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Knowledge-Intensive Innovative Entrepreneurship

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Foundations and Trends® in Entrepreneurship

Published, sold and distributed by:

now Publishers Inc.
PO Box 1024
Hanover, MA 02339
United States
Tel. +1-781-985-4510
www.nowpublishers.com
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2600 AD Delft
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Tel. +31-6-51115274

The preferred citation for this publication is

F. Malerba and M. McKelvey. *Knowledge-Intensive Innovative Entrepreneurship*.
Foundations and Trends® in Entrepreneurship, vol. 14, no. 6, pp. 555–681, 2019.

ISBN: 978-1-68083-519-9

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Volume 14, Issue 6, 2018
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Foundations and Trends® in Entrepreneurship, 2018, Volume 14, 4 issues. ISSN paper version 1551-3114. ISSN online version 1551-3122. Also available as a combined paper and online subscription.

Contents

I	Introduction to KIE	3
1	Introduction	4
1.1	Introducing KIE	4
1.2	Positioning KIE Through Three Starting Points	7
1.3	A Roadmap	14
II	KIE: Theory, Definitions, Measurements	16
2	Theoretical Foundation and Conceptualization of KIE Entrepreneurship	17
2.1	The Three Theoretical Building Blocks	17
2.2	A Theoretical Definition of KIE Firms	27
3	Conducting Research on KIE: Empirical Definition and Operationalization	29
3.1	An Empirical Measurable Definition of KIE	31
3.2	Operationalizing the Four Characteristics of KIE Firms . . .	31
3.3	Existing Research Designs: Surveys and Case Studies . . .	38

III KIE: Analytical Understanding and Empirical Evidence	41
4 Qualitative Understanding of KIE	42
4.1 Case Studies Relating Entrepreneurs to Knowledge, Innovation and Systems	43
4.2 Collaborative Research for Science and Technology	49
4.3 Case Studies of KIE in Sectoral Innovation Systems and Technologies	52
5 Quantitative Empirical Evidence on KIE	60
5.1 The Relevance of KIE Within the Population of New Firms	61
5.2 KIE and the Role of Knowledge, Innovation and Systems .	63
5.3 KIE and National Innovation Systems	72
5.4 KIE and Sectoral Innovation Systems	79
5.5 KIE in Low and Medium-Tech Industries	85
5.6 Taxonomies of KIE Firms	88
6 Towards a Process Model and Future Research Directions	93
6.1 A Process Model of KIE Entrepreneurship	93
6.2 Trajectories of Future Research	97
Acknowledgements	102
References	103

Knowledge-Intensive Innovative Entrepreneurship

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ABSTRACT

The interplay between innovation, knowledge and entrepreneurship constitutes a major driver of the economic, social and cultural development in modern societies and has major implications for public policy. To understand these broad trends, a novel literature on knowledge-intensive innovative entrepreneurship has recently emerged. In this book we provide a presentation of the key concepts, the relevant empirical findings and the main specific insights. We take a Schumpeterian, evolutionary and innovation system view of entrepreneurship, knowledge and innovation. In the conceptual framework proposed in this book, knowledge-intensive innovative entrepreneurs are involved in the creation, diffusion and use of knowledge; introduce new products and technologies; draw resources and ideas from the innovation system in which they operate; and introduce change and dynamism into the economy. This volume provides detailed insights into the progress made in defining and understanding

knowledge-intensive innovative entrepreneurship both theoretically and empirically; in discussing the current analytical understanding and empirical evidence; and in proposing the key directions and topics for future research.

Keywords: entrepreneurship; innovation; knowledge; innovation systems; evolutionary theory.

Part I

Introduction to KIE

1

Introduction

This volume examines knowledge-intensive innovative entrepreneurship, shortened as KIE. KIE firms are defined as new learning organizations that use and transform existing knowledge and generate new knowledge in order to innovate within innovation systems (Malerba and McKelvey, 2018a).

The emerging literature on KIE stresses the relevance of the knowledge-based economy, the central position of innovation in modern industries and services and the essential role of new firms in the economic growth of countries. Therefore, this volume puts forward the argument that KIE provides a modern view of entrepreneurship that links the intense use of knowledge by the new ventures with a high innovative activity related to the economy and markets.

