Advances in Spatial Science

João J.M. Ferreira
Mário Raposo
Roel Rutten
Attila Varga *Editors*

Cooperation, Clusters, and Knowledge Transfer

Universities and Firms Towards Regional Competitiveness

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Foreword

Is capitalism in crisis? Since the major financial crisis of 2007–2009 a number of people have wondered whether capitalism has outlived its usefulness and reached a fundamental dead end. What are the alternatives to a world dominated by large global corporations, many with greedy and manipulative senior managers who reward themselves with salaries, bonuses and payoffs, which are often widely perceived to be unfair and indeed nothing short of obscene? It is all too clear that shareholders lack the power to control these organisations and sovereign governments have lost the nerve and wit to regulate them. Maybe the politicians have wittingly or unwittingly colluded with big business, partly in a desire to generate economic growth and employment, and partly, let it be said, some are advancing their own pecuniary interests. Whatever the reasons, we need to seek alternative solutions to an economic system which is frankly failing billions of people across the world. Never was there a more critical time to provide workable economic and business solutions at the regional level.

These are big questions which people across the world are anxiously pondering but the answers to which are largely beyond the abilities and resources of ordinary people to resolve and, it appears, are largely beyond the abilities of politicians to resolve in any coherent and purposeful way. It is no small wonder then that many people are turning to small and medium-sized enterprises (SMEs) as a more logical and attractive answer to the age-old problems of how to not only generate growth and employment but also make businesses more accountable at the local and regional levels. As the great European Union and Eurozone experiment appears to be unravelling, it is natural for people to be thinking about economic and business solutions at the regional and local levels, and in particular, the development of small social enterprises and cooperatives, each controlled by local people and accountable to local people. If the nation state has shown itself largely incapable of promoting sustainable economic growth, then perhaps the regional context for promoting businesses may prove more successful. That SMEs are the small acorns from which big economic rewards will flow seems self-evident but despite decades of SME and entrepreneurial research we appear to be no further forward in ensuring that economic growth results in a more equitable distribution of wealth.

We need to untangle and forcefully demonstrate the tangible benefits of cooperation and competition between SMEs at the level of the region, the city and the village. We need to understand how information flows between small and medium-sized businesses and the regional state, how knowledge is transferred from universities, science parks and scientific research institutes to businesses enterprises and vice versa. But above all, we need to raise awareness of current developments, best networking practices and the development of all-important explanatory and predictive theories, which can spark much-needed innovations in the SME world, and help ensure a much healthier competition among enterprises than we have seen to date.

The authors of the chapters in this very timely book are to be congratulated in bringing to our attention the important issues of cooperation, competition, networking, knowledge transfers and innovation within the regional SME context. Having brought these issues to our attention is it too unreasonable not to expect our regional and national politicians to stop prevaricating and actually do something tangible and long-lasting in the generation of wealth and its more equitable distribution, for all our sakes?

Gary Akehurst

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Introduction

One of the key factors, if not the most determinant, of every private sector entity is its respective level of competitiveness. Traditionally, efforts to explain this competitiveness have been based on an aggregated perspective concentrating on the characteristics of its components, on macroeconomic indicators and on government policies.

There is a wide evidence that small and medium-sized enterprises (SMEs) play a wide role in sustaining growth and employment in Europe and in particular in regions eligible for the new regional competitiveness and employment objectives. Regional competitiveness may be defined as the capability of the region to attract and maintain firms with stable or increasing market shares in their respective activities while maintaining stable or increasing standards of living for those engaging in them (Malmberg and Maskell 1999). This draws attention to the region as institutional environment for SMEs. Although many SMEs are nowadays exposed to global competition, the regional institutional environment has a very substantial impact on their ability to network in order to access and create knowledge. Consequently, the regional level of analysis has lost nothing of its relevance, in spite of claims to the contrary by, for example, Shearmur (2011). Regional competitiveness is shaped by a combination of the competitiveness of regional firms and the institutional environment in which they are embedded. For SMEs in particular, the region remains the key context (Boschma 2004). Consequently, it is important to study how the regional institutional context affects innovation in SMEs. According to Malmberg and Maskell (1995), for example, the institutional endowment of a region or a country should be defined broadly and include not only all institutions related to the following factors: production; the efficiency level of goods and services markets; the quality of demand; governmental institutions and practices; and entrepreneurship but also soft institutions such as trust and social capital (Lorentzen 2008). This institutional network approach encapsulates the functioning and development of Regional Innovation System (RIS) designed to embrace all regional key players. In today's modern society, regional competitiveness and inter-firm cooperation are two crucially important fields of studies.

In business networks, the actions one firm takes also affect the wider extent of the network and thus also each individually networked firm. Regional cooperation between firms and between firms and universities may correspondingly be perceived as the foundation of regional competitiveness. Furthermore, cooperation and clusters have now become the guiding paradigms for explaining and promoting regional competitiveness (Cooke 2001; Ferreira et al. 2012). Vertical linkages among related industries and proximate regions represent important spillover forces influencing the economic performance of regions, especially within and across clusters related by either technology or linkages and across clusters common to proximate and adjoining regions (Delgado et al. 2007; Titze et al. 2011). Since linkages between SMEs and universities are not in many cases self-evident, regional clusters may function as important channels for university knowledge to flow to regional SMEs. University knowledge flows into a cluster through linkages between larger firms and more innovative SMEs on the one hand and universities on the other hand. Once in the cluster, other SMEs may also benefit from this knowledge (Harding et al. 2007).

Despite the advances made in the literature, the cooperation process between firms and universities, clusters and the transfer of knowledge in guiding and nurturing regional competitiveness has received relatively little attention.

This book strives to overcome this gap. This is achieved by bringing together new contributions from established scholars in the fields of management and economics as well as from the regional competitiveness literature. The three parts of the book are specifically designed to highlight the connection between inter-firm cooperation in regional clusters, innovation and regional networks and the role of universities in this all.

The book intends to bring about a very comprehensive international exchange of scientific perspectives within the scope of boosting awareness about current developments, case studies, best practices and new integrated theoretical approaches and applications. We believe such approaches open up some new directions in thinking on these issues. This is important within the context outlined here with these first steps serving to differentiate this publication from others on the subject. The book reaches beyond the traditional economic approach to clusters to incorporate “soft factors” in the explanation of regional competitiveness and thereby interweaving the literature on clusters into the literature on learning and knowledge creation as sources of regional competitiveness.

Overview of Book Contents

The book gathers the most recent developments from interlocking fields of knowledge, in particular from business and economics. In this sense, the book is composed of three mutually linked sections. Part I contains several contributions about cooperation processes and clusters in both the theoretical and empirical dimensions. Part II reports different approaches to entrepreneurial activities, innovation and

regional networks. Furthermore, the transfer of knowledge between university and industry is developed in Part III.

Part I: Inter-Firm Cooperation and (Regional) Clusters

This section includes five chapters. The first, *The startup location decision and regional determinants*, by F. Lasch, F. Robert, F. Le Roy and R. Thurik. Addressing the importance of small business and new firm formation for economic growth, a considerable outpouring of literature puts forward empirical evidence criticizing or confirming the "job generation process" theory that resulted in putting entrepreneurship rising to the forefront of research into that perceived as an "entrepreneurial" economy. Founding new firms represents a strategic asset to an entrepreneurial economy and many economic policies strive to craft and implement measures able to foster and stimulate entrepreneurship.

However, contrasting empirical evidence resulting from measuring the regional determinants of entrepreneurship leaves many questions about economic actors and their actions unanswered and the valuation and application of research results to practices and policies remains complex. This is precisely the situation this chapter intends to contribute towards resolving. For this purpose, the authors identify and measure regional factors for cross-sectional new firm formation activities that we compare with the already obtained results for high-tech firms).

The authorial conclusions report how the new high-tech venture development process is promoted and facilitated by support from government departments, universities and high-tech research institutes throughout their entrepreneurial process in recognizing the opportunities, collecting the resources and struggling to growth. Furthermore, they also found that start-up capital, technological support and human capital are the critical resources those institutes strive to provide in accordance with potential entrepreneur needs. And entrepreneurial networks built up through the institutional network structure are also important to new ventures gaining the resources necessary.

The second chapter undertaken by J. Jimenez-Moreno, R. Martínez-Cañas, P. Ruiz-Palomino and F. Sáez-Martínez, *The role of science and technology parks in the generation of firm level social capital through university-firm relations: An empirical study in Spain*, states that Science and Technology Parks (STPs) are artificial infrastructures playing a key role in regional innovation systems fostering the transference of academic research findings and generating knowledge spillovers. The main contribution of this chapter is to focus analysis on the value generated through relationships between universities and tenant firms. Therefore, the application of social capital theory enhances our understanding about the dynamism that is often a consequence of strong interactions between these actors. This chapter also contributes to extending previous studies that have tended to measure the value of STPs for firms using traditional economic indicators (mainly at the park level of analysis), such as annual growth, profitability, employment rate or the number of new companies launched. The main results obtained in this chapter are not only that

social capital can be generated by building and maintaining relationships with universities but also that the social capital generated actually does have positive and significant effects on knowledge acquisition and reputation.

The third chapter, *Knowledge transfer in or through clusters: outline of a situated approach*, by J. Hermans, aims to outline a research approach that would enable the study of clusters and inter-organizational knowledge transfers as a situated, political process. Such an approach rests on three basic assumptions: What research objects are of interest when exploring knowledge transfers through a situated approach? Which conceptual and methodological tools are deemed most appropriate? Why study knowledge transfers in innovation clusters through a situated approach? Or, alternatively: who are the stakeholders in such studies? The main conclusion points out how we need a deeper understanding of the mechanisms favouring R&D cooperation. The role of "spinning-out" in providing alternative paths and new insights into this cooperation would result from greater research. As a generator of norms for collaborative individuals, we need greater depth to our understanding of the actual means that government and administrative actors may deploy to provide such norms and how they guide cluster participants.

The fourth chapter, *How does a researcher become an entrepreneur in high-tech industrial clusters? A case study of Leuven high-tech cluster,* by R. Liu, H. Zhang and Z. Yang, states that high-tech entrepreneurship performed by researchers themselves is particularly prominent in high-tech industries where new ideas generated from advanced knowledge are of great importance. This chapter also seeks to explore how high-tech entrepreneurial activities are fostered in high-tech clusters. The authors chose one specific location, the Leuven high-tech region in Belgium, as the research case study. The high-tech industrial cluster in Leuven had played an important role in enhancing high-tech entrepreneurial activities in the local region and boosting regional development in the past few decades.

The final chapter in Section I, *Inter-firm cross border cooperation for entrepreneurial opportunities: a regional experience*, developed by J. Ferreira, M. Raposo and C. Fernandes, focuses on inter-firm crossborder cooperation and entrepreneurial opportunities. In this chapter, regional competitiveness is viewed as an outcome of these concepts. This is due to how successful entrepreneurship generates material benefits not only for the firm itself but also for the benefit of the whole territory in which it operates. The research undertaken aims to determine how SMEs in the crossborder regions of Castilla y Leon (Spain) and Centro Region (Portugal) might increase their levels of cooperation and identify the best operational practices through which the firms would be able to improve their competitiveness. Two research questions are correspondingly highlighted: why and how do firms share knowledge and innovation with respect to cross border cooperation and how does the regional dimension affect cooperation processes.

Part II: Entrepreneurial Activities, Innovation and Regional Networks

The sixth chapter by P. Cooke, *Transition regions: green innovation and economic development*, proposes the idea of "transition regions" as spaces where clusters of innovation emerge to exploit public and niche market demand for innovation, specifically in this case eco-innovation. Accordingly, the author discusses and critiques the main spatial and non-spatial theories that address methods by which societies may transition from a hydrocarbon to a post-hydrocarbon technological regime. Furthermore, the chapter seeks to demonstrate how a more theoretically informed framework based on regional innovation systems thinking, allied to evolutionary economic geography and development analysis, produces a superior transition model; and how his concept has the following powerful theoretical implications for inter alia externalities, endogeneity, networks, labour mobility and entrepreneurship as sources of innovative knowledge exchange.

The seventh chapter, *Clusters, learning, and regional development: Theory and Cases* by R. Rutten and D. Irawati, seeks to understand why some regional clusters perform better than others. The answer to this question must be sought along two related but distinct lines of inquiry. Firstly, the characteristics of regional clusters are important with regard to their success or failure in the global economy. Secondly, the regional characteristics wherein a cluster is embedded must also be considered. This chapter addresses both lines of inquiry based on the assumption that economic performance is fundamentally driven by innovation, learning and knowledge creation.

The importance of entrepreneurship and female entrepreneurship, in particular, has been considered an important and increasing factor in economic development. In Chap. 8, Socio-cultural factors and female entrepreneurship in the innovative sector in Catalonia: a qualitative analysis, authors M. Noguera, C. Alvarez, D. Ribeiro and D. Urbano analyse the main socio-cultural factors and their impact on female entrepreneurship in the innovative service sector in Catalonia (Spain) and establish differences with male initiatives using the institutional approach as a theoretical framework. Based on a comparative case study, the principal findings suggest that social networks, role models, entrepreneurial attitudes and family contexts are important determinants of female entrepreneurship. Family context is, in particular, a crucial factor, which might have a larger impact on women than men. The research contributes both theoretically, through the creation of knowledge in a less researched field such as female entrepreneurship in Spain, and practically, through the development of sustainable support policies for female entrepreneurial activities.

Many scientific publications and government reports quite clearly point to the potential impact that using knowledge generated in universities may play in the economy of a region or country. The ninth chapter, *Academic entrepreneurship and entrepreneurial learning: the best practice of IPB*, by J. Adriano, P. Fernandes, H. Sampaio, and J. Lopes, is concerned with the issue of cooperation in higher education at the regional development level mainly as regards the role that this type of educational institution must adopt in order to contribute efficiently to this purpose. The strategies and best practices adopted by the

Innovation and Entrepreneurship Office at a higher education institution, during its short existence, have been the target of ongoing reflections by participant actors within the framework of driving continuous improvement and maximizing results. This chapter presents a conceptual framework for successful entrepreneurial learning in terms of how higher education institutions may facilitate growth in knowledge about this area and thereby become more entrepreneurial.

Part III: Knowledge Transfers Between University and Industry

The academic and policy literatures have increasingly acknowledged that university engagement with the economy extends well beyond the private sector and includes the public and third (or not-for-profit) sectors. Chapter 10, *Academic interactions with private, public and not-for-profit organisations: the known unknowns,* by M. Abreu and V. Grinevich, is based on a recently completed survey of UK academics, providing micro-data on over 22,000 academics in the sciences, social sciences, arts and humanities and studies the interface between the university and external organizations by exploring the extent and determinants of academic interactions across all sectors, including private, public and third sector organizations. They find that the involvement of academics with private firms is substantial but less widespread than that with public and third sector organizations. Furthermore, they empirically demonstrate that the contributions of universities to the economy and innovation processes should be conceptualized within a wider context of private, public and social innovation.

Even though there seem to be some risks associated with the involvement of university scientists in spin-off processes, their importance is unquestionable. Chapter 11, *The role of academic spin-off founders' motivation in the Hungarian Biotechnology Sector,* by K. Erdős and A. Varga, finds that science- and business-related motivations break down into four types of academic entrepreneurs: (1) the "classical" academic entrepreneurs, driven by academic motivations while founding and running companies; (2) the "unbalanced" academic entrepreneurs, attributing absolute priority to either academia or business but never both; (3) the "impeded" academic entrepreneurs, very similar to "classical" academic entrepreneurs in their actual motivations but impeded from acting mostly by departmental factors and (4) the "externally motivated" academic entrepreneurs who strongly identify themselves with scientific norms whilst also realising the pressures from their university's leadership which does not always positively impact spin-off processes. Erdős and Varga shed light on the motivations behind Hungarian biotechnology spin-off founders and establish a corresponding typology. This research project focuses on a continental European system with both Germanic roots and the effects of the Soviet experience that clearly shape the environment unfolding around academic entrepreneurs. Nevertheless, biotechnology has come in for significant support in Hungary and that might enhance spin-off activities.

Chapter 12, *Hirschman mobility among academics of highly ranked EU research universities,* by E.M. Bergman, analyses the mobility of European university academics by recourse to data resulting from a large web-survey. Two mobility models are explored; one considers the factors contributing to an academic's decision to relocate to another university while the other examines whether that relocation would occur within the European research area (ERA) or elsewhere. Both models draw heavily upon Hirschman's seminal work that conceives career relocation as an "exit" decision and comparable to the main rationales for remaining (being "loyal" or having "voice") in the same post. The results clearly indicate that academics exercising either "loyalty" or "voice" are significantly less likely to be mobile. Moreover, those who do engage in mobility refuse to restrict potential destinations to within the ERA whenever placing value on either better material conditions, better quality colleagues, students or university reputation.

The question of how action-based entrepreneurial programs shape the role of entrepreneurial students is addressed in Chap. 13, *Action-based education in academic entrepreneurship: A new role of the student?* by L. Foss, E. Oftedal and T. Iakovleva. The scope of entrepreneurship programs offered by academia has expanded significantly. Examining the literature, more economic oriented studies with ex-ante and ex-post survey responses find that students do learn about their entrepreneurial aptitudes through entrepreneurship education. The role of entrepreneurial students is a crucial component to knowledge-based economies within the framework of which universities need to contribute towards regional innovation by helping to commercialize research-based ideas. Thus, universities need to educate students on how to get ideas to the market, interact and cooperate with inventors and technology transfer specialists and develop the skills and self-esteem that enable and empower them in terms of technology transfer and launching university spin-off ventures. The contribution of these authors includes theorizing and illustrating, with real life student and inventor examples, an action-based entrepreneurial program as well as setting out a (theoretical) framework with propositions for future testing.

We believe this book bridges academic research and draws on practitioner experience to provide a detailed understanding of how and why cooperation, clusters and the transfer of knowledge represent not only essential fields of study but also the very foundations for regional competitiveness.

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Part I
Inter-Firm Cooperation and (Regional) Clusters

Chapter 1
The Start-Up Location Decision and Regional Determinants

Frank Lasch, Frank Robert, Frédéric Le Roy, and Roy Thurik

1 Introduction

An important stream of literature in the past 20 years focuses on the impact of new firm formation, i.e., entrepreneurship, for the economic development of regions and nations. Addressing the importance of small business and new firm formation for economic growth (Audretsch 1995), a considerable outpouring of literature presented empirical evidence criticizing (Robson 1996) or confirming the "job generation process" theory and resulted in putting entrepreneurship at the forefront of research in an so-called "entrepreneurial" economy (Audretsch and Thurik 2000). The phenomenon of entrepreneurship is examined at various levels of analysis, such as individuals, firms, regions, or nations (Wennekers and Thurik 1999). Davidson and Wiklund (2001) argue that entrepreneurship research is dominated by micro-level analysis, mainly using the firm or the individual level of analysis. Reviewing nine peer-reviewed entrepreneurship journals, Chandler and Lyon (2001) find that only a small part of research designs focuses on the industry or macro-environment level. Davidson and Wiklund (2001) observe that the micro-level dominance increased over time, while the share of the aggregate level declined. Ucbasaran et al. (2001) call for more research on the existence of different and contrasting environmental conditions for entrepreneurship (see also Thurik 2009). But while the challenge of explaining how and why new firms emerge in

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regions or socioeconomic contexts raised much debate and resulted in an increasing body of literature, a certain number of gaps prevail.

