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Measuring systemic problems in National Innovation Systems. An application to Thailand

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ABSTRACT

The paper contributes to research on innovation systems in general and, in particular, to the current debate on rationales for innovation policy by providing a framework to identify systemic problems in a given system of innovation and test the framework empirically. The data were drawn from the Thai Community Innovation Survey in the period after which a major change in the country's innovation system policy had been initiated. By hierarchical factor analysis, systemic problems are identified and grouped into four components: institution, network, Science and Technology infrastructure and other support services. The analysis allows researchers to investigate the mismatch between policies and problems and identify policy gaps.

1. Introduction

Innovation system (IS) research is increasingly important to innovation policy making. Since the approach was flagged by the OECD in the mid nineties, an increasing number of governments have adopted IS explicitly in their innovation policies (Mytelka and Smith, 2002). However, applying the concept in practice is a daunting task (Chaminade and Edquist, 2006, 2010). Policies based on the IS approach often collide with old paradigms, rationales and instruments (Intarakumnerd and Chaminade, 2007) and, more often than not, end up being one-size-fits-all-policies rather than policies that take the specificities of the system into account.[1] One of the reasons for this is that we know too little about how to *identify* and *measure* specific problems in the system (if at all possible), despite several fruitful attempts to *define* them.

The literature on national systems of innovation (Lundvall, 1992; Edquist, 1997; Nelson, 1993; Freeman, 1987) and more specifically the strand of literature dealing with rationales for innovation policy (Lipsey and Carlaw, 1998; Smith, 2000; Chaminade and Edquist, 2006), has defined systemic problems as systemic imperfections that might slow down or even block interactive learning and other activities that are crucial parts of innovation process in a certain system of innovation (Woolthuis et al., 2005, 610).

Despite the prior efforts to *define* what systemic problems are (Carlsson and Jacobsson, 1997; Norgren and Hauknes, 1999; Smith, 2000; Woolthuis et al., 2005), to our knowledge, no attempt has been made thus far to empirically *identify* or *measure* problems in a specific system of innovation. This paper aims at contributing to filling this gap by analysing problems in the Thai innovation system. Thailand is an interesting case study, since the country, unlike the East-Asian Tigers, is a less-successful country in terms of technological catching up with the forerunners. It has also been a latecomer in trying to adopt and implement the IS approach, despite suffering from very clear systemic problems (Bell, 2002; Intarakumnerd et al., 2002). The paper investigates whether there is a mismatch between the systemic problems of the Thai innovation system and the innovation policies implemented in the country since 2001.

In doing so, we use data from the Thai innovation survey in 2003 which seems to allow a sufficient time lag for our analysis to identify systemic problems after a major political transition starting in early 2001, i.e., changing from a traditional research-based policy (pre-Thaksin administration) to a more explicit innovation

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[1] Todtling and Trippl (2005), for instance, argue that there is no "ideal model" for innovation policy and discuss how it can be tailored to specific conditions in different regions.

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system policy (Thaksin era). The Thai innovation survey has a particular advantage as it contains several detailed questions[2] that seem to allow identification of some of the systemic problems in Thailand. We employed hierarchical factor analysis in identifying institutional, S&T infrastructure, support services and network components/problems. These system components were then linked to a qualitative description of the real situation in Thailand in the discussion of whether there is a mismatch between Thai innovation policy instruments and the systemic problems captured.

The rest of the paper is organised as follows. In the next section, we give a brief summary of the IS approach and discuss its implications for innovation policy, and we introduce some major systemic problems as the prior studies pointed out. Section 3 provides an overview of the Thai innovation system and policy. Section 4 gives a general account of the Thai innovation survey and describes the dataset used and the questions selected to capture system subcomponents and system components. In Section 5, we provide descriptive evidence, present our hierarchical (two-stage) factor analysis, identify and measure problems of the innovation system and discuss them in the light of the recent transformation of the Thai innovation system and innovation policy. Section 6 matches the systemic problems found with some of the main current policies in Thailand. The paper is rounded up in Section 7 with conclusions and some final remarks.