1.1 Introducing KIE

Entrepreneurship as a domain of research is highly diverse and expanding, and one where leading scholars stress the need to continue developing underlying theories to better explain the phenomenon (Alvarez *et al.*, 2016; Carlsson *et al.*, 2013). Numerous articles and handbooks have attempted to define the wider field of entrepreneurship as a research field

as well as to characterize the phenomena and the appropriate lines of enquiry for future research (Bruyat and Julien, 2001; Carlsson *et al.*, 2013; Landström *et al.*, 2012; Shane, 2000; Shane and Venkataraman, 2000; Venkataraman *et al.*, 2012). Rather than surveying the very large literature on entrepreneurship in general or even entrepreneurship related to innovation and knowledge, this volume has a specific focus, namely a Schumpeterian inspired view on KIE. The overall view is presented at the end of this volume as a co-evolutionary process model of KIE.

In claiming that entrepreneurship drives economic development, Schumpeter (1934, 1942) focused our attention on how and why the activities of entrepreneurs create a disruptive, disequilibrium force in the economy, which in turn enables growth. More specifically, Schumpeter outlined the entrepreneurial function, whereby entrepreneurs play a key role in stimulating economic dynamism by using ideas and technical inventions, accessing finance and transforming those idea into technological, commercial and organisational innovations (Andersen, 2011; Kurz, 2012; Swedberg, 1991).

Researchers in the Schumpeterian tradition in entrepreneurship and small business economics have been involved in a number of relevant conceptual debates (Carlsson *et al.*, 2013; Landström *et al.*, 2012). These debates include whether opportunities are created or discovered (Alvarez *et al.*, 2013); whether entrepreneurs grasp existing opportunities or create new ones (Buenstorf, 2007; Shane, 2000); the extent to which new firms can challenge incumbents and transform the economic system by creating an entrepreneurial regime (Winter 1984; 2016); and the conditions stimulating entrepreneurial innovation (Acs and Autio, 2014; Autio *et al.*, 2014) and innovative entrepreneurship (Shane, 2009). Moreover, parts of the modern entrepreneurship literature recognize that knowledge – as gained through education, experience and so forth – affects how individual entrepreneurs are able to identify and react to opportunities (Aldrich and Yang, 2014; Alvarez and Barney, 2007; Ardichvili *et al.*, 2003; Shane, 2003). Therefore, the knowledge accumulated by the founders and teams within and across industries, as well as in scientific and research organizations, and in upstream or downstream activities, are vital for entrepreneurship survival and performance (Adams *et al.*, 2016; Agarwal and Shah, 2014; Klepper, 2016). Along these lines, the

emerging literature which has developed the empirical evidence and the conceptualization of KIE articulates the relationships between the entrepreneur (the person), the entrepreneurial firm (the organization), knowledge and the broader social and economic context (innovation system).

The existing conceptualization of KIE extends and integrates three theoretical building blocks constituted by Schumpeterian entrepreneurship, evolutionary economics and innovation systems. This perspective enables a conceptual understanding of both entrepreneurial and innovative processes, which are dependent upon different forms of knowledge in the economy. This emerging stream of literature on KIE includes a wide range of publication forms – from articles to books, as well as book chapters and working papers currently under review in journals. Because this emerging literature is rich and diverse, we have carefully chosen specific contributions and have grouped them into underlying themes. Rather than discussing all the work on entrepreneurship concerning knowledge and innovation, this volume presents selected and focused work on the topic of KIE.

The concept of KIE is also highly relevant for public policy which aims to stimulate knowledge, innovation and entrepreneurship. In recent decades, a community of researchers has been active in defining underlying concepts used by public policy. Early on, the focus was upon research and development (R&D), and its linkages to high-tech, medium-tech and low-tech industries, including the development of specific indicators and of arguments about the relative importance of high-tech industries in the economy (Hatzichronoglou, 1997). Later work continued the exploration of new indicators and understanding, by focusing upon different types of knowledge prevalent across the economy, such as low-tech industries, services and knowledge intensive activities (Eurostat, 2014). The OECD has been very active in promoting a view of the importance of knowledge in the economy, using a set of related concepts, e.g. knowledge economy, knowledge-based economy, learning economy, knowledge-intensive economy. The common denominators of these words are that they stress that the basis of competitiveness (and jobs) in the wider economy depends upon firms searching for, developing, and applying different types of knowledge in economic activities;

and that firms act within more holistic context such as innovation systems and entrepreneurial ecosystems. Thus, this volume on KIE is also highly relevant for public policy.

