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.

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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

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