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Preface

Innovation processes are influenced by many factors; they occur in interaction between institutional and organizational elements which together may be called 'systems of innovation'. The 'systems of innovation' approach has recently received considerable attention. It is considered by many to be a useful and promising analytical tool for better understanding of innovation processes as well as the production and distribution of knowledge in the economy. It also provides an appropriate framework for empirical study of innovations in their contexts. Furthermore, it is highly relevant from an innovation policy-making point of view.

Though the systems of innovation approach has great potential, it is also, like all new approaches, associated with conceptual and theoretical problems and weaknesses. As a means to sort out some of these problems and puzzles, I took the initiative and formed the Systems of Innovation Research Network in early 1994. Representatives from variants of the systems of innovation approach were invited to participate in the Network.

The objective of the Network was to contribute to building a more solid and sophisticated conceptual and theoretical foundation for the continued study of innovations in a systemic context. We wanted to stabilize and formalize the systems of innovation approach and thereby facilitate and elevate the quality of future empirical, theoretical, and policy-oriented work within the approach.

The Network met three times: in Vadstena, Sweden (June 1994), in Lanzarote, Spain (January 1995), and in Söderköping, Sweden (September 1995). Thus the Network participants were involved in continuous scientific dialogue over a considerable period. In Vadstena we discussed abstracts of papers, and in Lanzarote and Söderköping we discussed different versions of the developed papers – which are now chapters in this volume.

This book has three parts. Part I tries to sort out some conceptual problems. In Part II the systems of innovation approach is related to innovation theory. Part III is devoted to increasing our understanding of the functioning and dynamics of systems of innovation. These three parts will be discussed further in the general introduction. There are also shorter introductions to each of the parts, written by the co-editors of this volume, Björn Johnson, Esben S. Andersen, and Staffan Jacobsson.

We expect the readers of the book to be scholars and students from various social science disciplines who are interested in innovation and technical

change. The book has also been designed for people not yet familiar with the systems of innovation approach: in the introduction I have summarized and analyzed some important achievements that contributors to the systems of innovation approach have made in earlier literature. The circle of readers is also likely to include policy-makers dealing with R&D, innovation, and technical change. Because of the comprehensive and crucial macroeconomic consequences of innovation, policy-makers dealing with economic growth and employment issues should also be interested.

The Network activities were financed by the Axel and Margaret Ax:son Johnson Foundation, the Swedish Board for Industrial and Technical Development (NUTEK), and the Technology–Society Program of the Swedish Council for Planning and Coordination of Research (FRN). The Department of Technology and Social Change at Linköping University was also very supportive, administratively and in other ways. Thanks are especially due to Eva Danielsson whose organization skills contributed to the success of the Network's meetings. Many thanks also to Dawn House, not only for excellent language editing, but also for pointing out inconsistencies and flaws in logic. In addition Simon Ivarsson was prepared to work highly uncomfortable hours typing in numerous changes during the later stages of preparation of the book.

The most cordial thanks go to the authors who have contributed chapters to this book and also to those who added to the quality of the chapters by participating in the conference discussions.¹ In particular I want to thank the three co-editors for providing creative comments to the other authors at various stages of the Network's activities and for their imagination in helping to make the book coherent. I think we all agree that the Network activities were extremely rewarding 'interactive learning' experiences. I hope that those who read this book will gain as many new insights into the innovation process as we did!

Charles Edquist
Linköping
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¹ They include Olle Edqvist, Lennart Elg, Jean Guinet, Patrik Hidefjäll, David Mowery, Richard Nelson, Ulf Sandström, Rikard Stankiewicz, and Pekka Ylä-Anttila.

Systems of Innovation Approaches – Their Emergence and Characteristics

Charles Edquist

1. Introduction¹

It is almost universally accepted that technological change and other kinds of innovations are the most important sources of productivity growth and increased material welfare – and that this has been so for centuries. They are also a major cause of the destruction of old jobs as well as the creation of new employment.² 'Systems of innovation' is a new approach for the study of innovations in the economy that has emerged during the last decade. In this introduction I will discuss reasons why this approach is fruitful for studying innovation and technical change, and highlight some insights the approach provides into economic development. I will also review the historical development of the approach, outline its characteristics, and address the major arguments presented in this volume.

Innovations are new creations of economic significance. They may be brand new but are more often new combinations of existing elements. Innovations may be of various kinds (e.g., technological and organizational). The processes through which technological innovations emerge are extremely complex; they have to do with the emergence and diffusion of knowledge elements (i.e., with scientific and technological possibilities), as well as the 'translation' of these into new products and production processes. This translation by no means follows a 'linear' path from basic research to applied research and further to the development and implementation of new processes and new products. Instead, it is characterized by complicated feedback mechanisms and interactive relations involving science, technology, learning, production, policy, and demand.

Innovation processes occur over time and are influenced by many factors. Because of this complexity, firms almost never innovate in isolation. In the pursuit of innovation they interact with other organizations to gain, develop, and exchange

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² For supporting arguments see, for example, Abramovitz (1989), Denison (1985), Edquist and McKelvey (1992), Edquist (1993b), Edquist (1996), Nelson (1981), and Romer (1990).