As previously mentioned, this volume examines the emerging stream of literature on KIE. This volume covers a range of topics in order both to take stock of the current state-of-art research as well as provide detailed insights, which will facilitate future research and public policy implications. This volume presents the relevant definitions, the theoretical conceptualization and the empirical indicators and discusses public policy and trajectories for future research. The literature reviewed in this volume frames the broader phenomenon of KIE as a process of learning and problem-solving aiming to benefit from opportunity identification, creation and exploitation and which is conditioned by the linkages and networks related to innovation systems and knowledge-intensive ecosystems.

1.2 Positioning KIE Through Three Starting Points

This volume is restricted to focusing upon KIE as a distinctive form of entrepreneurship. This concept complements and contains some elements of, but is also different from, other types of entrepreneurship which are already present in the entrepreneurship literature. The concept of KIE is based on three starting points.

The first starting point is that the analysis of KIE as presented in this volume focuses primarily upon economic aspects of entrepreneurs and entrepreneurship. This means that in this volume we do not examine the sociological aspects, in terms of cultural and social aspects, relationships within and across groups; status and background. Nor we will analyze the psychological traits of the entrepreneurs (as in the stream of literature inspired by McClelland, 1967). Finally the volume will not go in depth into the cognitive dimensions and biases of entrepreneurs (Camerer and Lovallo, 1999; Kahneman *et al.*, 1982; Mitchell *et al.*, 2002). The authors do recognize that sociological, cultural, psychological, and cognitive theories could be useful to further explain KIE in later research. However, the concept per se has been developed to understand entrepreneurship related to profits and economic gains in (primarily) a market economy.

The second starting point is that the emerging literature on KIE departs from a Schumpeterian tradition related to the importance of the entrepreneur and of innovations in the economy, and of the role of uncertainty and risk-taking. It brings in a specific view on how knowledge in general is linked to the experience and knowledge of founders and to the capabilities of entrepreneurial organizations. This starting point means that the KIE literature rejects the assertion – quite diffused in the economics discipline – that knowledge is just mere information. This widely held view of information per se has been prevalent in a wide range of contributions in economics, starting from the analysis by Hayek (1954) and exemplified in the major and extensive work by Machlup (1984). In these contributions, the analytical focus is on issues related to decision theory, the communication of information and the static allocation of a given set of resources. In this framework, the pricing system becomes the key mechanism for the communication of information. This view can be found also in some entrepreneurship research. For example, Kirzner's (1973) view is one in which entrepreneurs are characterized by superior knowledge (equal to information) that enables them to benefit from the ignorance of others.

In contrast, in a KIE perspective, knowledge is considered more than information: it includes the selection, interpretation, absorption and process of information (Cohen and Levinthal, 1990; Foray, 2004; Metcalfe, 2002) and hence is related to the experience and knowledge of founders and to the capabilities of entrepreneurial organizations. Moreover, knowledge can be characterized in many different dimensions (for example, declarative or procedural, codified or tacit, and so on), and may involve a wide variety of dimensions and processes (Nelson and Nelson, 2002). In this respect, KIE moves away from the view that considers entrepreneurs as dealing only with information, because this widely held view in economics ignores the complexity of knowledge, the role of capabilities and the innovation process.

In order to develop this second starting point a bit more, we need to add that the Schumpeterian and knowledge view of KIE implies an understanding of entrepreneurship which is rather opposite from the one of the Austrian school. The Austrian school – and Kirzner in particular – sees entrepreneurship as a stabilizing force that accelerates the

process of adjustment to equilibrium (Kirzner, 1973). In contrast, the Schumpeterian view considers entrepreneurship as a disequilibrium force that disrupts existing practices and introduces novelty and chance into the economic system, while a Kirznerian perspective views entrepreneurship in an opposite way, as a force that accelerates the process of adjustment to equilibrium (Kirzner, 1973). For Kirzner markets cannot work without entrepreneurs, who are alert to situations of opportunities when situations of disequilibrium are present. Profits are not the returns to innovation or to actions facing true uncertainty, but the reward of the alertness to opportunities by the entrepreneur. In entrepreneurship literature, the ontology of Kirzner vs Schumpeterian view of discovery vs creation has in particular been applied to the debate about whether opportunities are discovered or created (Alvarez *et al.*, 2013).