Johnson (2004) describes the literature on regional differences of entrepreneurship as fragmented and heterogeneous and claims for disaggregated studies to produce reliable results for specific sectors. The main reason for the observed heterogeneity lies in a strong variety of research designs. Authors operate with different spatial aggregate levels and sample sizes and analyze mostly cross-sectional data. In the same line, Chandler and Lyon (2001) argue for increased emphasis on reliability issues and recommend more longitudinal research to reduce common method variance.

New firm formation is a strategic asset in an entrepreneurial economy and economic policy is preoccupied by crafting and implementing measures to foster and stimulate entrepreneurship (Audretsch et al. 2007). But contrasting empirical evidence in measuring regional determinants of entrepreneurship leaves many questions of economic actors and actions unanswered and the valorization and application of research results for practice or policy remains complex (Van der Zwan et al. 2011).

This is precisely the gap this paper intends to fill. For this purpose, we identify and measure regional factors for cross-sectional new firm formation activities that we compare with the results of high-tech firms (HT) that we obtained earlier (Lasch et al. 2013).

This paper is structured as follows. In Sect. 2 we follow the setup of Lasch et al. (2013) and identify commonly used regional factors and we formulate general hypotheses for new firm formation. Sections 3 and 4 are concerned with method and presentation of results for both economy-wide entrepreneurship and high-tech entrepreneurship. Section 5 compares the results while Sect. 6 concludes.

2 Literature

Entrepreneurship literature is inspired by a variety of disciplines like economics, economic geography, and sociology (Wennekers and Thurik 1999). Hence, the literature provides many variables and proxies to measure the impact of regional factors on entrepreneurship. The early literature uses theories of localization economies: Marshall–Arrow–Romer (Marshall 1890; Arrow 1962; Romer 1986), Porter (1990), and Jacobs (1969). Endogenous growth theories focus on the role of regional human capital and innovation (Romer 1986, 1990; Arrow 1962; Nijkamp and Poot 1998). New economic geography introduces the concept of market forces (Krugman 1991) emphasizing circular logic as trigger for the formation of agglomerations (Krugman 1998). Cluster theories describe the emergence of geographic concentrations of firms (Porter 1998). Knowledge-based economy approaches explore interaction between firms based on geographical proximity to external knowledge and innovation sources, networks, and knowledge spillovers (Audretsch and Keilbach 2007).

In sum, we find four broad factor groups that are commonly used in regional studies on entrepreneurship: infrastructure and industry externalities, entrepreneurship capital, human capital, and knowledge spillovers.

2.1 Infrastructure and Industry Externalities

The literature seems to agree on competitive advantages for new firms in densely populated areas with well-developed infrastructures (Reynolds et al. 1994; Keeble and Walker 1994; Audretsch and Fritsch 1994; INSEE 2000; Armington and Acs 2002). But some studies point out that diseconomies in agglomeration arise when certain thresholds of density are attained (Bade and Nerlinger 2000; Folta et al. 2006).

Hypothesis 1a. Population density has a positive impact on new firm formation.

The concept of industry structure opposes two viewpoints. Some argue that high level of industry concentration drives innovation and growth (Marshall 1890; Arrow 1962; Romer 1986; Porter 1990; Tödling and Wanzenböck 2003; Okamuro and Kobayashi 2006) while others point to positive effects of diversity and competition occurring between industries (Jacobs 1969).

Hypothesis 1b. Industry diversity has a positive impact on new firm formation.

Hypothesis 1b′. Industry concentration has a positive impact on new firm formation.

Population growth is associated to both market opportunities and increasing numbers of potential entrepreneurs (Krugman 1991; Reynolds et al. 1994; Keeble and Walker 1994).

Hypothesis 1c. Population growth has a positive impact on new firm formation.

Industry structure can also be captured using the share of small versus large firms. Here, we observe different positions in the literature. Some authors identify value chain and incubation effects of large firms (Bellandi 2001; Cooper 1985; Almus et al. 1999; Garnsey and Heffernan 2005). Others stress higher managerial learning opportunities in small firms enabling former employees to accumulate entrepreneurial skills (Greenan 1994; Kangasharju 2000; O'Gorman et al. 2005). Keeble and Walker (1994) find an effect of incumbent large firms on entrepreneurship in the service sector and similarly small firms on entrepreneurship in manufacturing.

Hypothesis 1d. Employment in very large firms has a positive impact on new firm formation.

Hypothesis 1e. Employment in very small firms has a positive impact on new firm formation.

2.2 Entrepreneurial Capital

We associate entrepreneurship capital to the entrepreneurs' perception of overall conditions for entrepreneurship, such as high regional firm birth (Audretsch and Keilbach 2005) and survival rates.

Hypothesis 2a. High firm survival has a positive impact on new firm formation.

More recently, the literature includes the concept of regional entrepreneurial capital to explain different levels of entrepreneurship across regions (Feldman 2001; Audretsch and Keilbach 2004a, b; Audretsch and Keilbach 2007). But empirical findings remain scarce (Freytag and Thurik 2007). In line with Audretsch and Keilbach (2005), we argue that regional entrepreneurial capital or expertise (Feldman 2001) produces an effect of new generations of entrepreneurs.

Hypothesis 2b. Entrepreneurial expertise has a positive impact on new firm formation.

Audretsch and Keilbach (2005) also establish a relationship between regional economic performance and endogenous entrepreneurship capital. Following this concept, we use the regional dependence from outside controlled decision centers as further measure of endogenous entrepreneurial capital and "culture."

Hypothesis 2c. Endogenous entrepreneurship has a positive impact on new firm formation.

2.3 Human Capital

Human capital is a popular concept to explain regional levels of entrepreneurship and is associated to educational attainment, employment, private capital, and social diversity. We find strong evidence for high regional educational attainment as source of entrepreneurship in the literature (Audretsch and Fritsch 1994; Evans and Leighton 1990). This relationship is more evident in studies dealing with high-tech entrepreneurship (Bade and Nerlinger 2000) and may also apply to studies examining entrepreneurship across all sectors of the economy.

Hypothesis 3a. Educational attainment has a positive impact on new firm formation.

Another facet of human capital is the regional employment structure. While Evans and Leighton (1990) argue that unemployed are more likely to become entrepreneurs as compared to working population in employment, we find contradicting findings in literature. Some consider unemployment as an important hurdle to entrepreneurship (Foti and Vivarelli 1994); others present evidence of unemployment out of necessity

effects on entrepreneurship (Audretsch and Fritsch 1994; Guesnier 1994; Lasch et al. 2007; Okamuro and Kobayashi 2006; Thurik et al. 2008).

Hypothesis 3b. Unemployment has a positive impact on new firm formation.

Investment capacity, wealth, and private capital are also associated to human capital. Raising sufficient capital consists in one of the most important entry barriers to entrepreneurship (Jones-Evans and Thompson 2009). In consequence, we suggest a positive effect of high levels of regional private investment capacity on entrepreneurship.

Hypothesis 3c. Private capital capacity has a positive impact on new firm formation.

Lucas (1988) argued that locations (cities) should not be observed only as collectors of human capital but rather as places generating new ideas. More recently, the literature presents evidence on the value of creativity and diversity for innovation and entrepreneurship (Florida and Gates 2001; Lee et al. 2004; Smallbone et al. 2010).

Hypothesis 3d. Social diversity has a positive impact on new firm formation.

2.4 Knowledge Spillovers

Knowledge created endogenously results in knowledge spillovers, which allows entrepreneurs to identify and exploit opportunities (Audretsch and Feldman 1996; Carlsson et al. 2009; Acs et al. 2009; Simmie 2002). Important external knowledge sources are universities (Bade and Nerlinger 2000; Fischer and Varga 2003; Anselin et al. 2000a, b; Engel and Fier 2000; Fritsch and Slavtchev 2007; Audretsch et al. 2004; Huffmann and Quigley 2002; Garnsey and Heffernan 2005) and public or private nonuniversity research and development (Bade and Nerlinger 2000).

Hypothesis 4a. Universities have a positive impact on new firm formation.

Hypothesis 4b. Private R&D firms have a positive impact on new firm formation.

Production and innovation tends to be geographically bound and the literature acknowledges that geographical proximity and location matters (Audretsch and Feldman 1996; Meusburger 2000). Knowledge externalities mean also interaction and network activity between firms located in geographical proximity (Hansen 1995; Aldrich and Zimmer 1986; Johanisson 1998; Nijkamp 2003; Varamäki and Veslainen 2003; De Propris 2002; Knoben and Oerlemans 2006; Torre and Rallet 2005). Finally, tacit knowledge is regarded as a valuable asset for new firms (Porter and Stern 2001; Gertler 2003; Storper and Venables 2004).

Hypothesis 4c. Incumbent knowledge-based firms have a positive impact on new firm formation.

3 Methods

The data we use is not a sample or panel but a complete and extensive dataset of all existing and newly created firms in France ("SIRENE" database). Our data include information of every new firm founded between 1993 and 2001 [total manufacturing/trade/services (MTS)-sector number of new firms is 1,836,671 while that in high-technology (HT)-industry is 84,535]. High technology is defined as computer/software services and telecommunications and other knowledge-intense services (Lasch et al. 2013). In addition to this data, independent variables come from public economic and population statistics administered by the French INSEE institute (*Institut National de la Statistique et des Etudes Economiques*) like census data and labor statistics. Answering the demand for more disaggregated studies, we use the aggregate level of labor market areas (LMA). These LMA are aggregations of the 33,000 municipalities in France into 348 LMA. LMA cover the economic area of influence of agglomerations and small- and middle-sized towns (this differs from the less aggregated French "départements" or the "régions"). MTS entrepreneurship is defined as all new firms founded in MTS sector while HT entrepreneurship is defined as new firm formation in high-tech industries like computer/software services and telecommunications and other knowledge-intense services. As we focus on the comparison of firm birth intensity between areas, we calculate our rate using the ecological approach and the *location quotient* (Schmude 1994): the firm birth rate in an area is divided by the national firm birth rate.

Similarly, HT entrepreneurship is measured by the LMA firm birth rate in the HT sector (number of new HT firms divided by the number of all existing firms in a labor market area). The 21 independent variables (Table 1.1) are associated to the four groups of regional indicators (agglomeration and local industry descriptors, entrepreneurial and human capital measures, knowledge spillovers).

4 Results

The explanatory power for the MTS (total manufacturing/trades/services sector) and the HT sector is generally high (ICS sector: $R^2 = 0.851$, Table 1.2; HT sector: $R^2 = 0.890$, Table 1.3).

Table 1.2 presents the results obtained for each variable in the MTS sector. Nine variables are significant at the 1 % level while twelve obtain no significant result. Eliminating size or unit effects, the standardized regression coefficient enables us to compare directly the results for each variable. Ranking the variables of the four factor groups in descending order according to the value of the regression coefficient, we obtain the strongest influence for entrepreneurial and human capital measures (H2 and H3), followed by agglomeration descriptors (H1, particularly population growth). External knowledge indicators are not supported statistically. Having said this, we have to acknowledge that the results of firm survival rate (H2a)

Table 1.1 Independent variables

Infrastructure and industry externalities
Population density per km^2 in 1994; INSEE industry diversity index in 1994; number of large industrial firms over 200 employees in 1995; population growth between 1982 and 1990; share of large firms over 200 employees in 1994 (%); share of very small firms with 0 employees in 1997 (%)
Entrepreneurial capital
Survival rate of new firms of the 1990 generation 5 years after start-up (%); share of owner-entrepreneurs under 35 years age in 1997; share of self-employed craftsmen/commercials/managers at the active working population in 1990 (%); share of salaried employees at the active population in 1990 (%); employment in local firms depending on regional headquarters/decision centers in 1997 (%)
Human capital
Share of population holding only a baccalaureate (high school diploma) as highest diploma in 1990 (%); unemployment rate in 1994; share of population under 65 years living under the level of social minima in 1996 (%); share of household owners among residential population (primary residence) in 1990 (%); share of foreigners at the residential population in 1990 (%)
Knowledge spillovers
Number of students in universities in 1996/1997; share of employment of nonpublic R&D firms at the total employment in 1993 (%); share of employment held by HT firms in computer services/telecom at the total employment in 1993 (%); share of employment held by HT firms in knowledge-intense services at the total employment in 1993 (%); share of employment held by HT firms in high-tech industries at the total employment in 1993 (%)

and educational attainment (H3a) are opposed to what is hypothesized and significantly so.

H1a (population density) is statistically significant and H1a is accepted.

H1b (industry structure) uses two variables (industry diversification; large industrial firms). Neither measure is significant, so we find no support for H1b.

H1c (population growth) is statistically significant supporting H1c.

H1d is measured using employment in very large firms. We find no support for H1d.

H1e is measured using employment in very small firms. We find no support for H1e.

H2a (firm survival) includes one variable. The regression result is negative and significant and we have to reject H2a. This may be due to a crowding out effect.

H2b (entrepreneurial capital) includes three variables (share of owner-entrepreneurs; liberal and managerial professions; share of salaried employees). Owner-entrepreneurs and salaried employees are significant measures in contrast to liberal and managerial professions. We give partial support to H2b.

H2c (regional entrepreneurial autonomy) is measured by employment in local firms depending on regional headquarters and not significant. We find no support for H2c.

H3a (education level) tests the effect of relatively low qualified population for HT entrepreneurship (population holding only a high school diploma as highest education level) and is significant. We have to reject H3a. It may be that a high share level of the population with only a high school diploma goes together with a

Table 1.2 Regression results for economy-wide (MTS) entrepreneurship

Variable	Beta (standardized)	Sig.	Rank
Infrastructure and industry externalities			
H1a: Population density	0.102	0.000***	9
H1b: Industry diversity	0.001	0.983	ns
H1b′: Large industrial firms	0.005	0.877	ns
H1c: Population growth	0.372	0.000***	1
H1d: Employment in large firms	−0.004	0.890	ns
H1e: Employment in small firms	0.060	0.109	ns
Entrepreneurial capital			
H2a: Firm survival rate	−0.171	0.000***	4
H2b: Owner-entrepreneurs	0.175	0.000***	3
H2b: Liberal and managerial professions	0.011	0.807	ns
H2b: Employees	0.182	0.000***	2
H2c: Regional decision centers	0.014	0.626	ns
Human capital			
H3a: Educational attainment	0.106	0.023**	8
H3b: Unemployment rate	0.148	0.000***	5
H3c: Social minima	0.023	0.629	ns
H3c: House owners	0.110	0.003***	7
H3d: Diversity	0.139	0.000***	6
Knowledge spillovers			
H4a: University	0.028	0.369	ns
H4b: Nonpublic R&D firms	0.025	0.403	ns
H4c: Computer and telecommunication	0.082	0.071	ns
H4c: Knowledge-based services	0.020	0.555	ns
H4c: High-tech industry	0.000	0.990	ns

$R^2 = 0.851$ (adj. $R^2 = 0.842$). *ns* not significant
**sign. 5 %; ***sign. 1 %

high level of firm start-ups because of the necessity effect: one cannot find a job with relatively low qualifications.

H3b (unemployment) intends to analyze the effect of satisfying local employment opportunities resulting in a significant correlation. We find support for H3b.

H3c (private capital) tests the local private investment potential for entrepreneurship (share of householders, share of population living under social minima standards). Only the richness descriptor obtains a positive and a significant result. We give partial support to H3c.

H3d (social diversity) uses one variable (share of foreigners) and is confirmed by the regression result.

The variables for H4a (university knowledge spillovers), H4b (R&D knowledge spillovers), and H4c (geographical proximity to incumbent HT firms) are not statistically significant which does not lead to support for H4a–c.

Table 1.3 presents the results obtained for each variable in the HT sector (see also Lasch et al. 2013). The setup is identical to that of Table 1.2 with the exception that MTS new firm formation is used as a control. Ten variables are significant at the 1 % level, four at the 5 % level, and seven obtain no significant result.

Table 1.3 Regression results for high-technology (HT) entrepreneurship

Variable	Beta (standardized)	Sig.	Rank
Control variable: economy-wide firm formation rate	0.328	0.000***	1
Infrastructure and industry externalities			
H1a: Population density	0.003	0.900	ns
H1b: Industry diversity	0.054	0.019**	13
H1b′: Large industrial firms	0.012	0.666	ns
H1c: Population growth	0.028	0.393	ns
H1d: Employment in large firms	0.082	0.002***	10
H1d: Employment in small firms	0.024	0.460	ns
Entrepreneurial capital			
H2a: Firm survival rate	0.029	0.266	ns
H2b: Owner-entrepreneurs	−0.089	0.000***	8
H2b: Liberal and managerial professions	−0.162	0.000***	4
H2b: Employees	−0.097	0.007***	7
H2c: Regional decision centers	0.141	0.000***	5
Human capital			
H3a: Educational attainment	0.135	0.001***	6
H3b: Unemployment rate	−0.054	0.134	ns
H3c: Social minima	−0.020	0.624	ns
H3c: House owners	0.032	0.313	ns
H3d: Diversity	0.087	0.003***	9
Knowledge spillovers			
H4a: University	0.068	0.011**	11
H4b: Nonpublic R&D	0.057	0.028**	12
H4c: Computer and telecommunication	0.269	0.000***	2
H4c: Knowledge-based services	0.179	0.000***	3
H4c: High-tech industry	0.044	0.029**	14

$R^2 = 0.890$ (adj. $R^2 = 0.883$). *ns* not significant
**sign. 5 %; ***sign. 1 %

Ranking the variables of the four factor groups, we obtain the strongest influence for external knowledge sources (H4), followed by entrepreneurial and human capital measure (H2 and H3). Agglomeration descriptors (H1) are the weakest factor group.

For this specific sector, the control variable cross-sectional new firm formation rate was introduced to see if HT entrepreneurship is influenced by the overall entrepreneurship level. While we find significant support for this trend, the results of the four factor groups and the variables used provide a totally different picture and give support to the specific nature of HT entrepreneurship analyzed on a regional level.

H1a (population density) does not yield a significant coefficient and H1a is not supported.

H1b (industry structure) uses two variables (industry diversification; large industrial firms). Statistical support is given to industry diversification, but not to large firms in the industry. We give partial support to H1b.

H1c (population growth) is not significant. Hence there is no support for H1c.

