



# Entrepreneurial propensity of innovation systems: Theory, methodology and evidence

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## ABSTRACT

This paper develops theoretically, methodologically and empirically the notion of the entrepreneurial propensity of innovation system by integrating knowledge intensive entrepreneurship (KIE) and innovation system (IS) concepts. It first uses a composite index methodology to measure knowledge intensive entrepreneurship and entrepreneurial opportunities at the national level. It then applies cluster analysis based on composite indexes for the EU countries in order to group them by entrepreneurial opportunities. We also assess the influence of a system's complementary activities on the emergence of KIE by partial least squares path modelling (PLS-PM) method. PLS demonstrates that the EPIS is statistically sound concept and that KIE is affected by market, technological and institutional opportunities. The paper provides empirical evidence that institutions affect knowledge-intensive entrepreneurial experimentation not directly but via technology and markets. KIE is market driven process; however, its overall effects are determined not solely by market opportunities but by interaction of market with technological and institutional opportunities. Hence, we show that KIE is a *systemic* feature of IS and that new knowledge, innovation and entrepreneurship are inseparable elements of a dynamic IS.

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## 1. Introduction

The dominant perspective on entrepreneurship views it as a nexus of enterprising individuals and valuable opportunities. Individual differences are seen as crucial in the discovery of entrepreneurial opportunities. In this perspective (the 'individual–opportunities nexus' perspective, I–O), entrepreneurship is the key property of individuals which enables them to discover and exploit new opportunities (Miller, 1983; Covin and Slevin, 1989; Lumpkin and Dess, 1996, 2001; Shane and Venkataraman, 2000; Shepherd and DeTienne, 2005; Lumpkin and Lichtenstein, 2005; Wiklund and Shepherd, 2005, 2008; Mitchell and Shepherd, 2010). The philosophical basis of this perspective is rooted in methodological individualism or the idea that 'social phenomena must be explained by showing how they result from individual actions, which in turn must be explained through reference to the intentional states that motivate the individual actors' (Heath, 2011:1).

Recently, there has been a noticeable shift away from the I–O nexus perspective towards a more eclectic understanding

of entrepreneurship. For example, Audretsch and Monsen (2008: 47) discuss factors which influence the capacity to generate entrepreneurial activity at different levels. These factors would be personal (individual level), inter-personal (team level), organisational (firm level), and related to networks (industry level). Some recent studies at a meso (industry) level have investigated why some industries host more new growth firms than others and concluded that the reason may lie in the fact that technological innovation is an important determinant of entrepreneurial opportunity and performance (Audretsch et al., 2008; Eckhardt and Shane, 2010). The introduction of databases such as the Global Entrepreneurship Monitor (GEM) has enabled research on the impact of technological entrepreneurship on economic growth to be tested at the levels of country, industry or firm (Yli-Renko et al., 2001; Acs and Varga, 2005; Minniti et al., 2005; Wong et al., 2005). However, despite the use of a multi-level perspective the research on entrepreneurship is methodologically rooted in individuals' behavioural characteristics. As pointed out by Heath (2011:7) 'too much emphasis on the action-theoretic perspective can generate its own fallacies . . . (or) assumptions about what must be going on at the aggregate level.' The explanations of social processes in terms of individuals alone are, following Hodgson (2007: 222) 'both prominent and problematic.' In mainstream perspective entrepreneurship is often framed as stock within production function approach (Audretsch and Keilbach, 2004, 2007). It is assumed that factors are independent of each other. This is quite different

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from our approach which looks at entrepreneurship as the property of innovation systems, not as stock that exists independently of other elements of the innovation system (Kirzner, 1973, 1980).

In this paper, our point of departure is that entrepreneurship is not only the property of individuals but also of economic and innovation systems (IS). By this we mean that there are significant differences in the entrepreneurial propensities of different innovation systems which cannot be explained by recourse to individual differences interacting with external institutions. In the paper, we quantify the scale and scope of an alternative systemic perspective on entrepreneurship. In Radosevic (2007, 2010, 2011) and Radosevic et al. (2010), we developed a conceptual perspective and methodology for exploring entrepreneurship from a systemic perspective. From an IS perspective, entrepreneurship is not only the property of enterprising individuals but also of systems of innovation. Entrepreneurship activity is a social activity which is dependent on structural features of the economic system and on social processes and mechanisms. From an entrepreneurship perspective, the key structural feature of an economic system is its capacity to generate different entrepreneurial opportunities independent of individuals' capacity to recognise and exploit them. In a nutshell, entrepreneurial activities and entrepreneurial propensities of the IS are not only derived directly from the behaviour of enterprising individuals but also from the structure of entrepreneurial opportunities and activities in the IS. The paper develops a conceptual framework, namely the concept of entrepreneurial propensity of innovation systems by integrating knowledge intensive entrepreneurship (KIE) into innovation system (IS) framework. We focus on KIE because of its close link to innovation which lies at the core of entrepreneurship.<sup>1</sup>