Hence, this Schumpeterian tradition places KIE in a theoretical perspective different from the traditional neoclassical view of entrepreneurship as an equilibrating process that wipes out temporary extra-profits in an industry. This also means that this positioning also places KIE in a different position even with respect to the most interesting recent attempts by the neoclassical tradition that aim to reconcile entrepreneurship and innovation (that is novelty and change) with incentives, competitive markets and equilibrium. To illustrate the differences, take as an example the recent sophisticated work by Baumol (2010), as further explained on page 11.

The strong Schumpeterian flavor means that the emerging literature on KIE sees entrepreneurship as a process of carrying out new combinations and of creative destruction related to innovation (Schumpeter, 1934). This also implies a broad view of innovation as related to “the new commodity, the new technology, the new source of supply, the new type of organization” (Schumpeter, 1942) and is linked to the extensive research done in innovation studies and economics of innovation. The Schumpeterian view of KIE also leads to the interpretation that the entrepreneur faces situations characterized by high uncertainty (as opposed to risk), as it has also been discussed extensively by Knight (1921) and (1942). For Knight, human behavior is inherently explorative and experimental, with economic activity facing uncertainty. This is particularly relevant for entrepreneurs, who bear major uncertainty when they mobilize resources and introduce novelty in the economic

system. When facing uncertainty, profits are the reward for this type of economic activity.

The third starting point is that this volume focuses upon knowledge-intensity. The Malerba and McKelvey (2018a) definition of KIE firms as new learning organizations that use and transform existing knowledge and generate new knowledge in order to innovate within innovation systems clearly positions and differentiates KIE from other types of entrepreneurship related in various ways either to knowledge or innovation. Many existing contributions about entrepreneurship do discuss certain aspects of knowledge, innovation, industrial structure and growth, and have been extremely useful for inspiration in several instances. However, these contributions cover only limited parts of the phenomena captured by KIE, as it will be explained below in relation to the three concepts of knowledge, innovation and industrial structure/growth, respectively.

Many definitions within the entrepreneurship literature discuss knowledge as related to a particular type of technology or as originating from university research and education organizations. We acknowledge that there is an enormous literature on entrepreneurial firms in high-tech industries reliant upon advanced technology (for example, Acs *et al.*, 2009; Audretsch and Thurik, 2001c; OECD, 2005); new engineering-based firms (for example Autio, 1997, 2007); and new technology based firms (for example Colombo *et al.*, 2004; Colombo and Grilli, 2005). These definitions emphasize the distinctiveness of the new ventures in terms of advanced technology and R&D activities. We certainly acknowledge that advanced technologies and R&D are indeed relevant for understanding some groups of KIE ventures. Instead, the overall KIE definition includes high-tech industries and technology per se, but is broader in that it also includes services, traditional industries, manufacturing, creative industries as well as a broad set of knowledge areas including also design, creativity, experience, and science.

Another stream of literature focuses upon knowledge related to the university – through concepts such as commercialization, academic entrepreneurship, and the entrepreneurial university. Perkman *et al.* (2013) provides a thorough review of this literature and propose a distinction of two ways in which the university may affect society, where one type is commercialization through patents and start-up companies and another type is academic engagement with industry through

knowledge networks and relationships. Perkman *et al.* (2013) also differentiate the analysis at the level of individuals, organizations and institutions, in order to make propositions that while institutions and organizations appear most likely to be involved in commercialization, individuals are key for academic engagement with industry. Agarwal and Shah (2014) explain in great detail the characteristics and relevance of academic and scientific entrepreneurship per se. Academic engagement and academic entrepreneurship definitively are one type of KIE firms. However the overall KIE concept is broader than academic entrepreneurship in that it encompasses all that entrepreneurship that is knowledge-intensive and innovative, and not just the type that belongs to the academic sphere.

Another approach is the stream related to entrepreneurship as knowledge filter, as proposed by Acs *et al.* (2009) and Braunerhjelm *et al.* (2010). In that tradition, knowledge becomes a key factor enabling the entrepreneurial function, creating opportunities and leading to economic growth (Audretsch and Keilbach, 2007). The knowledge filter definition and that of KIE have in common the point that entrepreneurship plays a major role in the transmission and transformation of knowledge. However, they are not synonymous. KIE focuses upon the aspect of being innovative (i.e. introducing new products and processes in the economic system), while the definition associated with the knowledge filter is associated with knowledge spillovers and not necessarily focused upon innovation.