H1d is analyzed using employment in very large firms. We find support for H1d.

H1e is analyzed using employment in very small firms. We find no support for H1e.

H2a (firm survival) includes one variable. The regression result is not significant and we cannot claim support for H2a.

H2b (entrepreneurial capital) includes three variables (share of owner-entrepreneurs; liberal and managerial professions; share of salaried employees). All are statistically significant. We give full support to H2b.

H2c (regional entrepreneurial autonomy) is measured by employment in local firms depending on regional headquarters and is significant. We confirm H2c.

H3a (education level) analyzes the effect of the share of modestly qualified population for HT entrepreneurship (population holding high school diploma as highest education level). We find a positive and significant effect and have to reject H3a. The same effect is found in the analysis for the total MTS sector.

H3b (unemployment) intends to analyze the effect of satisfying local employment opportunities resulting in a not significant result. We find no support for H3b.

H3c (private capital) tests the local private investment potential for entrepreneurship suggesting a positive relationship for richness (share of householders) and a negative one for poverty (share of population living under social minima standards). Neither measure is significant. We find no support for H3c.

H3d (social diversity) uses one variable (share of foreigners) and is confirmed by the regression result.

The variables for H4a (university knowledge spillovers), H4b (R&D knowledge spillovers), and H4c (geographical proximity) are all statistically significant. We find support for H4a–c.

5 Discussion

Comparing the results for the total MTS sector and the high technology, we obtain the following set of widely contrasting results.

5.1 Economy-Wide Entrepreneurship (Table 1.2)

Ranking the variables of the four factor groups we obtain the best result for entrepreneurship capital. Human capital measures fit second best to explain why entrepreneurship happens in certain LMA.

Compared to HT entrepreneurship, knowledge spillovers don't play a role in our model, which is a new result as the literature suggests the positive effect of this factor for entrepreneurship in general. Finally, we cannot confirm a strong contribution of agglomeration and local industry indicators. We measure some

competitive advantages for entrepreneurs in agglomerations, but the only other significant variable indicates local market opportunities as a main driver for entrepreneurship. In sum, when entrepreneurship support designs policy measures, a strong relationship between incumbent entrepreneurship and human capital is to be considered and knowledge spillovers appear to play only a secondary role (or existing policy measures call for improvement). Finally, new entrepreneurship emerges relatively independent from incumbent industry structure but appears to be especially sensitive to local market opportunities.

5.2 HT Entrepreneurship (Table 1.3)

Ranking the variables of the four factor groups, we obtain a completely different picture as compared to the MTS results. We measure the strongest influence for knowledge spillovers, followed by entrepreneurial capital indicators. Human capital measures figure next, but only two of the variables are significant and they rank somewhere in the middle (respectively, 6 and 9 out of 14).

Agglomeration and local industry descriptors rank lowest. Our results describe HT entrepreneurship as relatively independent from incumbent industry structure, overall entrepreneurship conditions (nonsignificant firm survival, negative results for overall entrepreneurship capital as proxied by share of owner-entrepreneurs and entrepreneurial/managerial expertise) and strongly linked to the geographical proximity to same or similar firms. Similar to this, human capital measures tend to indicate that we deal much less than expected with the educated high-tech entrepreneur and more with social diversity features. To our surprise, both measures for external knowledge sources from universities or private R&D firms (interaction, networking, cooperation, exchange of tacit knowledge and specialized skills, etc.) considered crucial for knowledge-based entrepreneurship in literature produce only weak regression coefficients and rank only 11 and 12 out of 14. Geographical proximity being the predominant regional factor seems to support the Krugman and Porter principles of location highlighting clustering, interaction of firms, circular loops, and cumulative effects (see Lasch et al. 2013 for more discussion).

6 Conclusion

The objective of the paper is to provide an answer to the question whether regional factors have potential for explaining new firm formation using data of French industries in the period 1993–2001. We identified and measured 21 regional factors explaining economy-wide entrepreneurship, which we compare with the results for the high-tech (HT) industry. Overall, our findings give support to the argument that regional factors for economy-wide entrepreneurship are not generalizable for specific types of entrepreneurship or industries. Hence, entrepreneurship support

should be tailored to specific industries. Our results also suggest that that HT entrepreneurship happens predominantly in entrepreneurial places. This can be concluded from the result that economy-wide new firm formation influences HT new firm formation. Economy-wide entrepreneurship is mainly driven by entrepreneurial capital effects like share of self-employed and share of salaried employment in the active working population and human capital effects like educational attainment, unemployment rate, share of house owners, and share of foreigners. Locally bound knowledge spillovers do not seem to play a role. HT entrepreneurship appears to be relatively independent of incumbent agglomeration factors (industry diversity or incumbent large firms) and incumbent entrepreneurial capital or expertise but depends much on locally bound knowledge spillovers from incumbent knowledge-based firms (see Lasch et al. 2013 for more results).

Our work is not free of limits that are mainly linked to the methodological choice of the level of analysis (aggregate regional level). Our findings call to be tested using variables on individual or organizational levels of analysis. A replication of this study using other sectors as control variable would in our eyes provide additional results on the stability and generalization of location factors. Surprising results, such as perverse effects for the influence of firm survival rates and educational attainment and weak results for knowledge spillovers, present other challenges for future research.

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Chapter 2
The Role of Science and Technology Parks in the Generation of Firm Level Social Capital Through University–Firm Relations: An Empirical Study in Spain

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1 Introduction

Nowadays, science and technology parks (STPs) generally represent a kind of public–private partnerships that are designed to foster knowledge flows, mainly among park firms, as well as between these firms and external R&D institutions, and thus improve regional economic growth (Link and Scott 2007). Despite there is no official definition of what is an STP, some common denominators across different existing models suggest a set of minimum standards and requirements that any knowledge cluster should have to earn this formal recognition (Link 2009).

Among these common denominators it can be highlighted that STPs facilitate access for firms to key factors such as R&D, human capital, innovation infrastructures, venture capitalists, technological capital, and social capital (European Commission 2008). These factors are related to the capacity to adapt to technological, economic, and social changes in markets. Therefore, STPs have emerged based on new institutional arrangements that facilitate interactive relations between universities, industry and government (Etzkowitz 2008).

Considering that STP literature is in an emerging stage of development, during recent years researchers have stimulated an important academic debate concerning whether such property-based initiatives really enhance the performance of firms and economic growth of regions (Martínez-Cañas et al. 2011). To this respect, there are differences of results in empirical researches founding positive or non-significant effects of STPs on firm performance (Link 2009). This divergence

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implies that previous studies do not analyze STPs from the point of view of their active role in the knowledge-based economy where intangible and relational aspects are critical in the market (Hansson 2007).

Thus, the main contribution of this chapter is to focus on analyzing the value generated through relations between universities and tenant firms. Therefore, the use of social capital theory will enhance our understanding about the dynamism that is often a consequence of strong interactions between these actors (Bueno-Campos and Rodríguez-Pomeda 2007). From this perspective of analysis, tenants have to set up effective networking activities to encourage the transfer of knowledge, resources, and innovations from universities (Hansson et al. 2005). So this chapter also contributes to extend previous studies that have tended to measure the value of STPs for firms using traditional economic indicators (mainly at park level of analysis), such as annual growth, profitability, employment rate, or the number of new companies created (Hansson 2007). With the adoption of a social capital approach, it can be taken into account the growing importance of knowledge or intangible aspects derived from social relations, which can be the appropriate variables to indicate success in a network economy (Westlund 2006).

The next epigraph develops the role of intangible relationship aspects in university–firm relations, using social capital at firm level to identify the source, main dimensions and benefits. In the third epigraph, a conceptual model and hypothesis of social capital generation through relations inside science parks is proposed. The fourth epigraph includes the methods and empirical results obtained. Finally, the last epigraph includes the main conclusions, limitations, and lines of future research.

2 Social Capital Generation in University–Firm Relations

During the last 20 years social capital theory has provided a distinctive and valuable answer to the question of why some people and some organizations do better in the sphere of interorganizational relations (Nahapiet 2008). This conceptual approach has also helped researchers to explain why and how organizations connect effectively, work cooperatively, and coordinate their activities to achieve a superior performance in the market. From this theoretical perspective, oriented toward strategic relatedness, firms are motivated to generate, develop, and maintain relationships with other organizations because relations ease the access to key resources, information, markets, technologies, advantages from knowledge and learning, scale and scope economies, as well as risk sharing (Gulati et al. 2000).

In this chapter we try to converge two related lines of research: science and technology parks and organizational social capital. On the one hand, we study STPs as an artificial physical structure that facilitates interaction among the economic agents located inside (Hansson 2007) but from a relational perspective where tenants obtain and mobilize key resources from their relations with universities as an important source of competitiveness that impacts their performance. So, this approach is focused on

science parks using the view of networks and knowledge-based organizations as the main source of competitive advantage in the market (Nahapiet 2008).

On the other hand, this chapter is considering that the unit of analysis is interorganizational relationships between universities and firms. So, we propose an approximation of study from the relational view (Dyer and Singh 1998) and from the theory of social capital (Westlund 2006). This relational approach considers all interactions between economic agents that generate a type of capital that in the literature is known as social capital. Thus, we contribute to previous work considering that economic agents interact in environments that influence and affect their business (Burt 2005). In the chapter, the positive environment created by STPs facilitates access to valuable resources of universities and R&D centers. These specific valuable resources are the ones that firms need to surive, grow and compete (Powell et al. 1996), and extends the effect of resources available to the organization (Adler and Kwon 2002; Westlund 2006).

2.1 Definition, Sources, Dimensions, and Effects of Interorganizational Social Capital

2.1.1 Definition

Social capital literature lacks a universally accepted definition of its central term. For that reason, some researchers discuss the core notion of social capital without using the term itself (Farr 2004). Trying to overcome this difficulty this chapter adopts the definition of social capital that has had a great influence over management studies and was proposed by Nahapiet and Ghoshal (1998). They consider that social capital is "the sum of the actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit. Social capital comprises both the network and the assets that may be mobilized through that network." This definition makes three distinctive contributions to management (Nahapiet 2008): its resource-based perspective, its ability to combine multiple dimensions of relationships, and its focus on performance outcomes. The definition is based on social capital's view of connections as both resources themselves and conduits to other resources that can be leveraged for material gain. It applies to individuals as well as groups and communities; we also add organizations (Nahapiet 2008). In this sense, and for our concrete study on STPs, social capital theory can address management questions related to access to resources and rent appropriation (Blyler and Coff 2003).

Social capital studies reflect different levels of analysis from an individual to a group, organization, community, region, or even international relationships (Zheng 2010). In that sense it provides a valuable way to characterize an organization's complete set of relationships, including those that cross institutional boundaries. Due to the vast quantity of research in social capital this chapter focuses on the

university–firm relationship as source, the dimensions of social capital and their effect on firm performance.

2.1.2 Sources

Social capital literature identifies three different ways in which social capital is created: historical ties, institutional facilitation or organizational facilitation (Scillitoe and Chakrabarti 2009). In this research, STPs constitute infrastructures that facilitate the development of valuable relationships for located actors. Furthermore, the main actors that can generate social capital inside STPs are (European Commission 2008):

- Universities, R&D institutions, and other higher education institutions that had created and/or participated in the commercialization of their research results. These institutions also want to establish a good environment for graduates that will enable them to participate in interesting applied projects, develop valuable relationships, attain good employment possibilities in the future, and offer the chance to create their own companies.
- Other tenants that are looking for new partners to upgrade their R&D with international ideas, good information systems, qualified labor pools, good locations, and excellent services and thus increase their profits.
- Professional managers of the STP who act as go-betweens for developing and facilitating relationships in order to follow a proactive strategy that enhances the global profit of the project, by offering premises and services needed to develop and consolidate the STP. Generally this staff is supported economically and financially by regional governments or corporate investors.

With this interpretation of social capital source, this study exclusively focuses on university–firm relationships that contribute directly and distinctly to the generation of social capital.

2.1.3 Dimensions

Nahapiet and Ghoshal (1998) define social capital as a type of capital that shows three different facets in relations: structural, relational, and cognitive. Each dimension is important for understanding the structure and content of mutual benefits in social relations (Lesser 2000):

- The structural dimension depends on the other subdimensions, such as a relative position within a relationship or network, individual relationships with other actors, and structural holes covered by firms (Lee 2009).
- The relational dimension derives from the interpersonal dynamics within the structure that lead to the formation of social capital through the generation of trust and reciprocity (Nahapiet and Ghoshal 1998).

– Finally, the cognitive dimension entails the common context within the structure, which includes but goes beyond language to address acronyms, subtleties, and underlying assumptions that constitute basic necessities for everyday communication within a firm (Lesser 2000).

These three core dimensions that form the social capital construct reflect differentiated but related aspects of relationships (Zheng 2010). Generally though, researchers consider each dimension separately; it is necessary to use a holistic view to obtain a complete understanding of the process-based linkages across structural, relational, and cognitive social capital (Lee 2009).

2.1.4 Effects on Performance

Social capital research emphasizes the performance outcomes of social connections (Lee 2009). There are important contributions in management and organizational literature to note the positive value of social capital at firm level. To cite just a few contributions, social capital reportedly has beneficial effects on interorganizational networks and resource exchanges (Tsai and Ghoshal 1998), the creation of new intellectual capital (Nahapiet and Ghoshal 1998), knowledge acquisition and exploitation (Yli-Renko et al. 2001), family firm success (Zahra 2010), interorganizational learning (Wu and Cavusgil 2006), knowledge acquisition and new product and service innovation (Martínez-Cañas et al. 2012).

Also, recent studies demonstrate the role of social capital in terms of how firms start to reconfigure three dimensions over time to affect value generation, in the form of start-up performance (Maurer and Ebers 2006), firm performance (Cooke 2007), and firm competitiveness (Wu 2008). This approach to study the benefits of relationships provides an interesting line of research in management to study how interactions of tenant firms in STPs create value through collaborative advantages.

3 Theoretical Model and Hypothesis Proposed

3.1 Theoretical Model

To study social capital generated in relationships we use as basis the conceptual model proposed by Adler and Kwon (2002). This model is structured into four main parts: (1) the generation of social capital, (2) the main dimensions (structural, cognitive and relational), and (3) the positive effect on business performance.

In the first part of our model we identify that organizational social capital is generated in relationships of tenant firms with universities. Adler and Kwon (2002) consider that the key sources of social capital are networks, norms, social beliefs, and rules. They consider that each of these sources makes a distinct contribution to the formation of social capital although all three are mutually interdependent. So,

the primary sources can be considered as direct sources generated with the important role of formal institutions (or more specifically rules) and trust as indirect sources or even direct sources of social capital.

In the second part of the model, the three main dimensions of social capital are identified: structural, relational, and cognitive. These dimensions are the effect or "more or less durable social relations" that influence the development of the mutual benefits of social capital (Lesser 2000): the structure of the relations, the interpersonal dynamics that exist within the structure, and the common context and language held by individuals in the structure. In the first dimension we consider social capital from an egocentric perspective in relations because we are concerned with the connections that firms have with universities. With the second, the relational dimension, we consider that social capital is not limited to the presence of contacts within the given network, and the positive interactions between individuals in the network lead also to the formation of social capital. In the literature, this facet of the relationship has been already discussed with concepts as trust and reciprocity (Nahapiet 2008). As, the third enabler of social capital we identify the "common language" that individuals can use. This use of "common language" includes but goes beyond languages and addresses also the acronyms, subtleties, and underlying assumptions that are the necessities of everyday communication (Lesser 2000). Trying to follow the structure of the theoretical model proposed by Adler and Kwon (2002) we are going to consider social capital as only one construct formed by his three main dimensions.

In the third part we analyze that organizational social capital can make collective action more efficient, because it becomes a substitute for the formal contracts and mechanisms of the market (Lesser 2000). Therefore, social capital at the firm level is an important input generator in the value creation process of firms; so we consider this effect on knowledge acquisition and exploitation (Yli-Renko et al. 2001), reputation (Wiedman and Hennings 2006), and new products and services development (Zheng 2010).

As a basic resume in Fig. 2.1, the three-part theoretical model of social capital generation inside science parks can be seen.

3.2 Hypothesis Proposed

For the hypothesis proposition we focus on the link between the second part of the model (social capital at firm level) and the third part (effects on firm performance), because it has been explained that the social capital originated in university–industry relationships and it has a multidimensional nature.

3.2.1 New Products Development

The value of social capital as an enabler depends on the willingness of exchange partners to engage in two-way interaction. The knowledge that firms can derive

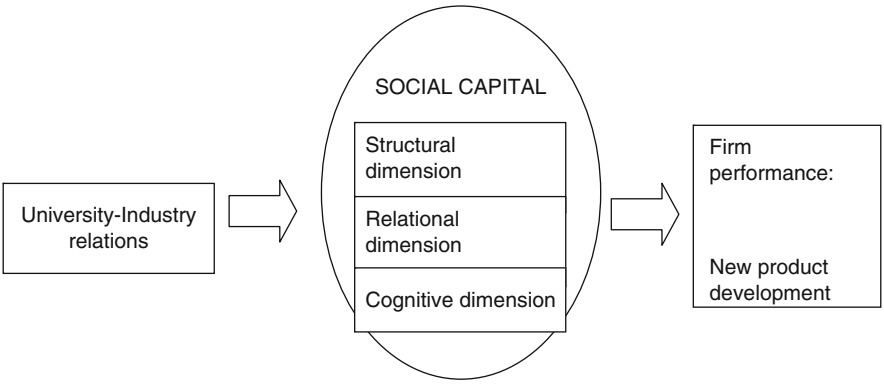

Fig. 2.1 Theoretical model of social capital. *Source*: Adapted from Adler and Kwon (2002)

from their relationships may be particularly valuable for the development of new products and services (von Hippel 1988). As a consequence, tenant firms can use laboratories, infrastructures and services that the university is offering inside science parks. For universities, firms can represent a source of timely, accurate, tacit, and confidential information on, e.g., developments in related technologies and customer needs. A high level of information exchange with a firm may thus enhance the ability of the firm to develop new products and bring them to the market. Also, as literature suggests, social capital enables innovation (Zheng 2010). We can express this idea formally as follows:

Hypothesis 1. The higher the level of social capital in university–firm relationships, the more will be the number of new products and services developed by the firm.

3.2.2 Technological Distinctiveness

Several studies provide empirical evidence implicitly linking learning with knowledge distinctiveness in new ventures. Value is enhanced by distinctiveness: the more distinctive the resource, the more readily it can be leveraged for rent-generating purposes. Because tenant firms located in science parks do not possess sufficient resources to compete with volume and cost-efficiency, distinctiveness is the primary mechanism for achieving competitive advantage, particularly in high-technology sectors. We can summarize that social capital enhances technological distinctiveness (Yli-Renko et al 2001), and we hypothesize:

Hypothesis 2. The higher the level of social capital in university–firm relationships, the more distinctive will be the technology of the firm.

