

A systemic innovation policy framework

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This paper proposes a way to link four innovation-policy-relevant approaches that have been developed in the recent years based on the evolutionary, systemic view of innovation – into a consistent framework that helps to design policies that stimulate technological innovations. The approaches include: (i) the structural analysis of innovation systems (Nelson, 1993; Freeman, 1988); (ii) the functional analysis of innovation systems (Johnson, 2001; Hekkert, 2007; Bergek et al., 2008); (iii) the systemic problems (Smith, 2000; Jacobson and Johnson, 2000; Klein-Woolthuis et al, 2005); and (iv) the systemic instruments (Smits and Kuhlmann, 2004, Wieczorek et al., 2009¹).

The structural analysis of innovation systems is based on evaluating and comparing the composition and the structural elements of various innovation systems. The elements differ, depending on locational and institutional contexts and account for varying rates of innovation. Comparison of the systems structures (e.g. Schmoch, 2006) has thus been a way to analyse the determinants and blocking factors of innovation systems.

The functional approach focuses on the processes (rather than the structures) that are important for well performing innovation systems. The processes are categorised as functions of innovation systems: e.g. entrepreneurial activities, knowledge development or market formation, and they clarify the dynamics of the innovation systems. The functions have also been used as a basis for identifying innovation policies (Bergek, 2008).

The systemic problems are defined as all factors that block the operation and the development of innovation systems, for example: too weak or too strong networks, poorly articulated demand or institutional capacity problems. The systemic problems are often referred to as a new policy rationale replacing the neoclassical market failure.

The systemic instruments are methods and mechanisms used by government, political parties, business or individuals to organise, coordinate and direct innovation systems. Systemic instruments are designed for (a coherent part of) a specific innovation system and have the form of programmes encompassing also traditional policy instruments in a way that allow for effective addressing of systemic problems through stimulation of the following conditions: (i) prevent undesired and untimely lock-in or provide conditions for creative destruction; (ii) manage interfaces among actors; (iii) stimulate participation of

¹ Paper on systemic instruments within an ongoing PhD research, currently under revision.

relevant actors (esp. users); (iv) stimulate/create conditions for/ learning and experimenting esp. for demand articulation and vision development; (v) stimulate presence of hard and soft institutions; (vi) prevent too weak and too stringent institutions; (vii) provide an infrastructure for strategic intelligence; (viii) stimulate physical and knowledge infrastructure.

So far the four approaches have been developed relatively separately from each other or as criticism of one to another (functions vs. structure). For that reason they were also used individually to suggest ways in which innovation policy processes could be improved. They are however all of a different kind and show different aspects of policy process leading often to an incomplete policy advice. Bergek et al., (2008) recognised the importance of linking the innovation system structure with functions and with the 'blocking mechanisms' in a common framework for policy makers. That framework, however, does not link very clearly to the advances on systemic problems and instruments. It is also of a very general kind: it clarifies neither the way in which the approaches reinforce each other nor what prevents their complementarity.

This paper contributes to filling in this gap. It argues that the four approaches (innovation systems structure, functions, problems and instruments) could altogether complement each other and provide strong building blocks of a framework useful for design of policy that aims to stimulate technological innovations. The paper shows that both the structural and functional analyses of an innovation system are critical in evaluating whether the system functions well and what its direction is. The functional analysis complements the structural one by being a manifestation of a way in which innovation system is organised. A link between functions and structure is critical because functions, contrary to the structural elements, cannot be modified by policies. They can however be useful to signal that there might be a problem with the systems structure or any of its elements. In other words they help identify a systemic problem, which requires specific systemic instruments to be solved.

Before proposing the framework, however, this paper critically reviews each of the four areas and proposes categorisations of innovation system elements, functions, systemic problems and instruments, which reinforce their mutual complementarity and by this help building a consistent policy framework for stimulating technological innovations. This is because none of the four fields, in fact, is fully agreed upon in the communities that use them. For example, the innovation systems structure is not consistently referred to, some authors include infrastructure as an element, some not. Some authors consider infrastructure as institutions (Schmoch et al., 2006), some as material part of the system (Smith, 1997). Functions list include sometimes 6 of them as in the positions of Johnson (2001) or 7 as in the literature of Hekkert et al. (2007). They are also often differently conceptualised. Further, there are a number of various, not necessarily consistent, categorisations of systemic problems (failures) in the literature (OECD, 1997; Smith, 2000; Jacobsson and Johnson, 2000; Klein-Woolthuis et al, 2005). Similarly, first work on systemic instruments presented 5 'functions' that the instruments should stimulate while Wieczorek et al., (2009) advanced this work and proposed 8 'conditions'.

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