In terms of innovation as related to entrepreneurship, there are recent streams of literature that stress innovation per se. One example is the innovative entrepreneurship discussed within the neoclassical tradition which sees knowledge as information. For Baumol, innovative entrepreneurship represents that partner of the inventor who covers the steps between invention and final marketing. According to Baumol (2010) the presence of competitive markets leads to discriminatory pricing for innovative activity, which entails that entrepreneurs set prices that differ. But due to competitive markets and intertemporal price discrimination, innovative entrepreneurs as a group should expect negative economic profits. In this way Baumol (2010) is able to insert entrepreneurship into a theory based on incentives and equilibrium. This view, albeit sophisticated and consistent, is at odds with the view of KIE based

on disequilibrium and on profits which are generated by knowledge and innovation and not by different information. Another stream of literature concentrates on highly innovative new firms (Schneider and Veugelers, 2010), in which the focus is on new firms that present a high rate of innovation and that may overcome various obstacles to their innovative activity. However, highly innovative firms are only a subset of KIE. KIE may not necessarily be highly innovative and do not necessarily have high growth, rather, in addition to innovation, they are characterized by a high knowledge intensity in their activity.

In terms of industrial structure/growth related to entrepreneurship, the existing literature provides many insights that can be of relevance for an understanding of KIE. The literature on KIE is consistent with the view that a variety of factors affect the supply and the demand for entrepreneurship (Casson, 1982, and 2003). On the one hand, the supply of entrepreneurship can be related to the distribution of entrepreneurial ability in the population and to socio-economic conditions that affect entrepreneurship and the institutional framework of the economy. On the other hand, the demand for entrepreneurship is related to the pace of change and the level of opportunities in an economy (Audretsch and Thurik, 2001c; Storey, 1994). Similarly, industrial structure and technological context affect the rate of entrepreneurship in an economy, and networks and education are important to the development and diffusion of knowledge and innovation. Hence, much entrepreneurship literature may be relevant for an understanding of KIE at a general level.

An example of the way in which industrial structure/growth helps to generate knowledge which affects later entrepreneurship is seen in literature related to spinoffs (Agarwal *et al.*, 2004; Klepper, 2016) and to vertical new entrants coming from the upstream or downstream industries (Adams *et al.*, 2018). This view of new firms examined according to the knowledge content of the founder emphasizes the differences in the knowledge and experience that the founder has at the moment of founding the new firms. This indeed represents a subset of KIE firms. However KIE includes more than new firms with industry experience, be in the same industry or in the upstream or downstream industries. Hence, the stream of literature on spinoffs and

the pre-history of the founders does not explicitly address whether the new venture is highly knowledge intensive nor the fact whether the new venture is innovative or not. Nevertheless this literature helps identify important inputs to specific types of knowledge relevant to entrepreneurship, specifically where the founder has direct experience and knowledge of the activities taking place in the same industry of the start-up phase and/or in upstream or downstream industries.

Another group of contributions regarding entrepreneurship focuses upon growth of firms. There is a large literature on gazelles (Birch, 1979; Henrekson and Johansson, 2010), and on unicorns. Both of these concepts are defined in terms of high growth rates over a certain period. In this tradition, there is relevant work done on high growth entrepreneurial firms (Coad, 2009) which can also be applied to KIE firms. But the KIE literature does not propose that all KIE firm grow at such rapid rates. Hence, the measurement and reasons for different rates of growth is an empirical issue and can vary across KIE ventures; it is not a way of defining KIE firms.

In summary, the positioning of the emerging literature on KIE has been done relative to three starting points. The first starting point is that the analysis of KIE as presented in this volume focuses primarily upon economic aspects of entrepreneurs and entrepreneurship. The second starting point is that the emerging literature on KIE builds upon the Schumpeterian tradition of the importance of the entrepreneur and of innovations in the dynamics of the economy, and the role of knowledge in entrepreneurship. The third starting point is that this volume focuses upon the knowledge intensity of the innovative activity of KIE.

In this positioning relative to other literature, it is clear that there are many existing definitions of entrepreneurship related to either knowledge, innovation, growth or industrial structure, which may capture some sub-set of the phenomena related to KIE, but which also differ in important ways. In fact the conceptualization of KIE is broader than other highly focused definitions of start-ups, such as new high-technology firms, academic entrepreneurship, unicorns and so forth. Moreover, KIE indicates a need to consider both knowledge-intensive and innovative firms: they can be found across all sectors, technologies, and industries.

It thereby includes services and traditional sectors and not just the academic spin-offs or firms in high-tech industries.

1.3 A Roadmap

Following this introduction, this volume is divided into three parts.