3.2.3 Knowledge Acquisition

Learning increases the distinctiveness of the firm's knowledge base, as new intellectual capital is created by innovatively combining firm-specific knowledge with universities' knowledge and resources. According to the resource-based theory, four basic conditions enhance the rent-generating potential of resources: scarcity, non-substitutability, imperfect imitability, and resource value (Barney 1991). As literature supports, social capital facilitates knowledge acquisition of value-resource key for competitive advantage (Yli-Renko et al. 2001). In line with the above arguments we can postulate that:

Hypothesis 3. The higher the level of social capital in university–firm relationships, the more distinctive will be the knowledge acquisition of the firm.

3.2.4 Firm Reputation

In social capital literature some researchers support the idea that social capital generates a better firm's reputation (Wiedman and Hennings 2006). Their assumptions are that the more information a customer has about a tenant firm located in a science park, the more authoritatively it will be able to detail to other potential customers the benefits and strengths of dealing with the firm, thus improving the reputation of this firm. So we can suggest that:

Hypothesis 4. The higher the level of social capital in university–firm relationships, the more reputation will have the firm.

4 Methods and Results

4.1 Sample

For testing the theoretical model proposed a survey to the firms' CEO from a sample of 1,280 Spanish firms that were located inside 21 science parks was sent. Those firms were from sectors such as aerospace and automotive, training and human resources, information technology, medicine, biotechnology, engineering, consultancy, and environmental activities. The more comprehensive database of tenants that was available in the firm directory of the Spanish Association of Science Parks (APTE) was used. From the whole directory only those firms for the above industries and with a high added value in their activities were identified. We received 214 valid questionnaires (16.87 of response rate). A test for response bias was made and there were no differences among the mail, e-mail, or online questionnaire responses. Also a common method bias test was made using

a one-factor Harman test (Scott and Bruce 1994) and the factors obtained did not represent a problem.

4.2 Operationalization of Variables

For measuring latent constructs we used items previously accepted in the literature for dimensions of social capital (Nahapiet and Ghoshal 1998; Yli-Renko et al 2001; Chakrabarti and Santoro 2004), new products development (von Hippel 1988), technological distinctiveness (Wernerfelt 1984; Yli-Renko et al 2001), knowledge acquisition (Ye 2005) and firm's reputation (Wiedman and Hennings 2006).

All concepts included in the present study, with the exception of innovation, were latent variables. Every statement-style item thus was measured on a Likert-type scale from 1 = "do not agree" to 5 = "completely agree." To measure social capital and knowledge acquisition, authors adapted statements from previous studies.

4.3 Statistical Method

The hypotheses were tested using structural equation modeling with the partial least squares (PLS) technique (Chin et al. 2003), which offers a flexible statistical approach with rigorous and robust procedures (Wold 1980). PLS was considered for the study as the best suitable method because this statistical tool is intended primarily for causal predictive analysis and has proved very useful in situations marked by high complexity but low theoretical information (Chin et al. 2003). Accordingly, the software PLS-Graph 3.00 was used (Chin 2003) and the stability of the estimates with a bootstrap resampling procedure (500 subsamples) was tested.

4.4 Assessment of the Measured Model (First Order Variables)

With regard to the measurement model, it is divided into first-order variables and second-order variables. All were reflective latent constructs (Chin 1998). As recommended by Chin (2010) we assessed the following for two types of variables: individual item reliability, construct reliability, convergent validity and discriminant validity of all the items from first- and second-order constructs. For the individual item reliability we considered it adequate when the value of its standardized load equals to or is over 0.707 (Carmines and Zeller 1979). For construct reliability, we evaluated it by examining their composite reliability of

Table 2.1 Measurement model: item loadings, construct reliability, and convergent validity

Latent variables	Item	Loading	Composite reliability	AVE
Structural dimension	SD01	0.8647	0.926	0.6584
	SD02	0.8567		
	SD03	0.7809		
	SD04	0.6865		
	SD05	0.6835		
	SD06	0.6955		
	SD07	0.8374		
	SD08	0.7787		
	SD09	0.6587		
Cognitive dimension	CD01	0.696	0.916	0.609
	CD02	0.8241		
	CD03	0.7938		
	CD04	0.8255		
	CD05	0.7618		
	CD06	0.7872		
	CD07	0.7656		
Relational dimension	RD01	0.7312	0.819	0.516
	RD02	0.8291		
	RD03	0.8809		
	RD04	0.7547		
Technological distinctiveness	TEDIS01	0.8525	0.912	0.722
	TEDIS02	0.8248		
	TEDIS03	0.8866		
	TEDIS04	0.833		
Knowledge acquisition	KNACQ01	0.8955	0.897	0.690
	KNACQ02	0.9124		
	KNACQ03	0.8576		
	KNACQ04	0.6251		
Reputation	REPUTA01	0.9265	0.920	0.852
	REPUTA02	0.9191		

the constructs (Werts et al. 1974). For convergent validity we evaluated by means of the average variance extracted (AVE) which should be greater than 0.5 (Fornell and Larcker 1981). Finally, for discriminant validity, according to Barclay et al. (1995), all reflective indicators should load more highly on their own construct than on others. In addition, AVE should exceed the variance shared between the reflective construct and other constructs in the model (Fornell and Larcker 1981). As it is showed in Table 2.1, both indicators and latent variables exceed the conditions proposed above to assess the four conditions that determines a good measured model.

For discriminant validity test, as it is shown in Table 2.2 (correlation matrix) the variance shared between any item in every focal construct and other latent constructs in the model (See bolded values in Table 2.2). Thus, the measurement model for the first-order variables of social capital is reliable and valid.

Table 2.2 Correlation matrix for first-order variables

	SD	CD	RD	TD	KA	RE
SD01	**0.865**	0.743	0.584	0.150	0.503	0.450
SD02	**0.857**	0.714	0.542	0.122	0.520	0.440
SD03	**0.784**	0.619	0.490	0.057	0.472	0.462
SD04	**0.687**	0.540	0.542	0.140	0.375	0.320
SD05	**0.682**	0.516	0.334	0.223	0.397	0.328
SD06	**0.696**	0.557	0.407	0.218	0.462	0.376
SD07	**0.839**	0.713	0.523	0.182	0.497	0.370
SD08	**0.780**	0.626	0.550	0.145	0.464	0.439
SD09	**0.659**	0.521	0.556	0.228	0.377	0.499
CD01	0.511	**0.696**	0.551	0.130	0.338	0.378
CD02	0.710	**0.824**	0.719	0.237	0.434	0.425
CD03	0.670	**0.794**	0.686	0.243	0.419	0.427
CD04	0.637	**0.829**	0.702	0.140	0.394	0.464
CD05	0.621	**0.761**	0.502	0.142	0.433	0.307
CD06	0.651	**0.790**	0.524	0.180	0.450	0.327
CD07	0.623	**0.766**	0.489	0.169	0.470	0.345
RD01	0.391	0.496	**0.732**	0.061	0.268	0.288
RD02	0.516	0.640	**0.829**	0.095	0.310	0.321
RD03	0.605	0.682	**0.882**	0.123	0.377	0.387
RD04	0.576	0.626	**0.755**	0.125	0.410	0.356
TEDIS01	0.149	0.160	0.050	**0.853**	0.025	0.019
TEDIS02	0.163	0.178	0.091	**0.825**	0.083	0.148
TEDIS03	0.151	0.184	0.097	**0.887**	0.065	0.123
TEDIS04	0.237	0.243	0.184	**0.833**	0.123	0.134
KNACQ01	0.525	0.463	0.354	0.085	**0.896**	0.586
KNACQ02	0.546	0.485	0.372	0.072	**0.912**	0.619
KNACQ03	0.516	0.473	0.352	0.093	**0.858**	0.626
KNACQ04	0.372	0.354	0.377	0.048	**0.626**	0.381
REPUTA01	0.499	0.463	0.451	0.156	0.608	**0.926**
REPUTA02	0.497	0.443	0.333	0.077	0.640	**0.919**

4.5 Assessment of the Measured Model (Second-Order Variables)

Second-order constructs involve more than one latent dimension and can be distinguished theoretically from unidimensional or first-order constructs (Wetzels et al. 2009). The main utility of using social capital as a second-order construct is that it provides more theoretical parsimony and enables us to analyze the joint effect of several latent variables. Because social capital dimensions are closely interrelated (Lee 2009; Zheng 2010), it was regarded the construct as reflective, determined by the effect of its three dimensions. Therefore, a step-by-step approach was used, including all the latent variable scores of the manifest variables of the underlying lower-order latent variables related to the structural, relational, and cognitive dimensions (Wetzels et al. 2009). As was done for first order construct, the measurement model was tested in terms of individual

Table 2.3 Measurement second-order model: loadings, reliability, and convergent validity

Second-order construct	Item	Loading	Composite reliability	AVE
Social capital in university–industry	SD	0.9187	0.936	0.831
	CD	0.946		
	RD	0.8682		

Table 2.4 Correlation matrix (AVE on diagonal)

	PRODSERV	DT	AC	RE	CSREE
PRODSERV	**1**				
DT	0.055	**0.959**			
AC	0.225	0.096	**0.947**		
RE	0.244	0.133	0.674	**0.954**	
CSREE	0.208	0.219	0.580	0.538	**0.967**

reliability, construct reliability, convergent validity (Table 2.3), and discriminant validity (Table 2.4).

As shown in Table 2.3, loadings, composite reliability, and AVE exceed the conditions above proposed that determine a good measured model. For discriminant validity (Table 2.4) the AVE should be greater than the variance shared between the latent construct and other latent constructs in the model (i.e., squared correlation between constructs) (Barclay et al. 1995); all latent variables satisfy this condition. In summary, the measurement model for the reflective second-order (as was for the first-order) variables used in this research is reliable and valid.

4.6 Structural Model: Hypothesis Testing

In Fig. 2.2, and on the basis of this empirical data, the proposed model is partially supported. On the left side of the model, first-order constructs (structural, cognitive, and relational dimensions) are significant and reflect the second-order latent construct (social capital). On the right side of the model it shows a positive and significant association in support of Hypothesis H3 ($\beta = 0.292$; $p < 0.001$) and Hypothesis H4 ($\beta = 0.148$; $p < 0.05$). So, the positive relationship predicted between the social capital and knowledge acquisition and firm's reputation was confirmed. Contrary to our expectations we have found a positive but not significant association in support of Hypothesis H1 and Hypothesis H2 (new products development and technological distinctiveness). Analyzing the R^2 values (Table 2.5) of the endogenous constructs, it can be stated that our research model has a weak predictive power, because only firm's reputation construct is explained in a percentage higher than 10 % which is the optimal minimum according to Falk and Miller (1992).

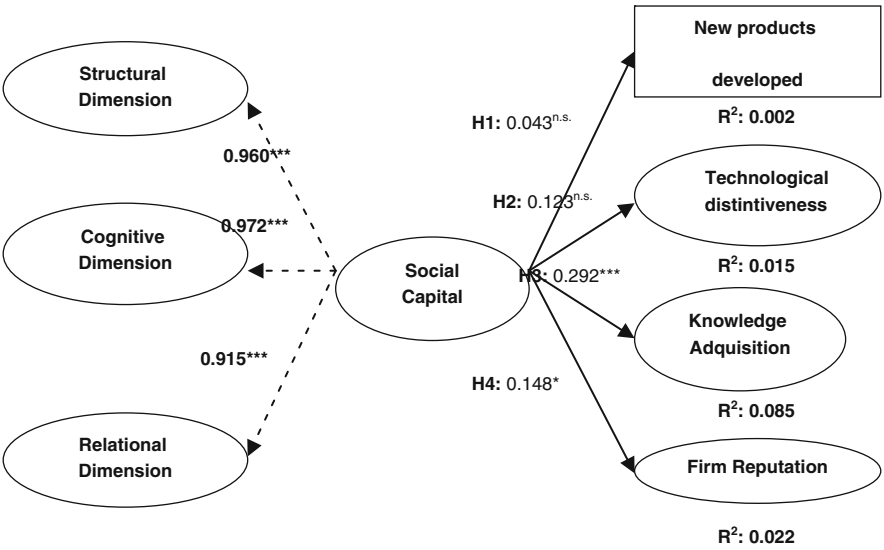

Fig. 2.2 Social capital in university–firm relationships

Table 2.5 Explained variance, hypothesis testing, and *t*-values[a]

	R^2	β/factorial loadings	*t*-Student bootstrap	Supported hypothesis
Hypothesis 1	0.002	$0.043^{\text{n.s.}}$	0.5541	No
Hypothesis 2	0.015	$0.123^{\text{n.s.}}$	1.3536	No
Hypothesis 3	0.085	0.292^{***}	3.8225	Yes
Hypothesis 4	0.022	0.148^{*}	2.1384	Yes

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

[a]*Notes*: (*Student* $t_{(499)}$, one-tailed test): $t(0.05; 499) = 1.64791345$; $t(0.01; 499) = 2.333843952$ and $t(0.001; 499) = 3.106644601$

5 Conclusions, Limitations, and Lines of Future Research

We can conclude that the main results obtained in this chapter are that social capital can be generated in relations with universities. Also, we found that social capital has positive and significant facets (structural, cognitive, and relational) reflected in each dimension. Furthermore, social capital generated through relationships with universities has positive and significant effect on knowledge acquisition and reputation. Contrary to what we have hypothesized, social capital has no significant positive effect on the development of new products and technological distinctiveness.

We think that we need to include in further studies more constructs and variables to explain these variables. We believe this research has positive implications for both park managers and for tenant firms. Park managers should adopt proactive strategies that facilitate the promotion of relations between universities and firms

for obtaining better results due to the interaction. These activities complement their formal activities for advising, space management, and creating high-value services. And for firms located, the results of our investigation show that firms should be proactive with relationships they establish with universities because they contribute greatly to improving their performance.

To finalize we conclude with some limitations of this research that it is difficult to extrapolate the results of capital social in other industries or even countries. Another limitation is that the study is only measuring social capital in one moment of time.

As future lines of research we should include more independent variables and we should analyze relations with other economic agents (inside and outside the park). We also need to develop a more complex model that should include other variables that can moderate the relationship between social capital and firm performance variables.

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Chapter 3
Knowledge Transfer in or Through Clusters: Outline of a Situated Approach

Julie Hermans

1 Introduction

Clusters usually assume a dynamic of innovation at the crossroad between proximity and distance. On the one hand, proximity triggers trust and a sense of common understanding between members that allow for the transfer of knowledge, especially its tacit components. But, at the same time, the innovativeness of the cluster also depends on distance: participants from different organizations with different skills, objectives, and interests interact in a joint network. It creates a complex context for knowledge sharing, full of creative tensions and power issues.

While insights from economic clusters (Porter 1998) or National (Lundvall 1992; Nelson 1993) and Regional Innovation Systems (Cooke et al. 1998; Asheim 2003) allow grasping the rationale behind the promotion of the innovation clusters, an important gap subsists in the understanding of the learning processes that are triggered, especially their political dimension. To make sure that such relationships keep their promises, it is important to understand what kinds of learning mechanisms are at stake and how partners ensure that the newly created knowledge is of interest for their parent organizations or themselves.

Nevertheless, power issues and their impact on knowledge transfers have not been studied yet in the context of innovation clusters. One potential reason is the scarce use of frameworks that adequately manipulate such research objects. The goal of this chapter is therefore to outline a research approach for studying interorganizational knowledge transfers in clusters as a situated, political process.

Especially, I use the Structuration Theory developed by Anthony Giddens (1984) as a conceptual framework for conducting a situated approach. Theoretical and methodological implications are discussed and illustrated with examples from

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in-depth longitudinal case studies. The cases are university–industry (U–I) R&D projects launched in the context of the Competitiveness Clusters of Wallonia, the French-speaking part of Belgium. They were conducted from June 2007 to August 2010 as part of my doctoral work (Hermans 2011). Drawing on them, I explore how power interactions shape the processes of knowledge creation and exchange between partners. The empirical material comprises data collected through semi-structured interviews, documentation, and observation. Events of power exercise—which I call "critical events"—and subsequent impact on knowledge transfers were observed during plenary meetings, recalled by respondents through interviews and codified by the project managers in the minutes of the plenary meetings.

The chapter is structured as follows. After the introduction, Sect. 2 briefly reviews the traditional approaches for the study of knowledge transfer. It also highlights a specific weakness in extant research as it fails to address interorganizational knowledge transfer as a political process. Then, Sect. 3 presents the outline of a situated approach by asking three basic questions:

What are the research objects of interest when exploring knowledge transfers through a situated approach?
Which conceptual and methodological tools are deemed appropriate?
Why study knowledge transfer in innovation clusters through a situated approach? Or said otherwise: who are the stakeholders of such studies?

I then conclude the chapter by presenting the key takeaways and challenges when adopting a situated approach. Going beyond its limitations, I also present implications for further research.

2 Towards a Situated Approach

2.1 Challenges in Clusters

In the last decade, the regional clusters gained worldwide popularity. More and more regional economic plans are shaped under its precepts (Ketels 2004), like the knowledge clusters in the Basque Country or the French "*Pôles de Compétitivité*". This trend is supported by strong theoretical arguments, notably the development of knowledge transfer and innovation though spatial agglomeration and collaborative linkages (Sydow et al. 2011; Boschma 2005), as well as by evidence of positive effects from success stories such as the Cambridge area and the Silicon Valley.

Regional clusters usually assume a dynamic of innovation at the crossroad between proximity and distance. On the one hand, spatial agglomeration as well as institutional (Ponds et al. 2007) or cognitive (Maskell 2001; Andersen 2006) proximity trigger trust and a sense of common understanding between members. The network configuration eventually leads to spillovers from local universities (Jaffe 1989; Varga 2002), the transfer of tacit knowledge (Audretsch and Feldman 1996), and the reduction of transaction costs between the participants of the cluster

(Lorenzen and Foss 2003), sometimes at the expense of external relationships (Maskell 2001). On the other hand, benefits also arise from the distance between the participants: by facilitating interactions between organizations with complementary skills or from different disciplines and economic sectors, the clusters create the diversity that preclude creativity and innovation both at the organizational level (Nooteboom 1994; Katz and Martin 1997) and the project level (Gibson and Vermeulen 2003; Edmondson and Nembhard 2009; Van der Vegt et al. 2010).

Nevertheless, the effects of such policies in terms of knowledge transfers are not straightforward. Too much proximity might trigger a lock-in in collaborative behaviors, with a lack of openness and flexibility (Boschma 2005). Besides, managing diversity in R&D collaborations is also one of its biggest challenges (Edmondson and Nembhard 2009).

Box 1: The Competitiveness Clusters of Wallonia

In this chapter, we focus on a clustering initiative that explicitly promotes the concurrent use of proximity and distance: the Competitiveness Clusters of Wallonia.