In this context, we seek to explore the following issues: What kind of entrepreneurial opportunities influence knowledge-intensive entrepreneurial experimentation? What are the relevant insights that can be generated based on a systemic perspective on entrepreneurship? In Section 2, we explain the notion of entrepreneurial propensity of IS (EPIS). In Section 3, we discuss data issues, develop a composite index methodology and aggregate a number of individually measured indicators (see also Appendix). Section 4 presents cluster analysis results for composite index constructs of entrepreneurial opportunities and knowledge-intensive entrepreneurship before applying partial least squares path modelling (PLS-PM) to test our conceptual model (see Section 5). The conclusion section summarises the major points. It is important to highlight that we develop and compare two approaches to index construction. First is the composite index methodology (OECD, 2008) (Section 3) and second is the construct formation tested in a hierarchical measurement model (first order reflective–second order formative) with statistical validity testing (Bollen and Lennox, 1991a,b; Diamantopoulos and Winklhofer, 2001; Jarvis et al., 2003; MacKenzie et al., 2005; Diamantopoulos et al., 2008) (Section 4).

## 2. Conceptual framework: entrepreneurial propensity of innovation system (EPIS)

The entrepreneurial propensity of IS is its capacity to generate and exploit entrepreneurial opportunities in order to create new knowledge-intensive enterprises, new technologies (innovations)

and new knowledge (Radosevic, 2007, 2010, 2011; Radosevic et al., 2010). The underlying idea is that KIE is a systemic feature of IS and that new knowledge, innovation and new enterprises are inseparable elements of an entrepreneurial IS.

KIE is embedded in IS, which is composed of heterogeneous actors and networks of various types and is shaped by institutions (regulatory systems). Accordingly, it could be considered that entrepreneurship in general, and knowledge-intensive entrepreneurship in particular, constitutes not only one of the activities (or functions) of an innovation system (Edquist, 2005; Bergek et al., 2008) but also one of its core properties. In that respect, we can distinguish between entrepreneurial experimentation (i.e. new enterprises) as one of the inputs or activities in the IS and entrepreneurial propensity of IS as an outcome variable. In this latter aspect, entrepreneurship (cf. as property of IS) could be understood as a social process rather than solely an individual level activity undertaken by individuals who respond to external opportunities. We consider individuals as an important but over-rated 'factor' in the exploitation of opportunities: the opportunities to which individuals 'respond' are *not exogenous but are shaped by them*. For example, the 5000 programming hours invested by Bill Gates and other chieftains of IT industry as youngsters were a precondition to exploit opportunities that emerged later on (Gladwell, 2008). So, 'grasped opportunity' could not be really 'grasped' without actively creating it—i.e. shaping that opportunity.

The traditional innovation system approach focuses strongly on the components within the systems, i.e. organisations and institutions. Organisations are the players or actors, while institutions are the rules of the game, constituting constraints to the actions of the organisations or enablers of changes (Lundvall, 1992; Nelson, 1993; Breschi and Malerba, 1997; Malerba, 2004). In this research, we refer to 'activities' in innovation systems, which are regarded as the determinants of the development and diffusion of innovations (Edquist, 2005). We do not focus on the variety of organisational forms within and across IS but take a functional (activity) approach to IS (see Hekkert and Negro, 2009). The activities influence innovation processes both individually but also through mutual interaction. These determinants are not independent of each other, but instead support and reinforce – or offset – one another. Hence, in order to understand the entrepreneurial propensity of individual IS, we should study the relations among various determinants of innovation processes (i.e. between each of the activities). Highly complementary activities create a highly entrepreneurial system of innovation while mis-matching activities weaken the entrepreneurial propensity of IS. The more the different activities in the innovation system are congruent, the higher the entrepreneurial opportunities.<sup>2</sup>

Opportunities are at the core of entrepreneurship (Shane and Venkataraman, 2000; Shepherd and DeTienne, 2005; Lumpkin and Lichtenstein, 2005; Wiklund and Shepherd, 2005, 2008; Mitchell and Shepherd, 2010). What constitutes entrepreneurial opportunity is generally seen as unproblematic. The dominant perspective is that entrepreneurship is a nexus of enterprising individuals and valuable opportunities which ultimately leads to good firm performance (Miller, 1983; Covin and Slevin, 1989; Lumpkin and Dess, 1996, 2001; Wiklund and Shepherd, 2003; Salaran and Maritz, 2009). Individual differences and how they interact with external factors are seen as crucial in the discovery of entrepreneurial opportunities. Yet, we argue that from an IS perspective, entrepreneurial opportunities emerge when three major sources of opportunities

<sup>1</sup> In this respect we follow Schumpeter who distinguishes between the 'circular flow' of an economy and innovation driven growth which generates qualitative change. For Schumpeter, unlike for Kirzner, any new business is not necessarily entrepreneurship. Metcalfe (2004) also thinks that this stretches the notion of entrepreneur too far. For him, 'Many business ventures are copies of existing businesses whose function is to ensure the continuity of economic activities through time, they are based on knowledge of well established markets and practices, and in that sense bring nothing new to the economy' (Metcalfe, 2004: 34).

<sup>2</sup> This resonates well with the long-term perspective on economic growth based on complementarities as expounded by Freeman and Louca (2001) and with Kremer's (1993) O-ring theory of economic development.

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