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## Introduction

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**Abstract:** The creation of new knowledge gives rise to opportunities to convert inventions into innovations. Technology-based entrepreneurship is concerned with the recognition, evaluation and exploitation of technological opportunities available in the knowledge base. In that sense, technology-based entrepreneurship may be seen as a ‘conduit’ for knowledge spillovers occurring through the successful commercialisation of new technology-based products and services. This special issue is dedicated to the management of this process, and to highlighting the circumstances in which new, small firms may contribute to it.

**Keywords:** technology-based entrepreneurship; knowledge base; knowledge spillovers; technological opportunities.

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## 1 Introduction

The field of entrepreneurship has been defined as “the study of how, by whom and with what consequences opportunities to produce future goods and services are discovered, evaluated and exploited” (Shane and Venkataraman, 2000). However, it can be argued that a great deal of research has focused on the discovery, exploitation and the consequences of opportunities without much attention to the nature and sources of the opportunity itself. However, Schumpeter’s view of the process of innovation and

economic growth points clearly towards the origin of what is arguably the set of entrepreneurial opportunities with the greater potential and bigger impact in decades to come. According to Schumpeter (1947), “the inventor produces ideas, the entrepreneur ‘gets things done’... an idea or scientific principle is not, by itself, of any importance for economic practice”.

After a generation of scholars spent the better part of a half-century trying to figure out the relationship among the entrepreneur, product development and technological innovation (Shane and Ulrich, 2004), today we know that technological opportunity is generated endogenously by investments in knowledge (Jones, 1995; Shane, 2001). Moreover, not only does new knowledge contribute to technological opportunity, but it also spills over for use by third-party firms, often new ventures (Azoulay and Shane, 2001).

The economic theory of endogenous growth, initiated by Romer (1986), has provided two fundamental contributions. The first is that the formation of knowledge and human capital takes place in response to market opportunities. The second is that investment in knowledge is likely to be associated with large and persistent spillovers to other agents in the economy. Since the marginal productivity of knowledge does not need to diminish as it becomes available to more users, the accumulation of capitalised knowledge assets would then lead to indefinitely sustained growth. However, the endogenous growth theory does not explain how spillovers occur, and what determines their scope and boundaries.

As Schumpeter before him, Arrow (1962) recognised that knowledge is not the same thing as economically relevant knowledge. The creation of new knowledge gives rise to opportunities to convert inventions into innovations. Technology-based entrepreneurship is concerned with the recognition, evaluation and exploitation of opportunities available in the knowledge base. The knowledge base is generated by knowledge creation activities, such as R&D performed by universities and incumbent companies. The size of the knowledge base determines the size of technological opportunity.

The ability of economic agents to absorb spillovers emanating from the knowledge base is influenced by their own R&D and other knowledge-related activities (Cohen and Levinthal, 1989). Investment in new knowledge increases the technological opportunity set as well as our ability to recognise, evaluate and exploit those opportunities. In this context, the technology-based start-up may serve as a conduit by which new knowledge spills over from its sources and is converted into commercial innovations, *i.e.*, new processes, goods and services (Shane, 2001; Acs *et al.*, 2005).

The creation of new technology-based ventures is far from being the only way for new knowledge to generate wealth; it has, however, gained importance over the last decades owing to two main reasons. First, the use of new technologies has reduced the importance of scale economies in many sectors (Audretsch and Thurik, 2000). Second, the increasing pace of innovation and the shortening of product and technology life cycles favour new entrants and small firms, which have greater flexibility to deal with radical change than large corporations (Christensen and Rosenbloom, 1995).

Successful commercialisation of new technology-based products and services implies that technological opportunities existing in the knowledge base are recognised, evaluated and exploited. This special issue is dedicated to the management of this process, and to highlighting the circumstances in which new, small firms may contribute to it.

## 2 The papers in this special issue

All papers in this special issue are extended and improved versions of works presented at the *3rd IEEE International Conference on Management of Innovation and Technology* held in Singapore in June 2006. Over 20 works were submitted in response to a direct invitation to the authors. Selection and revision of the papers published followed the customary double blind review process.

The first two papers in this special issue look at two critical and often explored issues in entrepreneurship research. Baptista and Preto examine the long-term impact of new firm creation on employment growth, while Melgarejo *et al.* look at new firm survival. Two fundamental novelties distinguish these studies. First, Baptista and Preto propose an empirical model of dynamic, bi-univocal causality between variations in entrepreneurship and in unemployment. Second, Melgarejo *et al.* examine whether the type of ownership influences financial structures and long-term survival, a fundamental issue in technology-based firms, where time to market is often long and initial investments are usually significant.

Accounting for dynamic, double causality is vital if one wants to distinguish the effects of unemployment increases on subsequent entrepreneurial activity (often individuals start firms as a 'refuge' from unemployment), from any positive effects achieved by entrepreneurs who succeed in running enterprises that require outside labour and contribute to increase overall productivity and competitiveness. Results of the Portuguese case show that the predominant causal effect is the induction of more self-employment by increases in unemployment. As the unemployed tend to possess fewer capabilities required to recognise, evaluate and exploit entrepreneurial opportunities, such increases in entrepreneurial activity do not lead to future employment growth. Melgarejo *et al.* find that employee/labour owned firms – which usually have less access to outside financing – tend to perform better in the short-term than participatory capitalist firms, but fall behind in the long term.