This policy was launched by the Walloon Government in 2005. The emergence process of the Competitiveness Clusters combines a technocratic selection with a bottom-up approach: first, the number of clusters as well as their area of focus were a priori defined by local authorities on the basis of the work of Professor Henri Capron from the Free University of Brussels (ULB); then, the government of the Walloon Region opened a call for proposal and let the involved actors build their cluster with a limited set of guidelines (see Hermans et al. 2012).

The Walloon Region defines the Competitiveness Cluster (Bayenet and Capron 2007) as the combination on a given territory of companies, training centers, and research units which (1) experience critical mass that allows for international visibility and (2) engage in partnerships to create synergies around innovative joint R&D projects. Indeed, this policy provides the newly created clusters with a budget specifically dedicated to the conduct of collaborative projects. As argued by Bayenet and Capron (2007), the Competitiveness Clusters distinguish themselves from other innovation networks by materializing their potential partnerships into concrete innovative projects. Those projects involve both research actors and industrial partners with the goal of either targeting "the concrete realization of industrial applications within 3 years, or the building of a prospective vision about a given theme as a way to ensure the competitiveness of the industrial members of the cluster" (Gouvernement Wallon 2005).

In those clusters, public funding is therefore dedicated to the conduct of joint R&D projects that stimulate the interconnection of local—but distinct—actors, with a balanced—and mandatory—involvement of universities, SMEs, and big firms. Following its rationale, interorganizational knowledge transfer should ensue and innovation should flourish.

In the clusters such as the Competitiveness Clusters of Wallonia, partners from different organizations, with different rules, skills, and objectives, must sit together and define a shared R&D challenge. Then, they have to share resources to reach personal and aligned goals. In other words, partners must be convinced to work together in the cluster, and, as a consequence, power and politics become critical issues (Phillips et al. 2000). In this light, taking into account the social embeddedness of knowledge transfer, especially its political dimension, appears as a central challenge when studying clusters. This is particularly true inside publicly promoted clusters where partners are driven by diverging goals and interests but nevertheless cooperate in order to access the promised subsidies.

2.2 Traditional Approaches and Limitation

Influenced by mainstream economics (Nooteboom 2000), U–I knowledge transfer has been mainly studied as a one-way flow of basic and mostly public knowledge (Etzkowitz et al. 1998) from research institutions to firms. A quantitative approach has been generally used to understand and measure such flows, for instance, by focusing on publications and patent citations as sophisticated spillover indicators (Breznitz and Feldman 2012). By providing evidence of spatial effects, studies like Jaffe (1989) or Audretsch and Feldman (1996) have been crucial for our understanding of the role of tacit exchange in U–I knowledge transfer, but this literature fails to uncover the specific sharing processes at stake in specific relationships such as the ones that prevail in clusters and R&D cooperations. In fact, the way by which tacit and codified knowledge is exchanged between partners is still relatively unknown (Agrawal 2001). Moreover, it does not fully account for the social embeddedness that is assumed in regional clusters: the need to ensure a shared understanding and to bridge cognitive distances.

The knowledge-based view (i.e., Kogut and Zander 1992, 1996; Nonaka and Takeuchi 1995; Spender 1996; Nahapiet and Ghoshal 1998; Cook and Brown 1999) of the firm (KBV) is a perspective that arose in opposition with mainstream economic theories and which proposes "that a firm be understood as a social community specializing in the speed and efficiency in the creation and transfer of knowledge" (Kogut and Zander 1996, p. 503). Like the resource-based view (RBV), the KBV of the firm supposes that organizations should develop resources that are "valuable, rare, imperfectly imitable, not substitutable" (Barney 2001) in order to sustain competitive advantage. But KBV diverges from RBV on two main issues. The first one is about the type of resources under study. KBV considers knowledge-based resources as the most important assets for the firm (Grant 1996). Assets such as industrial secrets, talented employees, and absorptive capacity (Cohen and Levinthal 1990) are therefore at the heart of competitive advantage. The second divergence is about the role of managers which shifts from the actual management of resources to the management of the context of their use (Nahapiet and Ghoshal 1998). Managers are now supervising the contexts that favor

interactions between knowledge creators (Spender 1996; Nonaka et al. 2000; Reinhardt et al. 2001).

In this way, a KBV approach recognizes that knowledge is not a public good produced outside the economic system, as could have been argued by mainstream economics (Boschma 2005). It rather focuses on its social embeddedness (von Krogh and Roos 1996), using the underlying concept of social capital and structures to explain the creation and sharing of organizational knowledge in context (e.g., Nahapiet and Ghoshal 1998). In other words, it builds on "a pluralistic understanding of knowledge, and a view of organizations as complex adaptive systems, where meaning is socially constructed through ongoing activities of semi-autonomous groups" (Carland et al. 1996, p. 161).

From this perspective, the social interactions amongst cluster participants lead to the transfer of knowledge by building on the "informal norms of trust and reciprocity, in short, the social capital that is required so that companies, intermediate organizations and public agencies be capable of self-organizing around a process of interactive learning" (Cooke and Morgan, 1998, p. 23) (Diez 2001, p. 909). In other words, regional clusters are a source of competitive advantage for both the laboratory and the firm. Indeed, one important advantage of KBV for the study of regional cluster lies in its common definition of academic laboratories, research institutions, and companies as knowledge-creating entities.

Nevertheless, KBV has an important weakness considering the context of clusters. This perspective frames specific hypothesis about the nature of an organization as well as about the people in it: as argued by Spender, "organizations learn and have knowledge only to the extent that their members are **malleable beings** whose sense of self is influenced by the organization's evolving social identity' and thus learning is **primarily** internalized from the social context" (1996, p. 53, emphasis added by Felin and Foss 2005, p. 443). As a consequence, the KBV poses that individuals will mobilize their talent in a way that contributes to collective goals, taking for granted the alignment of interests between people and the collectivity to which they belong. By doing so, it eludes the political processes behind knowledge exchanges in organizations, processes that are nevertheless highlighted by the underlying sociological references (e.g. Giddens 1984; Bourdieu 1986; Coleman 1990).

In the context of regional clusters, the intertwining of multiple organizations, institutions, or even "societal spheres" (Giddens 1984; Sydow et al. 2011) undermines the hypothesis of aligned interests between participants. The hypothesis is particularly difficult to hold in the case of publicly promoted clusters such as the Competitiveness Clusters when subsidies are an important driver of the network. Indeed, the joint R&D collaborations are expected to advance the objectives and strategies of the parent organizations (Luukkonen 1998), but what happens when such objectives and strategies are per nature diverging, like in the case of universities and firms (Dasgupta and David 1994)? In such a context, knowledge transfer is better understood as a continuous political process: knowledge transfer is better thought in terms of the strategies that partners can deploy to

shape the opportunities for knowledge creation and to make sure that it is a source of value for their organization or even themselves.

However, apart from rare exceptions like Easterby-Smith et al. (2008) or Lawrence et al. (2005), the combination of knowledge and power is still eschewed by researchers in innovation studies. So far, traditional approaches, from both economics and the KBV of the firm, fail to provide the tools to explore such dimensions. This chapter addresses this gap and proposes a situated approach that accounts for the socially embedded nature of knowledge transfer in or through clusters without eluding its political dimension.

3 Knowledge Transfer Through a Situated Approach

3.1 Research Objects in a Situated Approach

In the previous section, I plead for a study of regional clusters that recognizes interorganizational knowledge transfers as a situated, political process. Such an approach builds on three basic pillars:

1. The study of actions (Nooteboom 2000; Anderson 2003) and its context (Suchman 2007) to understand subsequent knowledge transfer.
2. The distinction between knowledge creation and sharing as complementary facets of knowledge transfer. As a matter of fact, researchers interested in interfirm learning and knowledge transfer (Jiang and Li 2009) call for an exploration of both processes (Lubatkin et al. 2001) as their distinctive and combined effects are still to be explored.
3. The recognition that interorganizational knowledge transfer is not a one-way flow but rather a process that eventually affects each partner. Supported by empirical evidence (Harmon et al. 1997) as well as theoretical arguments (Meyer-Krahmer and Schmoch 1998) concerning university–industry interactions, I align with the interactive approach proposed by Santoro and Saparito (Santoro and Saparito 2003), a perspective that has gain more attention since the work of Ring and Van de Ven (1992, 1994) on interfirm cooperation.

Behind those assumptions lies a view of knowledge transfer as a situated activity, suggesting that "thinking beings ought therefore be considered first and foremost as acting beings" (Anderson 2003, p. 91). Knowledge transfer happens because people work together; partners jointly define and carry out experiments in order to solve a common R&D challenge. Such a view acknowledges the socially embedded nature of knowledge production (von Krogh and Roos 1996; Bozeman 2000; Dietz and Bozeman 2005) and innovations (Alter 2000; Baba and Walsh 2010) in clusters. It also allows incorporating social factors such as organizational politics (and interorganizational politics) when exploring the learning processes

experienced by the partners. These components therefore form the keystone of a situated approach of interorganizational knowledge transfer.

As a result, a situated approach shapes the research questions that are deemed appropriate when studying clusters as well as the way researchers answer them. Specifically, it advocates for a threefold shift from extant studies:

- A shift from the **knowledge flow to the knowledge interaction** as the main research object
- A shift from **instrumental factors to political factors** to understand learning processes
- A shift from the **(inter)collective level to the interpersonal level** (Grabher and Ibert 2006) as the main level of analysis, especially when organizations, groups, and networks are intertwined within a given cluster

In this way, individuals are seen as self-interested actors whose personal interest might align with organizational and interorganizational goals. It allows considering the multiplicity of logics and loyalties that influence their behavior (Grabher and Ibert 2006) as they create and share knowledge inside the cluster.

Box 2: Case Definition in a Situated Approach

In Hermans (2011), two related research questions are explored:

(1) How does the nature of the R&D project (from exploratory R&D to exploitative R&D) influence knowledge transfer between partners?
(2) How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?

In order to answer them, multiple case studies were conducted. The chosen unit of analysis, which defines both the case and its boundaries, is the "collaborative research": the "exchange relationships in formal research projects undertaken by university researchers and other research partners" (Landry and Amara 1998).

As informed by a situated approach, this unit of analysis is an emergent construct which focuses on actual interactions: it takes the formal project as a starting point for the selection of the case(s), but it may take distance from its official definition and boundaries. Indeed, it focuses on individual partners who actually engage in exchange relationships and continue to jointly conduct the R&D activities throughout the project (Debackere and Veugelers 2005). As expressed by Katz and Martin, "exactly where that border (of the collaboration) is drawn is a matter of social convention and is open to negotiation" (1997). As a result, I use a strategy of self-reported collaboration to draw the relevant borders. This strategy is proposed by Bozeman and Corley (2004) and permits the respondent to determine which exchange relationships are part of the collaborative research.

(continued)

As an example, the case studied to answer the second research question is a collaborative research named **Axis-1**. Axis-1 is a subpart of MEGAPROJECT, an ambitious project that is part of the first call for projects of the Competitiveness Clusters. MEGAPROJECT is best described as a portfolio of subprojects (see Fig. 3.1). These subprojects, or SP, are characterized by various levels of technological maturity: some SP explore technologies and products that are new for the partners or even for the whole industry while other SP focus their efforts on the enhancement of existing products or production processes. Axis-1 for instance was designed as an exploitative research: deliverables were supposed to be realized in industrial settings and the focus was on finding the "right design" rather than on producing new scientific (and publishable) knowledge.

Axis-1 is itself composed of two subprojects. They both have specific legal agreements, resources, and deadlines, but the majority of partners work on both sides and consider Axis-1 as one collaborative research. As expressed by a project manager: "Axis-1 is composed of two projects that are considered as two dimensions of the same project (...) Axis-1 is quite specific; its two internal projects have a lot of similarities and are treated in common for more interactions."

Indeed, the "real partners" are the people that sit "around the table." As expressed by a junior researcher: "When I say 'partners', I mean (undisclosed names), all those people; the people who are really... the people we are working with."

By contrast, members of MEGAPROJECT from other SP are not automatically included as partners; Axis-1 is conducted independently from MEGAPROJECT with only punctual interactions with those other partners.

3.2 Research Tools in a Situated Approach

3.2.1 Conceptual Framework

The Structuration Theory in Context

The exploration of knowledge transfers as a situated activity requires a theoretical framework that accounts for its social embeddedness as well as for the process of interest alignment between the individuals that participate in the cluster. In Sect. 2, I present the KBV as a promising framework but it also shows that the knowledge-based streams fall short to account for the political dimension. Because the KBV is defined by its seminal authors as a sociologically informed perspective on management (Nahapiet and Ghoshal 1998), I turn to the social theories that are used to build its foundations. In this chapter, I therefore propose the Structuration Theory developed by Anthony Giddens (1984) as an interesting alternative.

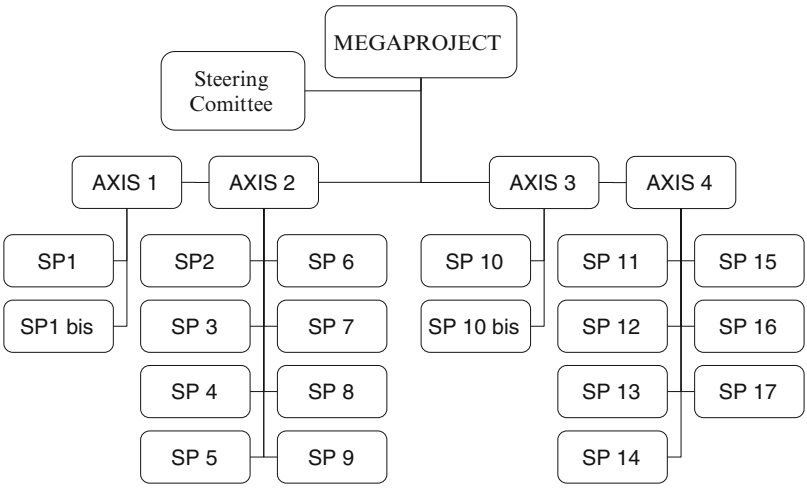

Fig. 3.1 MEGAPROJECT as a portfolio of projects

Like in KBV, Giddens distinguishes between two types of knowledge: discursive knowledge and practical consciousness, "all things which actors know tacitly about how to 'go on' in the contexts of social life without being able to give them discursive expression." But, unlike them, the Structuration Theory links the "knowledgeability" of individuals to a missing concept in organizational learning (Easterby-Smith et al. 2000): **power**, the ability of one individual to accomplish things that depend on others (Chazel 1983, Giddens 1984). Like in KBV streams, the Structuration Theory considers the organization as a social community (Kogut and Zander 1996; Nahapiet and Ghoshal 1998), but it refocuses our attention on the fact that there are sociopolitical systems (Child 1997). Therefore, the Structuration Theory goes beyond the weaknesses of the KBV and provides researchers with a powerful paradigm to understand knowledge exchanges in cooperative contexts (Orlikowski 1992, 2002).

Another central asset of the Structuration Theory in the context of clusters is its account for the multiple institutional contexts that are at hand. This is coherent with the existing models of innovation which intend to explain "the current research system in its social contexts" (Etzkowitz and Leydesdorff 2000): the Triple Helix model (Etzkowitz and Leydesdorff 2000), the "mode II" of research production (Gibbons 1994), and the National (Freeman 1992; Lundvall 1992; Nelson 1993) and Regional (Cooke et al. 1998; Asheim 2003) Innovation Systems.

While recognizing the influence of the institutional sphere on U–I knowledge transfer, the Structuration Theory goes beyond "the institutionalists' self-confessed tendency to determinism" (Whittington 1992) by considering the competences of individuals who draw upon institutional resources and thereby (re)produce them. By doing so, it contributes to existing models such as the Triple Helix whose founding father recently advocated for "a turn towards reflexivity in sociology in order to obtain a richer understanding of how the overlay of communications in university-

industry-government relations reshapes the systems of innovations that are currently subjects of debate, policy-making, and scientific study" (Leydesdorff 2005).

The Structuration Process

In accordance with a situated approach, Giddens defines a social system as a set of relationships that only exists in and through the continuity of social practices (Giddens 1984). The Structuration Theory therefore focuses on the structuration process of social systems: "the structuring of social relations across time and space, in virtue of the duality of structure" (Giddens 1984). In other words, this framework describes how social systems—for instance the clusters—are structured through the interactions of individuals—academic researchers and companies' employees—who are "knowledgeable," reflexive, and apply adequate rules and resources to interact.

The set of rules and resources that individuals draw upon, constraining and at the same time enabling their actions, is what Giddens calls "structures." As expressed by Orlikowski (2000):

> Giddens (1979, 1984) proposed the notion of structure (or structural properties of social systems) as the set of enacted rules and resources that mediate social action through three dimensions or modalities: **facilities, norms, and interpretive schemes**. In social life, actors do not enact structures in a vacuum. In their recurrent social practices, they draw on their (tacit and explicit) knowledge of their prior action and the situation at hand, the facilities available to them (e.g., land, buildings, technology), and the norms that inform their ongoing practices, and in this way, apply such **knowledge, facilities, and habits** of the mind and body to "structure" their current action. In doing so, they recursively instantiate and thus reconstitute the rules and resources that structure their social action.

Through the duality of structures, individuals bring meanings to a given context, focus on the adequate resources, and are able to act. But they are also constrained by the structures: they provide the conditions for actions, **they define what members of a given system believe is possible and the panel of actions they can choose from to reach their goals**.

Overlapping Structures in Clusters

While Giddens' work does not focus on the organizational context, it has been presented as a powerful framework to explore organizations and networks (Phillips et al. 2000; Lawrence et al. 2002; Sydow and Windeler 1998; Pozzebon and Pinsonneault 2005; Pozzebon 2004), especially in the case of plural and overlapping systems (Whittington 1992). Indeed, the Structuration Theory inspires the study of various economic phenomena and dedicated systems: the management and evaluation of interfirm networks (Sydow and Windeler 1998), knowledge management in distributed organizations (Orlikowski 2002), knowledge creation

through consulting relationships (Hargadon and Fanelli 2002), or more recently leadership in clusters (Sydow et al. 2011).

In Hargadon and Fanelli (2002) for instance, the authors highlight the interest of overlapping networks for knowledge creation. They show how consulting firms specialized in new product development interact with their clients to produce new innovative products: **the consulting firms provide the clients with new solutions that were not seen as *possible* by the clients while the clients provide the consulting firm with the empirical field to enact them in action**. While the clients might be trapped in their own organizational routines, the relationship with a consulting firm brings an overlapping of networks and opens the set of possibilities for new knowledge creation. Orlikowski (2000, p. 412) explains that phenomenon in the following terms: "by enacting various interpenetrating (and perhaps even contradictory) structures, actors experience a range of rules and resources that may generate knowledge of different structure and awareness of the possibilities for structural change" (Sewell 1992; Tenkasi and Boland 1993).