2. Innovation systems and innovation policy

2.1. Main assumptions of the innovation system approach and policy implications

Since the seminal works of Freeman (1987), Lundvall (1988, 1992), Nelson (1993) and Edquist (1997) in the eighties and the nineties, the innovation system approach has gained much scholarly attention and has been largely adopted by practitioners and policy makers in both developed and developing countries (Lundvall et al., 2006; Muchie et al., 2005; Mytelka and Smith, 2002; Edquist and Hommen, 2008). In this framework, the innovation process is seen as sophisticated, involving various dynamic arrangements and links between system components, which essentially enables knowledge sharing and other support for the firm's innovation activities. Systemic agents and components, such as firms, users, universities, public organisations, institutions and so on, usually vary from region to region, sector to sector and country to country (Lundvall, 1988, 1992). Learning might stem from internal research and interactions with Science and Technology providers (Science and Technology to Innovation – STI mode of learning) as well as from daily working routines, i.e., learning by Doing, Using and Interacting (DUI mode of learning) (Jensen et al., 2007).

The general policy implications of the IS approach are different from those of the neoclassical theory in terms of rationales (Chaminade and Edquist, 2010), objectives and instruments (Borrás et al., 2009) for policy-making. The major conflict between the IS and neoclassical approaches to innovation policy stems from the rationales for public intervention. Scholars in the neoclassical tradition suggest that the policy maker needs to intervene in case of market failure, i.e., when the market cannot reach or return to an optimal equilibrium. According to this approach, the policy maker acts as if he or she has an entire set of accurate, necessary information at hand and, therefore, can supply a general set of rationalised solutions to direct the firm's behaviour and other market conditions (Metcalfe, 1995a,b), with the main goal to bring the economy (back) to a Pareto optimum.

The proposal from the IS perspective is, on the other hand, not to base the policy rationale on market failures (Lundvall and Borrás, 2004), but instead on systemic problems.[3] The scholars in the IS and evolutionary economics traditions reject the notion of optimality (and thus that of equilibrium or failure).[4] Innovation process is path-dependent and context-specific, and it is not possible to specify an ideal or optimal IS (Chaminade and Edquist, 2006). Policy making (on the evolutionary basis), thus, needs to be adaptive and experimental, but not optimising (Metcalfe, 1995a). The IS scholars put forward that since the concept of optimality is not to be applied, policy makers are expected to intervene when the system cannot achieve the objectives of supporting the development, diffusion and use of economically useful knowledge and innovations (Edquist, 1997; Lundvall, 1992), i.e., when some systemic problems exist.

Some may interpret that the hidden assumption in this logic is that policy makers have complete information and would know what the problems of the system are. This is far from reality. Policy makers have very limited information about the functioning of their system of innovation. As a consequence, policy makers have to attempt and reattempt to implement different policy options that may influence the firm's (innovative) behaviour as well as other actors in the system. This evolutionary process is obviously characterised by a large extent of trial and error (Metcalfe and Georghiou, 1998). The very issue in this context is "how well policy makers learn and adapt in the light of experience" (Metcalfe, 1995a, 31), and how well can they analyse and interpret the (limited) information that they have on their innovation system.[5]

2.2. Systemic problems and their identification

Although the literature on systemic problems is scarce and dispersed, attempts have been made to *theoretically* discuss some potential major problems in the system all related to either the components of the system (organisations, institutions or relationships) or to the evolution of the system over time, although none of the studies hitherto offer any empirical evidence of such problems or suggest how they can be identified empirically.

Although almost each author has his or her own list of potential systemic problems, they can be pinned down to infrastructure problems, capability problems, network problems, institutional problems and transition and lock-in problems (Chaminade and Edquist, 2006).

Infrastructure problems refer mainly to an inadequate provision of research and innovation infrastructure. From the policy perspective, there might be a research infrastructure problem if, for example, the universities lack capabilities to conduct research; if there are not R&D centres; if the links between university and

[2] These include the questions on, for example, institutional support and innovation environment not available in the standard Community Innovation Surveys (CISs) in Europe.

[3] As indicated in Chaminade and Edquist (2006), we prefer the term 'system problem' to 'systemic failure'. This is to avoid any possible connection with the neo-classical notion of "optimality".

[4] One may argue that to apply the evolutionary theory alone is already sufficient in setting a sound framework for innovation policy making. In our view, many of its theoretical elements might be difficult for policy makers to comprehend and, for this reason, the IS concept, which has proved central to the evolutionary approach (Metcalfe, 1994), is nowadays essentially used as a language tool for the communications between IS and evolutionary, theorists/researchers as well as policy makers.

[5] This paper is related to this last purpose. We do not claim that we are proposing a method to identify systemic problems as this will imply that we have perfect information about the system. Rather, we propose a method to better explore and analyse existing information to provide a better (but not optimal) picture of some problems in the system.