptive systems perspective, small-scale factors have large-scale results (the butterfly effect). Economic systems are adaptive: the system changes its behaviour as a response to the environment. Learning is a form of adaptation to the environment: the system changes its behaviour as a result of its interaction with the environment. The system incorporates some elements from its environment. An analogy would be the plant that climbs and adapts itself to the form of the support it finds.

Developing countries are often slow learners: they modify their response to external changes very gradually. Too often they adopt more efficient organisational patterns and technologies at a leisurely pace. Instantaneous adjustment only occurs in neoclassical models. In the real world, inertia and path dependence as well as slow and tortuous learning processes differ from prompt adjustment and growth.

In addition, following an external shock, systems do not always go back to their previous equilibrium; however, they can attain a new one, several equilibrium states in a row, none or even collapse. The catching up of developing countries – the normal unfolding of human societies according to conventional economics – is far from guaranteed. Instead,
catching up is only one possible adaptation of less-developed countries to the changing world economy. Other adaptations may include perpetual backwardness compared to more advanced countries, retrogress or even collapse and disappearance to become regions of larger and more successful nations.

In a nutshell, complexity and the complex adaptive systems (CAS) perspective provide a new and far more fertile, sophisticated and realistic approach to the economic world than conventional neoclassical economics. The economy is not seen in perpetual equilibrium but in continuous change, particularly due to the mutual adaptations of economic agents – individual as well as organisations – with one another. Agents develop strategies, and then change them if they are not successful, or if competition grows. Companies, regions and nations develop new products and new product families, and often neighbours imitate them. Imitation forces the original innovator to change strategies, develop new products or improve them. Often the latecomer becomes the new product – or product-family – leader, forcing the previous leader to innovate or disappear. Thus, perpetual change, but not perpetual stasis, is the substance of macro- and microeconomic analysis. Economic systems are complex adaptive ones, and they must be studied as such.
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Abbreviations

AEGIS Advancing Knowledge-Intensive Entrepreneurship and Innovation for Economic Growth and Social Well-Being in Europe
BFTB Bang for the buck
BRICS Brazil, Russia, India, China, South Africa
CIS Community Innovation Survey
CONACYT National Council for Science and Technology (Mexico)
DARPA Defence Advanced Research Projects Agency (USA)
DEA Data Envelopment Analysis
DMU Decision-making units
EAEPE European Association for Evolutionary Political Economy
ECHONET Energy Conservation and Homecare Network (Japan)
EMA European Medical Agency
EPO European Patent Office
EU European Union
FDA Food and Drug Administration
FDI Foreign direct investment
FIT Feed-in-tariff
GDP Gross Domestic Product
GEM Global Entrepreneurship Monitor
GERD Gross expenditure on R&D
GHG Greenhouse gas
GNI Gross national income
HEMS Home energy management system (Japan)
ICMM International Council on Mining and Metals
ICT Information and communication technology
IMIT Institute for Management of Innovation and Technology
INSERM National institute for health and medical research, France

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List of Abbreviations

ITRI  Industrial technology research institute, Taiwan
JPO  Japan’s Patent Office
KIBS  knowledge intensive business services
KIE  knowledge intensive entrepreneurship
KfW  Kreditanstalt für Wiederaufbau (Germany)
LDC  Less developed country
MITI  Ministry of Economy, Trade and Industry (Japan)
NEDO  New Energy and Industrial Technology Development Organization (Japan)
NIH  National Institutes of Health, USA
NIS  National innovation systems
NREL  National Renewable Energy Laboratory, USA
NTUA  National Technical University, Greece
OCCTO  Organization for Cross-regional Coordination of Transmission Operators (Japan)
OECD  Organization for Economic Cooperation and Development
ONERA  National Office for Aerospace Study and Research (France)
PEI  Innovation stimulus program, Mexico
PESTI  Public expenditure in STI
PNCyT  National policy for science and technology, Mexico
PPP  Purchasing power parity
REI  Relative Efficiency Index
RIS  Regional innovation system
SBIR  Small Business Innovation Research Act
SIS  Sectoral innovation system
STI  Science, technology and innovation
TEPCO  Tokyo Electric Power Holding Company (Japan)
UNCTAD  United Nations Council on Trade and Development
UCL  University College London
UNU-MERIT  United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology
USPTO  United States Patent and Trademark Office
WIPO  World Intellectual Property Organization
XIDEA  a software tool for the analysis and evaluation of decision-making units