Such a recursive process between new possibilities and actions can be witnessed in the context of regional clusters: *in* the cluster as partners contribute to common goals in the context of joint projects or *through* the clusters as they bring back knowledge to their parent organization. Through the overlapping of structures, clusters should create value for the parent organizations: they should allow for the possibility "to act otherwise" (Giddens 1984) in which "lies the potential for innovation, learning and change" (Orlikowski 2000).

Power in the Structuration Process

Knowledge creation in regional clusters should be stimulated by the overlapping of structures. Academic laboratories as well as companies provide their partners with solutions that were not seen as "possible" before the collaboration. **But the transposition of rules from one context to another, especially when the context is still emerging, is not neutral**. The overlapping is constructed through interactions between individuals with diverging interests and asymmetrical access to resources: the facilities that partners have access to enable them to shape the project, its borders, its participants, and its relevant rules. By doing so, partners exercise power and reproduce resources as structures of domination.

Partners have to agree about a "problem" and ways to answer it within the cooperation. The definitions of the problem and its solution are an important stake; they compete to shape it, enrolling allies to their cause even if those allies come from a different universe with "distinct logic and horizon" (Akrich et al. 1988). As a result, collaborations are "multilayered systems entwined through partially overlapping, partially competing logics as their members anchor in different linchpins of identity and loyalty" (Grabher and Ibert 2006). Participants are at the same time members of the project, members of an organization, and entrepreneurs of their own human capital (Nooteboom 2000; Hollingsworth 2002; Grabher and Ibert 2006). A twofold process of interest alignment must be explored and the

Structuration Theory provides researchers with tools to do so (Pozzebon 2004; Phillips et al. 2000): vertically through the individual-collective articulation (Child 1997; Pozzebon 2004) and horizontally between individuals from various organizations and functions through the notion of interpenetrating structures (Orlikowski 2000).

In fact, this framework allows considering academic and industrial partners as individuals with different interests and motives and who have to coordinate their actions—share common and specific resources under common and specific rules—in order to contribute to the cluster activities, to bring back the gained knowledge to their organizations, and to develop their own human capital.

3.2.2 Methods

Because knowledge interactions are the primary research objects in a situated approach, the in-depth case study is a privileged research strategy (see Table 3.1). The justification builds on two main blocks: the necessity to use naturalistic methods to approach knowledge interactions and the adequacy of a longitudinal qualitative case study when the Structuration Theory is used as a conceptual framework.

The naturalistic case study, defined as the systematic examination of a case in real-life settings (Decrop 1999), is considered as an adequate research strategy to study U–I knowledge transfer as a social and political process for the following reasons. First, power relationships are difficult to grasp for an external researcher, requiring in situ observations and access to the field to witness the actual interactions. Knowledge is then considered as the product of social interactions (von Krogh and Roos 1996; Bozeman 2000), requiring to be studied through its context of production preferably through qualitative methods (Lockett and Thompson 2001) like interviews and in situ observations. Such a qualitative approach is particularly appropriate given the difficulty for measuring and interpreting organizational phenomena in the context of U–I interactions (Link et al. 1998).

Second, the phenomenon of interest—knowledge transfer—and its context—regional clusters and their joint R&D projects—are difficult to distinguish from one another (Yin 1994).

Finally, long-term exposure to the case and its implicit multiplicity of data sources allow for an access to off-record issues as well as a better identification of taboos and contradictions in the discourse of actors. It is an essential tool to draw an accurate picture of "competing and opposing loyalties" (Grabher and Ibert 2006) at stake in the collaboration.

Such a naturalistic approach—or at least its methodological aspects—is coherent with the study of situated actions as proposed by the promoters of ethnomethodology like Suchman (2007). According to her, the expression "situated action" underscores "the view that every course of action depends in essential ways on its

Table 3.1 The in-depth case study as a privilege research strategy

Features	Justification
Qualitative approach	Intangible flows mostly explored through a qualitative approach (Lockett and Thompson 2001); it allows to capture the significant tacit component of knowledge flows as well as people-related concerns proper to U–I collaboration (Davenport et al. 1999)
	Qualitative research appropriate given the difficulty for measuring and interpreting organizational phenomena in the context of U–I interactions (Link et al. 1998)
	Need to be close to the data and the informant (Decrop 1999)
Longitudinal approach	Need to witness the longitudinal, contemporary events that the researcher does not control (Yin 1994)
	Relevance of longitudinal, diachronic studies (Pozzebon and Pinsonneault 2005) to explore the structuration process (Giddens 1984) at stake in U–I collaborations
	Long-time exposure to gain trust and to access off-record issues
Multiplicity of data sources	Combining semi-structured interviews with the observation of social interactions allows accessing both the discursive knowledge and practical consciousness of the knowledgeable actors (Giddens 1984)
	Better triangulation to identify taboos and contradictions in the discourses of actors, especially about the interests at stake in the joint R&D project
Naturalistic approach	The phenomenon of interest—knowledge transfer—and its context—the joint R&D project—are difficult to distinguish from one another (Yin 1994)
	Knowledge is considered as the product of social interactions (von Krogh and Roos 1996; Bozeman 2000), requiring to be studied through its context of production

material and social circumstances. Rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action" (Suchman 2007, p. 70). And because people tend to overlook the fleeting circumstances of action, the a posteriori narration of actions is not enough.

Because knowledge transfer is treated as a process that depends on contemporary actions that the researcher does not control (see Yin 1994), a situated approach might favor longitudinal methods in order to directly observe the sequence of events that describe "how things change over time" (Van de Ven 1992). A longitudinal approach is also required in order to give an account of the structuration process at stake in the case. As expressed by Pozzebon and Pinsonneault (2005): "Along with other scholars (Jones 1997; Rose 2000), we suggest that process approaches are more appropriate when structuration is adopted as the theoretical approach."

Another requirement when using the Structuration Theory through a situated approach is the combination of multiple data collection methods such as in situ observation and semi-structured interviews. On the one hand, an observation phase is needed in order to access the practical consciousness of actors as well as unintended consequences of their actions. On the other hand, individuals are seen as knowledgeable and reflexive. The researcher therefore considers that they can

interpret their own behaviors as well as the power interactions that shape them. Even if this competence is limited by unintentional consequences and unknown conditions (Giddens 1984), individuals understand the conditions of their actions, define goals based on motives that they are able to express, and know that others will do the same.

It implies that respondents are able to give an account of their actions: the researcher has to be attentive to respondents' feedbacks and own interpretations of the phenomenon at hand—the double hermeneutic as expressed by Giddens. Besides, as all actors are involved in the structuration process, each partner in the R&D project is considered as a potentially valuable respondent. As a result, the researcher gives voices to the "ordinary" actors that nevertheless contribute to the innovation process (Alter 2000) like technicians, junior researchers, and other "underlings."

Box 3: The Structuration Process in the Competitiveness Clusters

In Hermans (2011), the Structuration Theory is used to make sense of the political process at stake in the Competitiveness Clusters of Wallonia and their dedicated R&D projects.

During the case studies, a central data collection method was the observation of events of power exercises as materialized in "critical events." The critical event is as an observable incident which starts when an actor of the project speaks up with a "voice" attitude (Hirschman 1970). This event comes from an increasing feeling that something has to be done differently; it opens a negotiation space in which each partner can propose a solution and thereby activate a power relationship. Critical events were witnessed in real-life settings during plenary meetings and team building events. They were also remembered by respondents during semi-structured interviews of partners, allowing a focus on behaviors rather than impressions (Hargadon and Fanelli 2002). Their effects were traced through the minutes of the meetings, especially through the "further actions" section, as well as during subsequent interactions.

The analysis of critical events draws a particular attention to the modalities that are mobilized by the actors when discussing their solution. Informed by the Structuration Theory, I focus on three specific dimensions of modalities:

- The cognitive dimension which refers to the interpretive schemes (goals, roles, scripts) that enrich the joint R&D project (Hargadon and Fanelli 2002)
- The relational dimension which has regards with the social norms that are relevant for the project's members and give direction for action
- The structural dimension which concerns the links and configuration of the network of partners (Nahapiet and Ghoshal 1998) or, from the point of

view of Giddens, the access to enabling and constraining resources of the project (Giddens 1984): facilities and frustrations

Those modalities qualify the "R&D problem" that is put into question and potentially guide the project in a new direction. They are drawn from the interpenetrating structures that are relevant for the project and that the social researcher can infer through their superficial manifestations (Nizet 2007). Moreover, their mobilization implies an impact on the structures of the project: relevant rules are challenged, reinforced, or modified by the project's interactions.

The observation of critical events also focuses the attention of the researcher to the actual leeway that individuals have to speak up. It allows for the identification of the "playing fields" (Mintzberg 1983) that actors dare mobilizing when participating in a critical event. For instance, an academic professor might openly criticize the R&D problem tackled by the project, while an underling might not dare to do so and therefore prefer to discuss the way it is currently implemented. The researcher can subsequently infer the interests that are served—and disserved—by the new arrangements.

Some key outcomes are drawn from the analysis. First, it reinforces a KBV approach of management which defines "the role of managers not as directing other people, but as enabling the performance of collaborators by shaping the (inter) organizational context (rules, values, boundaries)" (Tywoniak 2007). Indeed, critical events provide managers with the possibility to reinforce the rules that they deem relevant for the collaboration.

But the structurationist perspective proposed in this work also shows that underlings that come from other organizations might not take for granted the relevancy of such rules. Likewise, the analysis shows that the alignment of interest is particularly difficult to hold for academic frontline researchers who are torn between the project's interests, their loyalty to the laboratory, and their role as *entrepreneur of their own human capital* (Grabher and Ibert 2006).

When managing the interorganizational context for knowledge creation and sharing, managers should therefore pay a particular attention to the following tasks:

(1) The delimitation of the collaborative research: the designation of the people who are deemed "partners" along with the development of a strong common understanding about the goals and means of the project. In the case of the Competitiveness Clusters, public authorities provided crucial insights by repeatedly claiming that the projects were part of the "economic redeployment of the Walloon Region."
(2) The creation of opportunities for underlings to "speak up" in the project. Indeed, a voice attitude keeps the individuals invested in the collaboration and challenges the project with new insights.

(continued)

(3) The creation of opportunities for "spinning-out" of the project. Indeed, the norms and values that drive the collaborative research also define its limitations. A collective understanding can be very efficient to channel partners towards a common goal, but it also creates a blueprint which impedes alternative thinking.

For that reason, a strong identity of the main collaborative research could be combined with peripheral projects that escape the definition and ways of doing of the main research. Besides, it might allow for a better alignment of interests for the academic researcher who develops a personal project. In this case, delicate issues include the allocation of resources between the main collaborative research and its peripheral parts and the risk of confusion resulting from the blurring barriers that tell them apart.

Such "spin-outs" were witnessed in the case studies that I was exploring to answer the first research question: (1) How does the nature of the R&D project (from exploratory R&D to exploitative R&D) influence knowledge transfer between partners? Indeed, the Structuration Theory informs the researcher about the emerging nature of the collaborative research. In the cases under study, I therefore look for potential hybridizations (subparts of different nature inside the main collaborative research) and iterations (from exploration to exploitation and backwards).

Then, I studied the expected roles and contributions of individuals as the R&D activities vary between exploitation and exploration. As expressed by Phillips and his colleague (2000): "the negotiation of collaborative relationships involves a wider and more fundamental range of issues, including the roles to be played by different participants, and the nature of the problem to be addressed." I therefore explored such negotiations: the emerging modalities, their mobilization by actors who want to impose a new solution (e.g., changing the nature of the project, from explorative R&D to exploitation R&D), and how such solutions relate to the organizational, interorganizational, and personal goals.

3.3 Stakeholders of a Situated Approach

Traditionally, a scientific study is addressed to two kinds of stakeholders. On the one hand, there is the research community who will draw on its theoretical and methodological contributions to build subsequent studies. On the other hand, practical recommendations are formulated for a well-defined set of practitioners like managers in the case of management studies or public authorities in the case of economic analysis. When researchers study knowledge transfers in clusters through a situated approach, however, things can get complicated.

First of all, because regional clusters bring together actors from different organizations and institutions, the set of stakeholders becomes more complex:

public authorities, R&D managers, Technology Transfer Officers from universities, and directors of research center are all potentially concerned by the research findings. In addition to them, a situated approach also targets a set of less usual stakeholders. Indeed, by focusing on the interactions that are actually conducted in the cluster and its projects, a situated approach takes into account the underlings: the "frontline" researchers and employees who are actually performing the research tasks and are collaborating on a daily basis.

Secondly, the situated approach outlined in this chapter provides researchers with a way to introduce power issues when studying knowledge transfers in regional clusters. However, it would be hazardous to deny that the same phenomenon is at hand in their own research. Said otherwise, the power relationships that the researcher is studying are at the same time affecting his work:

- Public authorities that are subsidizing the clusters are, at the same time, a source of additional financial resources for the researcher, or at least for his employer—the university.
- The R&D managers and the professors involved in the cases under study are controlling the access to the field: they manage the openness of the project so that the researcher can access interesting information, and they also have a "right to monitor" on his work.
- Junior researchers and technicians who are interviewed and observed might want to use the research as a way to be heard by their hierarchy.
- Last but not least, the university is the current employer of the researcher; it assesses his work and sees regional clusters as a potential source of fund as well as a way to legitimize its existence.

Indeed, from the perspective adopted in this work, scientists are not disinterested; they are an organized interest group and the researcher actually belongs to it. There are two important consequences for the researchers who adopt a situated approach when studying knowledge transfers in clusters. First, researchers should make clear who are the stakeholders of their research and reflect on the extent to which such stakeholders (especially their peers) might influence their work. Secondly, even if a situated approach assumes that power is a central driver of human cooperation (Friedberg 1997; Giddens 1984), researchers should also recognize that power relationships are sometimes endemic. They should seek for the unveiling and transformation of alienating structures: prevailing structures that prevent individuals from self-realization (Chua 1986; Orlikowski and Baroudi 1991).

Box 4: Alienating Structures in the Competitiveness Clusters
In Hermans (2011), alienating structures at stake in U–I collaborations and more generally contract-based research in universities are partially exposed.

(continued)

In such projects, researchers have a taken-for-granted precarious position: hired on a short-term basis, they work on a project defined and launched by the head of the laboratory who takes distance with the ongoing project once it has started to turn to the next contracts. As a result, the project might present a "win–win" situation at the organizational level but it ignores the individual interest of the researcher who is not yet hired. As a consequence, these researchers dedicate a lot of attention to their role of *entrepreneur of their own human capital* (Grabher and Ibert 2006), sometimes at the expense of their roles of "laboratory member or project participant." In fact, findings call for a deeper debate about the status of academic researchers. It should benefit the academic researchers but also the U–I collaboration through the retaining of talents.

4 Conclusion

In this chapter, I outline a situated approach for studying interorganizational knowledge transfers in or through clusters. I also present the Structuration Theory as an interesting theoretical framework to include politics in the study of regional clusters. In particular, the Structuration Theory:

- Allows considering the cooperation in clusters as an emerging construct, a network of actors drawing upon plural and overlapping structures
- Orients the researcher towards specific processes and aspects of social systems (Nizet 2007) like interest alignment, especially in the context of plural social systems (Whittington 1992) and multilevel studies (Morgeson and Hofmann 1999; Child 1997)

Before concluding, some takeaways should be acknowledged. First, a situated approach draws the attention of the researcher and his stakeholders away from the mainstream "one-way flow" conceptualization of U–I knowledge transfers. It rather presents knowledge exchanges as embedded, situated actions that affect both sides. This conceptualization might bring practitioners with well-needed insights about the process in which they are daily involved.

Second, a situated approach allows for the observation of the modalities (norms, interpretive schemes, and facilities) that become (or cease to be) relevant for the partners. Specifically, the Structuration Theory orients the researcher to the structuration process at stake in the cluster. Rather than taking its structures for granted, the researcher looks for its construction and transformation: the interpenetrations of structures from distinct organizations, the prevalence on one's norms over the other, and the dismissing of logics that were previously praised. For example, even if it may seem taken for granted, the way a researcher is considered as a partner of the collaborative research (or not) is not natural and impacts the way people interact with each others. By doing so, it unveils the mechanisms that are

driving collaborative behaviors as well as the damaging habits that gradually enter the collaboration.

Finally, it gives voices to the "ordinary" actors that nevertheless contribute to the innovation process (Alter 2000): because all individuals are involved in the structuration process, each partner in the R&D project is considered as a potentially valuable respondent.

Nevertheless, a situated approach also provides the researchers with a number of challenges. From a methodological point of view, it requires an important access to the field and a long-term immersion in order to grasp the actual power issues. The intensity of resources that are needed to perform a situated study invites the use of complementary approach. An interesting example is the dual methodology developed by Leonard-Barton (1990) who combines insights from an in-depth longitudinal case study with multiple shorter replicated cases. Another possibility is the use of agent-based simulations to explore complex systems.

From a theoretical perspective, the complexity and abstract character of the Structuration Theory have also been considered as a serious challenge (Nizet 2007; Jones and Karsten 2008). For this reason, the construction of the conceptual framework requires a lot of efforts. Besides, the Structuration Theory might not be the only adequate framework when adopting a situated approach. In fact, other epistemological or ontological affinities might guide the researcher towards other authors (Pozzebon 2004) such as Coleman (1990) or Bhaskar (1989). Then, maybe the greatest challenge for a researcher adopting a situated approach is about managing the power issues that are influencing his current work and his future inquiries. Indeed, studies of interorganizational knowledge transfers from a situated approach are full of promises. Two phenomena of particular interest are the mechanisms behind "speaking up and spinning-out."

First, a deeper understanding is needed about the mechanisms that favor speaking up in R&D collaborations. In particular, the role of project leader—with or without hierarchical power—should be explored in order to ensure that interesting ideas are not dismissed or, worth, kept secret by fear of speaking up. Second, the role of "spinning-out" in providing alternative paths and new insights to the collaboration should be investigated. Interesting issues comprise the balance between a strong identity of the main project and the relative independence of a spin-out; the alignment of interest between the peripheral parts and the main project; the management of interactions that bring back the newly created insights into the main collaborative research.

Finally, a better understanding of the role of public authorities is needed. While it is already known that public authorities act as an "animator" (Diez 2001), in other words, as a generator of norms for collaborative individuals, more insights are needed about the actual means that administrative agents can deploy to provide such norms and how they guide the clusters' participants.