These results provide evidence of two important issues in the development of technology-based ventures. First, in addition to the generation of technological opportunities through investment in knowledge-creating activities, the availability of entrepreneurial human capital capable of recognising and exploiting such opportunities is a requirement for successful technology-based entrepreneurial activity that will increase future productivity, competitiveness and employment. Second, while access to sources of finance may not be crucial during the initial stages of development, it gains importance as new firms need to grow in order to respond to market requirements and opportunities.

The paper by Mendonça *et al.* provides an example of the role new technology ventures may play in furthering industrial development by taking advantage of opportunities arising from knowledge spillovers that larger firms are unable or unwilling to exploit. When mapping the knowledge bases – *i.e.*, the underlying technologies and knowledge flows – of the Portuguese chemical industry, the authors find that the ability to generate value-creating knowledge is concentrated in very early stages of product life-cycles, often in new product development, whereas incumbents in the Portuguese industry are mostly concentrated in subsectors that have reached maturity. Owing to this asymmetry in knowledge bases between R&D being carried out at universities and the activities of incumbent firms, opportunities for technology-based start-ups are numerous.

The following papers in this special issue are concerned with a variety of issues in the management of the knowledge spillover process, *i.e.*, with how technological opportunities are developed into commercial innovations. These issues include: human resource management (individuals being the most important depository of knowledge in new technology-based organisations); the management of interchanges between business people and researchers; the role played by users as innovators; the integration of employees, customers, suppliers, competitors and other stakeholders in the conception and development of new ideas; and the implementation of ICTs as instruments of communication and knowledge management in firms.

Ho and Wilson focus on individuals as sources and instruments for the development of economically relevant knowledge. They utilise cognitive mapping and in-depth case studies to link founders' mental models and emergent employment systems in the New Zealand biotechnology industry. Their findings suggest that biotechnology founders emphasise a 'star' system in their mental models of employment, and are heavily influenced by resource scarcity – particularly the difficulty of recruiting top scientists to biotechnology start-ups – as well as external stakeholders.

Hayes and Fitzgerald provide us with a fascinating discussion of the cross-cultural dialogue between scientists and business people. Technology commercialisation combines the discoveries of one occupational group (scientists), with the skills of another (managers), thus involving interactions across occupational cultures. Using the context of Australian hybrid industry-research organisations composed of academic, government and industry personnel, their study considers how dissent can be interpreted as a sign of dysfunction. Identifying distinctive patterns of argumentation as typical of commercial and research occupations, the authors conclude that occupational forms of argumentation could influence the outcomes of commercialisation.

While user-developed innovation has been a recurrent research topic for well over a decade, the paper by Braun and Herstatt is innovative in that it concentrates on various factors (of which legal aspects are of particular interest) that may prevent users from attempting to innovate. The authors argue that the barriers to user innovation seem to be progressing, as users will frequently lack not only the legal and contractual right, but also the technological ability to innovate. We may thus be faced with the possibility of a paradigm change: a move towards having to obtain licences to innovate.

The paper by Brem and Voigt addresses the participation of both internal and external sources in the innovation process. The authors propose an integrated idea management model whose examination confirms the tendency towards the growing integration of external stakeholders as sources and instruments for the development of knowledge into innovation. Brem and Voigt suggest that idea and innovation management should be integrated during the building up stage of emerging technology ventures, while internal and external network structures are still manageable and often consist of the managers' and founders' personal contacts.

Finally, the paper by Amaral examines the adoption of mobile ICTs in knowledge-based organisations versus traditional ones. While in traditional organisations, where technological functionalities are limited and job-oriented, outcomes appear linked to greater sales volume or new businesses, in knowledge-based organisations outcomes appear to be related mostly with intangibles associated with better knowledge management: quality of service, reinforcement of firms' networks of contacts and better management of workflows.

### 3 Conclusion

This special issue aims to contribute towards a greater understanding of the role played by new technology ventures in taking advantage of opportunities existing in different industries' knowledge bases. Many of these opportunities originate in spillovers from R&D carried out by universities and large firms, which incumbents fail to exploit. Two factors appear as fundamental for the success and future impact of technology-based entrepreneurship: the existence of human capital capable of recognising and exploiting opportunities, and the financial ability to invest and grow when compelled by market opportunities.

The papers address issues of great importance in the way new or existing firms may recognise, evaluate and exploit technology-based opportunities, spanning from internal human resources to external sources such as users and other stakeholders, and from the cross-cultural interchange between scientists and business people to the role played by the introduction of new technologies – such as mobile ICTs – in increasing the ability of firms to better manage knowledge, improving external networks and quality of service.

Serving as guest editor for this special issue was a learning experience, which underscored how much work is needed to better understand the link between knowledge bases, technological opportunities and successful technology-based ventures. A considerable amount of variance in both subjects and perspectives characterises the pages that follow, showing that, while the possibilities for future developments are plentiful, the road forward is likely to elicit substantial debate with regard to what is and is not an important topic for further inquiry. However, because the combination of novelty and utility promise significant profits for the individual willing to create (Lepak *et al.*, 2007), surely there are sufficient incentives for scholars wishing to make a contribution to the scientific community to bear this uncertainty.

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