- Part II focuses upon theory, definitions, and measurements of KIE, and includes Sections 2 and 3.
- Part III focuses upon empirical evidence on KIE, and includes Sections 4 and 5.
- Part IV focuses upon a process model of KIE and on future research directions, and includes Section 6.

More specifically, Part II of this volume consists of Section 2 on the theoretical building blocks of KIE and Section 3 on research design for empirical work and measurements.

Section 2 on the theoretical building blocks starts with the Schumpeterian tradition that deals with the entrepreneur and innovation then discusses evolutionary economics that focusses on knowledge and co-evolution and finally examines the innovation systems approach which puts a lot of emphasis on the context. Then it discusses the integration of three building blocks for a theoretical definition of KIE.

In Section 3, the existing KIE literature on measurements and empirical data is examined. The emerging literature proposes an empirical definition and a way in which KIE can be measured and analyzed. KIE are defined as new firms that are innovative, have significant knowledge intensity in their activity, are embedded in innovation systems and exploit innovative opportunities in diverse evolving sectors and contexts (sub-section 3.1). There are many ways to translate these constructs into measurements and to carry out research. In sub-section 3.2, some basic measures and indicators of each characteristics of KIE are presented. This section contains a discussion of several issues related to data in surveys and case studies. These insights are useful for conducting research on many future topics.

Part III of this volume discusses analytical understanding of KIE in Section 4 as well as quantitative understanding and proposed taxonomies of KIE ventures in Section 5.

Section 4 on the qualitative understanding of KIE initially discusses the specificities of KIE entrepreneurial processes (sub-section 4.1) with both an analysis of the entrepreneurial process and its relation to collaborative research for science and technology. Then in sub-section 4.2, entrepreneurs and ventures are examined with respect to knowledge, innovation and systems, in terms of phases of development, search, innovative opportunities and networks. In sub-section 4.3, the discussion moves to review work on KIE in sectoral innovation systems and technologies, with particular attention to information technology and digitalization, renewal of existing industries and emerging technologies and industries.

Section 5 presents the quantitative evidence on KIE. It first examines the relevance of KIE within the population of new firms (sub-section 5.1), and then the role of knowledge and innovation systems with respect to the characteristics of KIE ventures, capabilities and performance (sub-section 5.2). The analysis then moves to KIE in relation to national innovation systems (sub-section 5.3), particularly European countries, China, India, Russia and Latin America. Finally, the section concludes with a discussion of KIE and sectoral innovation systems (sub-section 5.4). First differences across sectors are examined, then the focus moves to high-tech industries, low and medium tech industries and creative and digital industries, followed by the existing taxonomies of KIE ventures (sub-section 5.6).

Part IV of this volume discusses a process model and future research. This Section outlines a process model for KIE that brings together the theoretical and conceptual understanding, in ways of relevance for both public policy and future research (Section 6). Sub-section 6.1 presents the model. It consists of origin of the KIE venture; the role of knowledge, opportunities and market conditions in affecting learning in the whole entrepreneurial process; the linkages between the management and development of the new venture and the innovation systems, with two-way interactions with actors and institutions. Sub-section 6.2 highlights the most interesting directions and topics for future research.

Acknowledgements

Financing and Acknowledgments

The initial research was developed during two European Union Projects. The first is the KEINS Research Project “Knowledge based entrepreneurship: institutions, networks and systems (EU project CT2-CT-2004-506022). The second project was the AEGIS Research Project (2013) “Advancing Knowledge-Intensive Entrepreneurship and Innovation for Economic Growth and Social Well-being in Europe” [grant number 225134], European Commission, DG Research, Brussels. This work was also supported by the Swedish Research Council Distinguished Professor’s Programme, awarded to Professor McKelvey, on “Knowledge-intensive Entrepreneurial Ecosystems: Transforming society through knowledge, innovation and entrepreneurship”.

For useful comments and suggestions, we wish to thank the participants at the following projects and conferences: The European Union projects KEINS and AEGIS; the workshop held in Gothenburg 2015 on “Evolutionary approaches informing research on entrepreneurship and regional development”; the Montreal International Schumpeter Society Conference (ISS 2016); the SPRU 50th Anniversary Conference in Sussex in 2016; the European Association for Evolutionary Political Economy (EAEPE) in Manchester in 2016; Globelics in Athens in 2017; and the UNICAMP/InSyPo Conference in Sao Paolo in 2017 and in 2018.

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