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Chapter 4
How Does a Researcher Become an Entrepreneur in the High-Tech Industrial Cluster? A Case Study

Rongzhi Liu, Haiyan Zhang, and Zhi Yang

1 Introduction

In the past few decades, the high-tech industrial cluster, as well as the science and technology park, played an important role in promoting research and industry cooperation and enhancing the technology commercialization in many places around the world. It has been pointed out by Saxenian that the interaction between universities and the research institutes and the enterprises in industrial clusters is a primary driver for the growth of Silicon Valley (Saxenian 1996). Feldman (1994) insisted that the innovativeness of high-tech industry relies to a large extent on the basic researches, which are largely taken by the R&D activities of government lab or universities. The enterprises' geographic proximity to universities and technology institutes enable the rapid knowledge and technology transfer. Therefore, high-tech enterprises prefer to agglomerate near universities and technology institutes, in order to benefit from the knowledge spillover, while researchers began to transform themselves into high-tech entrepreneurs.

Since later 1990s, the rise of high-technology entrepreneurs provided a new perspective for the research on the entrepreneurship (Robert 1991). As compared to traditional entrepreneurs these new generations of entrepreneurs have higher education level and are more familiar with the innovation process and new technological achievement (Graham et al. 2009). When these individuals, mostly new

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engineering graduates or university researchers, engaged in the entrepreneurial process with the purpose to transform their technological findings into new applications or products with the support of the university incubators, they may enjoy the so-called advantage of geographical proximity, i.e., being closely linked to the new technology development on the one hand and innovative business opportunities on the other hand (Elfring and Hulsink 2003).

Indeed, the previous empirical studies had found that when the individual's talent is misfit with the domain of the entrepreneurship activities, the economic return is negatively related to the entrepreneurship or showed the bimodal distribution[1] pattern at best (Evans and Leighton 1989; Hamilton 2000; Moskowitz and Vissing-Jørgensen 2002). Therefore, it is of great advantage for the scientist to start business in their expertise domain, and the high-tech entrepreneurship performed by researchers themselves is particularly prominent in high-tech industries where new ideas generated from advanced knowledge are of great importance. However, studies on the entrepreneurship have been dominated by start-ups in low-growth and low-tech industries, while the process about how researchers or scientists are transformed into entrepreneurs during the process of the spin-off enterprises establishment is not extensively explored. Few studies have systematically investigated the effect of high-tech industrial clusters on the growth of entrepreneur's at individual level, and in-depth qualitative exploration on this process is still very limited. However, as argued by Walcott (2003), it is the power of individuals to affect innovation and development process, rather than the agglomeration effects, while Smith et al. (2005) applied the case of Oxfordshire to explain how the expertise of talented individuals could be translated into the fastest growing high-tech economy in the UK. Therefore, to understand the determining factors for the entrepreneurial growth at the individual level may assist policy makers to plan courses of action that meet the interests of entrepreneurs, industrial clusters, and societies at both organizational and civic levels (Rosenblatt and Sheaffer 2001).

This research mainly focused on the investigations about "how scientists become entrepreneurs in high-tech industrial clusters, by considering the important role of universities and research institutes in industrial clusters." This paper aims to explore the procedure of how the major players in industrial clusters support the high-tech new venture creation process and reveal their association effect and interactive mechanism.

The rest of the paper is structured as follows: firstly, the concept of high-tech cluster and entrepreneurs is briefly described to build the theoretical framework for the understanding of research focus. Then, the research methodology and data source are explained. Thirdly, the interview data are analyzed to understand how researchers set up the spin-off enterprises with the support of universities and relevant government departments. Fourthly, the key findings and possible directions for future research in this important field are discussed.

[1] In statistics, a bimodal distribution is a continuous probability distribution with two different modes. These appear as distinct peaks (local maxima) in the probability density function (data source: http://en.wikipedia.org/wiki/Bimodal_distribution).

2 Literature Review

2.1 High-Tech Industrial Cluster and the Entrepreneurship

Industrial cluster comes in various forms, and two broad distinctions can be made: one kind of cluster is generated from spontaneous agglomerations of enterprises and related actors; the others designated as "constructed" cluster are included by public policies (UNCTAD 1998) such as the industrial park, incubators, and export processing zone. The high-tech cluster is usually originated from the "constructed" cluster and some also comes from the innovation of spontaneous clusters.

The university and political and social institutions play an important role in the development of such a high-tech industrial cluster, as it creates links between high-tech new venture and university researchers and encourages the transfer of technology and skills from research institutes to the enterprises in the cluster. When analyzing the Cambridge Industrial cluster, Mccormick (1999) found that the formation of the Cambridge High-tech Industrial cluster depends on the good knowledge base, rich human capital, and convenient infrastructure of the Cambridge Park. All levels of European government had tried to promote the creation of science and industrial parks, incubators, export processing zones, and techno-poles (Mytelka 1991) to foster the location advantages of cluster and promote the innovation system development. The establishment of those science and industrial parks usually starts from a real estate project with the purpose of designing the high-tech industrial clusters to promote the knowledge-intensive enterprise. According to the formal and informal linkages with universities and research institutes, the cluster management office will try to provide service for the technology and business skill exchanges between enterprises (UKSPA 1996). Mytelka and Farinelli (2000) explores the relationship between various kinds of cluster, innovation system, and the sustained competitiveness and insisted that the high-tech cluster, which was based on knowledge-intensive and science-base industry, is different from tradition cluster; it relies on learning and innovation to a large extent and presents a high level of R&D expenditure and with a rapid export growth.

Lissoni (2001) insisted that the geography approach of the enterprises, universities, research institutions, and intermediary organizations in the industrial cluster facilitates the establishment of the stable and continuous relations between different organizations by the interaction of the major players in the industrial cluster and creates conditions for the tacit knowledge transfer and diffusion accurately within the organization; thus, it promotes the innovative activities.

Technology-intensive entrepreneurship is often encouraged in the high-tech clusters. High-tech entrepreneurs are usually recognized as the knowledge creators, agents of change, and both pragmatic and visionaries. They need to be capable to have long-range planning and a high degree of flexibility, in order to solve problems and cope with an ever changing environment (Dosi and Malerba 1996). Giacon (2010) summarized four main typologies of high-technology entrepreneurs according to the ENEA report, the recent work by Di Minin et al. (2003):

(1) the emergent young entrepreneurs who are smart and sometimes highly educated (PhD or master degree) who are able to build rapidly a growing businesses, particularly in the ICT industry; (2) former manager or scientist who creates a spin-off; (3) the academic entrepreneur who started from the academic projects of the universities; (4) the "family entrepreneur" who led the evolution of the previous firm from traditional products to innovations rich of technology upgrading and improvements.

2.2 The Entrepreneurship Process

The research of Bygrave (1994) insisted that the procedure of how the entrepreneur starts a business is indeed a continuous process of opportunity recognition, assessment, development, and collecting resources to achieve the goals. Shane and Venkatraman (2000) also pointed out that one of the most critical issues in the field of entrepreneurial research is to explore how the entrepreneurs discover and exploit the opportunities.

It is a primary step to perceive and recognize the business opportunities from the complex environment, with the purpose to distinguish those potential that could explore new market, create new products or value-added services. Timmons (1999) reckoned that opportunity recognition is the process to commercialize an idea or originality into a business project, which is accompanied by the process of opportunity recognition and assessment.

The opportunity development process is not always intended; however, the intension to search for the valued business opportunities played important role in the new venture creation process (Bhave 1994). Some entrepreneurs who generate the entrepreneurial intension in an early time will start to establish the enterprise when there is only a basic idea; other entrepreneurs are very cautious, they will wait to make the final decision after a complete investigation, feasibility analysis, and well preparedness in acquisition of the necessary entrepreneurial resources.

After the stage of business opportunity development, entrepreneurs need to acquire necessary resources to realize the entrepreneurial opportunities. Brush et al. (2001) reckoned a simple model to describe the resource building process: firstly, the potential entrepreneurs determine the required resources according to the opportunity and access to channels to gather resources. Secondly, entrepreneurs need to participate in the entire process of collecting the necessary resources and integrate resources to develop the business idea into new products or value-added services. At this stage, business plan is required to change the opportunity into a real value-added project. Bhave (1994) believes that the creation of new products or services is to build a bridge to connect the supply side (business enterprises) and the demand side (consumers).

3 Research Methodology

In exploring "how researchers become entrepreneurs in high-tech industrial clusters by considering the important role of the universities in the industrial cluster and their effects on entrepreneurial activities," this paper follows the phenomenological approach to collect as much as in-depth data and to investigate the contemporary phenomenon within its real life context (Creswell 1998; Strauss and Corbin 1990; Yin 2003).

Advocated by Beccattini's research (1979), the industrial cluster has been studied as a unit of analysis. And in the industrial cluster, eleven interviewees were chosen; six are high-tech entrepreneurs, and five of them are staff from the high-tech cluster organizations. Each respondent completed a one-on-one interview either face-to-face or via telephone.

Data was collected through semi-structured, open-ended interviews, allowing participants to provide in-depth descriptions of their entrepreneurial experience and the impact that the cluster environment had on this process. The interviews were recorded and then transcribed for data analysis.

3.1 Sample Selection

With the purpose to research on the high-tech entrepreneur development process in the relevant clusters by applying a case study approach, we need to choose a cluster dominated by the high-tech industrial and involves the entrepreneurs that transferred from researchers. Therefore, the industrial cluster of case example is chosen to meet the citrate as the following: (1) strong scientific base has formed in the local area with distinct research centers; (2) technology transfer is facilitated and promoted by the institutes; (3) scientists in the university and research institutes have been transformed into entrepreneurs during the technology transferring process; (4) high-tech entrepreneurial activities are funded and promoted by both universities and research institutes and the government.

We followed the proposed sampling strategy and chose Leuven high-tech cluster in Belgium as the single-case research. The high-tech industrial cluster in Leuven has played an important role in enhancing the high-tech entrepreneurial activities in the local region and promoted the regional development in the past several decades. The province of Vlaams-Brabant is ranked among the 25 most renowned European academic research centers (see Table 4.1). There are three knowledge institutes, the K.U. Leuven Association, IMEC, and the VIB departments, which guarantee a continuous input of knowledge and innovative ideas and promote the technological and business development of the Leuven region. They have attracted a large number of knowledge-intensive companies, resulting in a high-tech ecosystem in Leuven areas, within the province of Vlaams-Brabant in Belgium.

Table 4.1 Leading European regions in employment in high-tech knowledge-intensive services

	Total number (1,000)	% of total employment
Berkshire, Buckinghamshire, and Oxfordshire (UK)	101	8.9
Stockholm (SE)	84	8.3
Oslo og Akershus (NO)	43	7.4
Praha (CZ)	44	7.0
Comunidad de Madrid (ES)	204	6.7
Bedfordshire and Hertfordshire (UK)	52	6.6
Hovedstaden (DK)	56	6.4
Bratislavský kraj (SK)	21	6.4
Auvergne (FR)	33	6.2
Province of Vlaams-Brabant (BE)	29	6.2

Source: Eurostat regional yearbook 2009

The contribution of the K.U. Leuven Association to the Leuven knowledge economic region is closely linked to the achievement of the nano-electronics research institute IMEC, which conducts world-leading research on nano-electronics and has global partnerships in ICT, healthcare, and energy. Furthermore, many departments of the Flanders Interuniversity Institute for Biotechnology (VIB) are also located in Leuven. The K.U. Leuven Association, the Leuven-based VIB departments, and IMEC have a combined R&D budget of € 593 million and employ about 19,500 people, of whom 6,000 are researchers.

Over the last few years, four major technology domains have emerged in the Leuven region, which has created dynamic clusters in which innovative companies and knowledge centers interact closely. The enterprises in this cluster are mostly specialized in the high-tech industry of life sciences, nanotechnology, mechatronics and smart systems, and clean-tech.

3.2 Data Collection

For the purpose of this study, in-depth interview was conducted to collect first-hand data (see Table 4.2). Two groups of interviewees are involved. The first group of interviewees consists of six founders of high-tech new ventures located in the Leuven region, who used to be professors and doctoral researchers in the universities or research institutes, and their present businesses resulted from their previous research activities and expertise, while the other group of interviewees includes five administrative staff from the high-tech incubator, research institutes, and the government offices.

In the preparatory stage of this study in late 2010, preliminary information was collected from incubators and high-tech science parks supported by the K.U. Leuven and the regional development agencies (POM); finally six

Table 4.2 The interview questions

Interview questions with group 1

The entrepreneurial process

1. What type of business do you own?
2. What sort of work did you do in your last job? If you were employed by someone else before starting your current business, what did the company do?
3. When and how do you start to establish your business? Could you please describe the most important events happened during the development of your enterprise?
4. Are there any specific reasons why you choose the location of Leuven Region? What are the major barriers or incentives of locating here?
5. Are there any major persons or organizations played very important roles in your entrepreneurial process? How do they influence your business?
6. What kinds of support do you think are rather important for new ventures? Can you get these supports from the relevant institutes?

Environment evaluation of the high-tech cluster

1. Are there any policies or incentives that support your entrepreneurial activities, i.e., reduce the risks for individuals starting a new company, and facilitate entrepreneurs' efforts to acquire resources?
2. Has your enterprise participated in government-sponsored programs or enjoyed privileges stemming from government policies that favor entrepreneurs?
3. How do you evaluate the government policies regarding the new business establishment in Leuven region?
4. Will your enterprise intend to cooperate with other enterprises to influence the government decisions?
5. How do you gain the knowledge to start and manage a new business?
6. Do you think the knowledge regarding founding a new business is widely spread in your region?
7. Have you become members of any industrial associations (i.e., chamber of commerce)? If yes, do you think they provide any kinds of useful information or services? What and how?
8. Do you or your enterprise have any formal or informal contact with the universities or research institutes? Can those universities or institutes provide any valuable support for your enterprise development?
9. How do you make the decision to become an entrepreneur?
10. Do you feel you are admired with your entrepreneurial activity?
11. Is the creative and innovative thinking valued? Could you prove an example?

Interview questions with group 2

1. How do you evaluate the government policies regarding the high-tech new venture creation in Leuven region? (Advantages and disadvantages?)
2. How do you promote the member enterprises of your organization communicate with each other?
3. As in the high-tech industry, some of the knowledge or information are confidential; in this case, how do the network event prevent the barriers of open communication between participants?
4. Have you ever organized activities to promote the high-tech enterprise network? How do you identify the theme of the seminars, event, or programs according to the needs of the members?
5. Are there any cases that the member enterprises of your organization become business partners according to the event you organized? Please give some examples
6. What are the differences of your training projects from those provided by the universities or research institutes? For example?

entrepreneurs were chosen as sample for case studies. The interviews with administrative staff of the regional development office, research institutes, and supporting associations were intended to explore supporting activities of these institutions in the high-tech entrepreneurial development process. The five administrative staff who participated in these interviews had also been frequently mentioned by the interviewed high-tech entrepreneurs as important players of their business networks.

Besides the interviews, second-hand data and historical documents were also collected to enrich the understanding of the business environment of the region, as well as the comparison with and triangulation[2] of the research topic. The profile of interviewees is shown in Table 4.3. All interviews were recorded, transcribed, and evaluated through multiple rounds of independent assessments by the authors in order to ensure the reliability of findings (Yin 2003). In every case, archival data was used to bolster interview data.

4 Data Analysis and Discussion

4.1 The Background Information of the Case

In this study, Leuven high-tech industrial cluster refers to the group of enterprises and institutes geographically approach to the Katholieke Universiteit Leuven (K.U. Leuven), the research institutes of IMEC, and other relevant institutes; it is also supported by the government offices, in the city of Leuven. In the following Sect. 4, a brief introduction will be given about the major actors (K.U. Leuven, IMEC, K.U. Leuven Research & Development, etc.) in this cluster.

4.1.1 Institution Base: The City of Leuven

Seen from its scientific tradition, the city of Leuven has a long experience in high-tech business development, which has enabled the region to be one of the most important locations of the European knowledge-intensive industry. Leuven is located in the center of Flanders and Europe with favorable transportation infrastructure. Various renowned knowledge institutes, incubators, and science parks are located in the area, and the presence of venture capitalists provides a fertile environment for spin-off companies and international R&D-intensive companies.

[2] In social science, triangulation is defined as the mixing of data or methods so that diverse viewpoints or standpoints cast light upon a topic.

Table 4.3 Interviewee's information

Type of interviewee	Major business activity[a]	Date of establishment	Position of interviewees	Interview date
High-tech entrepreneurs	Computer programming activities Computer consultancy activities	4/15/2003	Founder	11 February 2011
	Manufacture of instruments and appliances for measuring, testing, and navigation	11/12/2009	Founder	11 February 2011
	Other research and experimental development on natural sciences and engineering	2/13/1998	Founder	14 February 2011
	Infrared cameras and technologies	2010	Manager	16 February 2011
	Activities of engineering and technical advice, except activities of geometricians	5/25/1998	Founder	16 February 2011
	Other specialized, scientific, and technical activities	2/20/2009	Founder	16 February 2011
Staff members of supporting organization	Other associations n.e.c.	6/10/1996	Manager	25 February 2011
	Nonprofit organization	11/1999	Managing director	25 February 2011
Government officers	Agency for regional development in the province of Flemish Brabant	2006	Staff	28 March 2011
Staff members of research institutes	Research in nano-electronics: ICT, healthcare, and energy	1984	Staff, business development office	28 March 2011
	University department: promote and support the knowledge and technology transfer between the university and industry and society	1972	Coordinator, innovation and incubation center	16 February 2011

[a]*Data source*: Belfirst Database

4.1.2 K.U. Leuven

Situated in the heart of Western Europe, K.U. Leuven has been a center of learning for almost six centuries. Founded in 1425 by Pope Martin V, K.U. Leuven bears the dual honor of being the oldest extant Catholic university in the world and the oldest university in the Low Countries. With 36,923 students (including 5,078 international students) and 9,560 people employed (1,463 senior academic staff; 5,136 junior academic staff; and 3,098 administrative and technical staff), K.U. Leuven is not only the education center but also the pool of talented researchers and technologies in the local region.

4.1.3 IMEC

IMEC is a world-leading research institute that performs in nano-electronics, which leverages its scientific knowledge with the innovative power of its global partnerships in ICT, healthcare, and energy. As one of the largest independent R&D organizations in the world with a mission to perform research and development, ahead of industrial needs by 3–10 years, in microelectronics, nanotechnology, design methods, and technologies for ICT systems, the headquarters of IMEC is located in Leuven, and it has offices in Belgium, the Netherlands, Taiwan, the USA, China, and Japan with around 1,900 staff, including more than 500 industrial residents and guest researchers.[3] With its superior research talents and infrastructures, IMEC had become the research and innovative engine to the high-tech industry, especially ICT industries in the Leuven region.

4.1.4 K.U. Leuven Research & Development

To facilitate the high-tech entrepreneurial activities, K.U. Leuven Research & Development (LRD), the technology transfer office of K.U. Leuven, was established in 1972 as one of the first technology transfer offices in Europe. LRD actively promotes and supports the transfer of knowledge and technology between the university and university colleges on the one hand, and industry on the other hand. Several incubators, science parks, and business centers in the Leuven region provide state-of-the-art lab and office space for innovative spin-off companies as well as international research-intensive companies.

