Innovation, knowledge creation and systems of innovation

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Abstract. The main objective of this paper is to provide greater understanding of the systems of innovation approach as a flexible and useful conceptual framework for spatial innovation analysis. It presents an effort to develop some missing links and to decrease the conceptual noise often present in the discussions on national innovation systems. The paper specifies elements and relations that seem to be essential to the conceptual core of the framework and argues that there is no a priori reason to emphasize the national over the subnational (regional) scale as an appropriate mode for analysis, irrespective of time and place. Localised input-output relations between the actors of the system, knowledge spillovers and their untraded interdependencies lie at the centre of the argument.

The paper is organized as follows. It introduces the reader, first, to some basic elements and concepts that are central to understanding the approach. The characteristics of the innovation process are examined: its nature, sources and some of the factors shaping its development. Particular emphasis is laid on the role of knowledge creation and dissemination based on the fundamental distinction between codified and tacit forms. These concepts recur throughout the paper and particularly in discussions on the nature and specifications of the systems approach. The paper concludes by summarizing some of the major findings of the discussion and pointing to some directions for future research activities.

1. Introduction

At the turn of the century the world economy is undergoing a process of profound restructuring. Three developments have set the stage for this process. The first is a technological revolution, centering initially on telecommunications and microprocessors, but now extending to biological science that has created new industries and changed the methods that many established in-

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dustries employ for production and distribution. The second has been a managerial revolution, initially associated with the diffusion of Japanese techniques for quality control, team production and supplier relations, but now extending to many innovative forms of production employed around the world including increasing individualisation and diversification of working relationships. The third development, reinforcing the first two, is the considerable empowerment of capital accompanied by a decline of the influence of labour unions. Under these conditions nation-states and regions come increasingly under stress to sustain competitiveness and, thus, economic welfare.

Today, it is widely recognized that technological change is the primary engine for economic development. Innovation – the heart of technological change – is essentially the innovation process that depends upon the accumulation and development of relevant knowledge of a wide variety. Certainly individual firms play a crucial role in the development of specific innovations but the process that nurtures and disseminates technological change involves a complex web of interactions among a range of firms, other organisations and institutions.

The systems of innovation approach has recently received considerable attention as a promising conceptual framework for advancing our understanding of the innovation process in the economy. The approach contrasts with previous attempts such as the traditional OECD approach to technological change and innovation that focused on the R&D system in the narrower sense, primarily by analysing resource inputs and outputs of the system. A too narrow focus on R&D overlooks the importance of other types of innovative efforts in the business sectors and, thus, the innovative performance of low-tech sectors in the economy.

The main objective of this paper is to provide greater understanding of the approach as a flexible and useful conceptual framework for innovation analysis. It presents an effort to develop some missing elements and to decrease the conceptual noise often present in the discussions. The subsequent part of the paper examines the characteristics of the innovation process: its nature, sources and some of the factors that shape its development. It aims to introduce the reader to concepts that are central to understanding the systems approach and to emphasize the role of knowledge creation and dissemination.

A system of innovation may be thought of as a set of actors such as firms, other organisations, and institutions that interact in the generation, diffusion and use of new – and economically useful – knowledge in the production process. Institutions may be viewed as sets of common habits, routines, established practices, rules or laws that regulate the relations and interactions between individuals within as well as between and outside the organisations. Part 3 specifies elements and relations that are essential to the conceptual core of the systems of innovation approach. Territorially based systems build on spatial proximity – as either regional (subnational), national or global systems of innovation. Current research practice is focusing almost exclusively on the national scale in systems of innovation research (see for example, Lundvall 1992; Nelson 1993; OECD 1994; Edquist 1997a). But – as argued – there is no a priori reason to emphasize this particular spatial scale, irrespective of time and place. A strong case is made for the importance of the subnational scale as an appropriate mode of analysis. Localised input-output relations between the actors of the system, knowledge spillovers and their untraded inter-dependencies lie at the heart of this reasoning. The concluding part of the