[3] http://www2.imec.be/be_en/about-imec.html

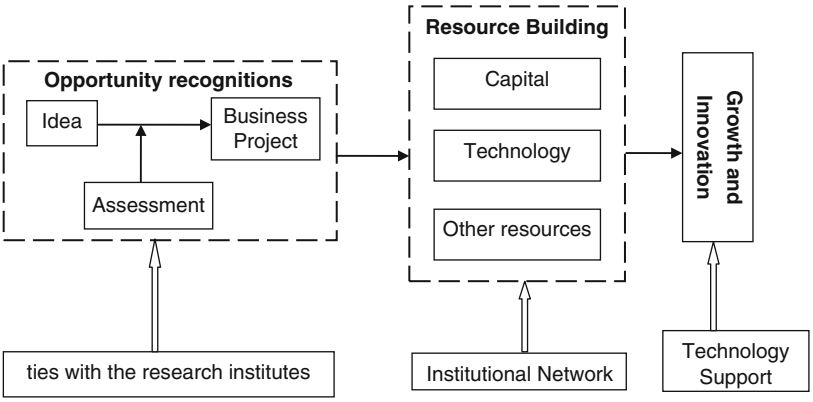

Fig. 4.1 The concept framework of data interpretation

4.2 High-Tech Entrepreneurial Process in Leuven

Our study found that the supporting organizations play different roles in the process of high-tech entrepreneurs' growth and the spin-off enterprises establishment. In line with prominent approaches that have been proposed for conducting inductive analyses through case study research (Eisenhardt 1989, 1991; Glaser and Strauss 1967; Miles and Huberman 1994; Yin 2003), the analysis presented in the following section can be structured according to a set of evolving categories that emerged during the course of our study, namely, high-tech entrepreneurial process in the cluster through the following three stages: (1) opportunity recognition and ties with the research institutes; (2) resource building and institutional network; (3) innovation and technology support. All procedures, as well as social network establishment modes and implications for the firms' possibility to appropriate synergistic effects through their establishment process, are explained in the following (see Fig. 4.1).

4.2.1 Opportunity Recognition of Ties with Research Institutes

The entrepreneurs whom we had interviewed in the spin-off companies used to be research PhD or professors working in the university or research institutes, such as IMEC; when participating in the expo or conference, their research achievement was recognized to have the market potential in the society; with the enthusiasm to see their research achievement being applied and help the society in the real business, they get the idea to commercialized it. As one of the interviewees described how he started the business:

> When we participated in an expo and present our research findings, there were some companies asked us to produce it for them, and then we got the idea to start our own business [...]

Besides that there are also some other situations when a kind of new and innovative technology is developed, the researchers see the potential of its wide application in the society in the near future and dedicate to start the business in this field. As one of the entrepreneurs who was engaged in the 3D scanning technology described, when he was a researcher in the university 10 years ago, he thought this 3D technology is quite new and would have a widely application in media markets in the near future:

> When we first developed this 3D scanning technology almost 10 years ago, it was bright new, but you can see now it is so popular in the media market with 3D movies and etc.[. . .]

However, for this kind of start-ups, the beginning stage is really hard when the market for this totally new technology is rare. For example, in this specific 3D scanning enterprise, benefit is rear in the first 10 years until the rapid development of 3D media market. Recently, new investment comes to the companies from the USA, and they had recently developed a new division which tried to enter into the American market. However, the enterprise still keeps their office in Leuven region even when the majority of the market had moved to America, as stated by the entrepreneur:

> [. . .] we can gain sufficient technology support and sense new development opportunities near the innovation base in Leuven, and I have also built strong social ties in the local place, which is an advantage for the business development.

In the industrial clusters, the institutional network enlarges the channels of opportunity perception for those personnel that approach the innovation centers, and successful stories of new enterprises creation make people become more sensitive to the business opportunities. Moreover, the social and institutional ties in the cluster provide necessary assistant for the nascent interpreters to access the opportunities more efficiently.

4.2.2 Resource Building and Support of Institutional Network

Although the researchers from the university or research institutes enjoy the priority to access the innovative entrepreneurial opportunities, they usually lack knowledge to transform and innovate idea into a business. Moreover, in the early stage when the new product or service is not well known in the market, the investment-profit rate is relatively low. Therefore, it is of huge difficulty in the early stage of high-tech start-ups. And in the high-tech cluster, resource building is usually supported by the university department, as well as the research institutes and government agencies. As stated by the LRD office:

> In Leuven, researchers are guided step by step through the process of transforming a business idea into a business plan by internal and, if necessary, also external advisors [. . .] the technological expertise of the researchers is combined with the business savvy of the LRD staff to produce a business plan that will serve both as an instrument to help convince investors and as an internal guiding tool for the entrepreneurs.

Table 4.4 The activity of POM

Function	Activities
Industry development	Development of new business zones
	Management of company zones
	Optimization of the existing economic infrastructure, via Brownfield development, park management, etc.
	Strengthening of the airport as an economic gateway and the strengthening of the airport region
Management function	Development and management of business centers, incubation and innovation centers, multifunctional buildings, and access building
Network function	The strengthening of the business community with projects concerning quality optimization, innovation support, internationalization, and promoting the environment
	The further development of the Flemish Brabant knowledge economy

Besides the guide of doing business, Leuven region also offers an ideal infrastructure for R&D-intensive ICT companies. The Arenberg Science Park, which opened in 2004, covers an area of 125,000 m^2. It offers multifunctional office space and ultramodern lab facilities, as well as support services. This science park, adjacent to the IMEC research campus, consists of four clusters, two of which focus on biotechnology and two of which on ICT and related high-tech sectors. The Arenberg Science Park houses numerous K.U. Leuven and IMEC spin-off companies. In addition, the K.U. Leuven Innovation & Incubation Centre (I&I) is a specialized incubator for mechatronics offering outstanding facilities for prototyping and small-scale production (see Table 4.4).

However, the locational proximity of firms and institutions in a cluster only creates the potential for economic value and does not necessarily ensure its realization. For a residing firm to access important resources and information in a cluster and realize the potential economic benefits offered by the cluster, the firm has to be connected locally (Owen-Smith and Powell 2004; Porter 1998). The city of Leuven, the province of Vlaams-Brabant and the Flemish government collaborate closely to form a strong institutional network that can facilitate resource building of the high-tech new enterprises and promote the regional development. And POM is one of the representative organizers to perform these tasks.

POM, established in 2006, is a member of EURADA, the European association for regional development agencies. The POM for Flemish Brabant undertakes actions that contribute to the socioeconomic development of the province, as executor of the provincial socioeconomic policy. POM is active basically in the field of promoting the high-tech industry development by various activities (see Table 4.4).

POM of Flemish Brabant has also established and managed various science parks in Leuven area, which provide the infrastructure for high-tech enterprises and cluster development. Shared with the same mission of entrepreneurial process development and in the form of property-based associations by using knowledge agglomeration and resource sharing, the incubators, science parks, and business

Table 4.5 Function and facilities of science parks, business centers, and incubators in Leuven

Name	Type	Facilities and function
Arenberg Science Park	Science park	13 ha, close to IMEC, consists of four clusters, of which two focus on biotechnology and two on ICT and other high-tech sectors
Haasrode Science Park	Science park	136 ha, accommodates tens of high-technology businesses, employing around 5,000 people in total
Business Centre Leuven	Incubator	Provides modern offices for young companies with an option of extensive services on the basis of shared costs. It offers 70 modern offices of between 20 and 50 m^2
Bio-incubator Leuven	Incubator	The building has 12 modules, each offering 250 m^2 of state-of-the-art laboratory and office facilities. Highly qualified staff and an extensive network of professionals provide expert support and advice
Ubicente	Business center	42,000 m^2 office space
Campus Remy		37,000 m^2 business parks located at less than 10 min from the Leuven city center, in a green environment alongside the Leuven canal
Innovation & Incubation Centre Kortijk (IICK)	Incubator	Offers infrastructure, services, and management support to starting high-tech companies: modern and well-equipped offices and meeting rooms; up-to-date technological infrastructure; and administrative service, management advice, and assistance
K.U. Leuven Innovation & Incubation Centre (I&I)	Incubator	Shared facilities: four meeting rooms with audio-visual equipment, kitchen, cafeteria, and parking area; shared equipment (PC network with shared software, fax, photocopier, and connection to the computer network of the K.U. Leuven)

Source: http://lrd.kuleuven.be/en/hitech, accessed on 29 July 2011

centers in the Leuven region provide state-of-the-art lab and office space for innovative spin-off companies and create an innovative dynamic and stimulating environment in which entrepreneurs and companies in the field of high-tech industry can develop their ideas and technologies. Table 4.5 shows the science parks and business centers and incubators and their basic information.

Moreover, a large amount of capital is available to support and stimulate innovative entrepreneurship, either via venture capital groups or via university funds, such as BNP Paribas Fortis Private Equity, KBC Private Equity, and the Gemma Frisius Fund, which is a seed capital fund established by K.U. Leuven and two private equity groups. In addition, an early-stage technology VC with exclusive focus on microelectronics and advanced materials, i.e., Capital-E, is closely linked to IMEC, a world-leading research in nano-electronics located in Leuven.

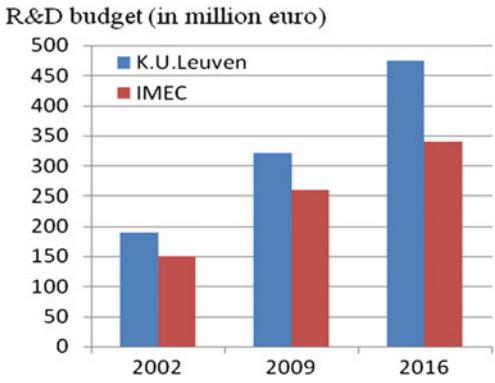

Fig. 4.2 R&D budget. *Source*: http://www2.imec.be/be_en/about-imec.html

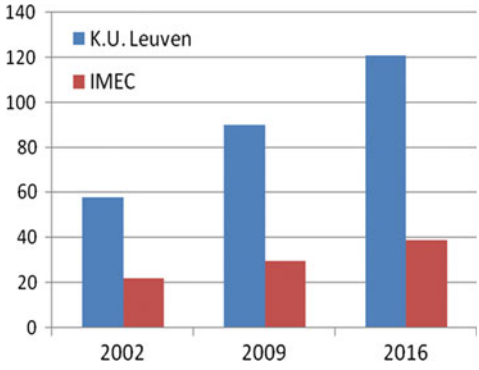

Fig. 4.3 Number of spin-off companies

The Leuven region is also home of several venture capital firms managing funds such as the Capricorn funds and the Quest for Growth fund.[4]

4.2.3 Innovative Development

In the Leuven region, the direct cooperation in research programs has become the most efficient way of transferring knowledge and technology between knowledge institutes and industry, while IMEC and K.U. Leuven have played an important role. Figures 4.2 and 4.3 show the current and estimated research budgets and incomes of research cooperation of K.U. Leuven and IMEC. Moreover, the creation and the growth of dedicated K.U. Leuven R&D innovation platforms, e.g., CD3 in the area of drug design and discovery, Leuven-MRC in the area of materials innovation, L-MTC in the area of medical and healthcare technologies, have

[4] http://lrd.kuleuven.be/en/hitech access on 29th July 30, 2011.

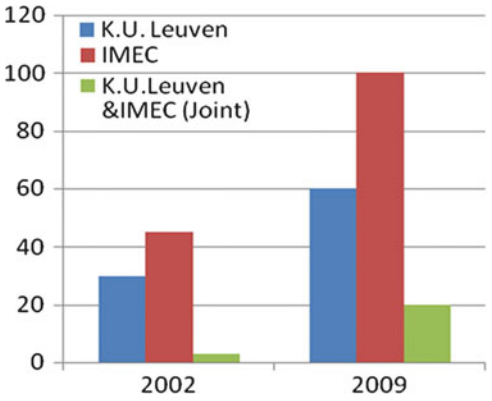

Fig. 4.4 Number of patent applications

sparked technology transfer and created ample opportunity for close academic-industrial interaction.

The technology which is sufficiently market-ready can be immediately transferred to an existing company, whether or not via tailored licensing. Another efficient way to innovate is the creation of spin-off companies that exploit research results and intellectual property developed within the knowledge institutes; Fig. 4.3 shows the number of spin-off companies from K.U. Leuven and IMEC. Figure 4.4 shows the number of patent application by K.U. Leuven and IMEC in 2002 and 2009.

In the high-tech industrial cluster, innovation is achieved through direct or indirect interaction between the universities and enterprises, which encourages the technology resource flow between them. Moreover, the universities and research institutes provide the industrial cluster with rich and high-quality human resources and innovative knowledge resources. In the area of Leuven, a large group of graduates or researchers choose to start their business locally as they feel familiar with the location and have deep roots there. As stated by most of our interviewees, they choose to establish their enterprises in Leuven region because their education was gained from the universities and social contacts had been built during the studying and research process.

Besides the government's effort in building up the entrepreneurial networks and promoting the cooperation between enterprises and research institutes, there are also some nonprofit organization or associations that put effort in establishing the locational relationship, such as the Leuven Innovation Networking Circle (Leuven, Inc), which aims to stimulate high-tech entrepreneurship by bringing together like-minded people from academic research groups, high-tech start-ups, consulting agencies, venture capitalist firms, and well-established companies in the Leuven region. In addition to this horizontal network, several specialized technology cluster networks are in place to stimulate the interaction between university and industry. In addition, the Vlaams-Brabant Innovation Centre also supports innovation in SMEs.

5 Research Findings

Innovation is the driving factor in the process of entrepreneurial development and the formation of industrial clusters, while the cultivation of innovative ability is very important for maintaining the competitive advantages of new ventures, which is crucial for the growth and sustainability of high-tech clusters. Researchers, who have knowledge about the innovation process and technological development trend, especially in entrepreneurial friendly high-tech clusters, have easier access to resources that enable them transform their research achievement into services or products by establishing high-tech enterprises with the support of various organizations. In the case of Leuven high-tech region, the enterprises, universities, regional government agency, service agencies, and financial institutions settled together to form a regional innovation network; the cooperation between these players has promoted the spillover process and transformed innovative achievement into industries. This has been critical aspects of the development of new ventures in high-tech clusters. Indeed, knowledge spillover and knowledge sharing are the motivation factors for high-tech industrial cluster development (Athreye 2000).

According to our interviews with those high-tech entrepreneurs in the Leuven region, the transformation process that they experienced from researchers to entrepreneurs is highly promoted and supported by various parties in high-tech industrial clusters of the region. Figure 4.5 illustrates this process, i.e., how researchers became entrepreneurs by recognizing the entrepreneurial opportunities during their research project and transforming their research findings into business applications and products through optimizing resources and promoting enterprise growth.

And in this case, we also found the developing process of high-tech new venture is promoted and facilitated by universities and high-tech research institutes throughout the entrepreneurial process for recognizing opportunities, mobilizing the resources, and competing for growth. The supporting process is shown in Table 4.6.

6 Conclusion and Future Research

Innovation and new technology development usually require a large amount of investment in the beginning stage and will need a relatively long period to gain the stable profits. Therefore, it is usually hard for the high-tech entrepreneurs to start the business and find venture capitals in the market. And in this case, we found the high-tech new venture developing process is promoted and facilitated by the support from government department, universities, and high-tech research institutes throughout their entrepreneurial process in recognizing the opportunities, collecting the resources, and the struggle to growth.

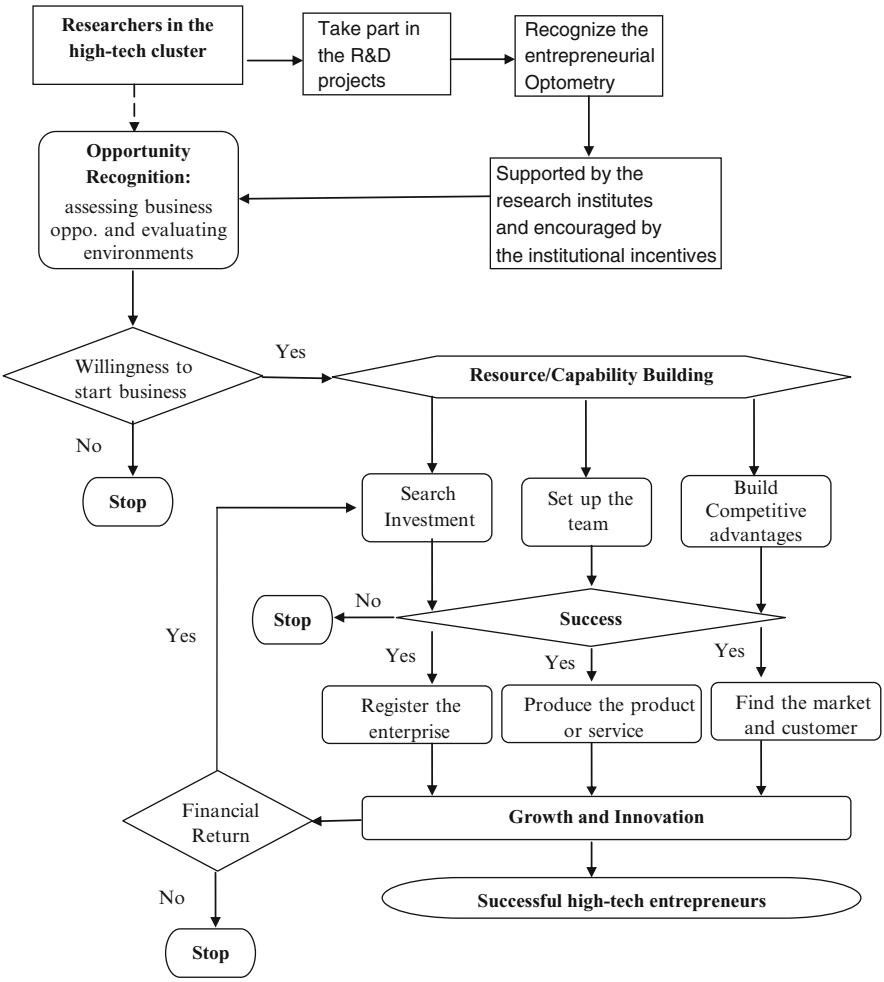

Fig. 4.5 The flowchart of high-tech entrepreneurial process in Leuven

In the trend of knowledge economy period, the successful high-tech entrepreneurs will create tremendous value to create new jobs, promote the industrial structure upgrading, and encourage the continuous regional development. Thus, it is of great importance for the relevant institutes and associations to set up policies and establish channels to support the high-tech entrepreneurial process. Feldman (2001) had reckoned that the development of social and institutional network is positively related to the growth entrepreneurial capability of the talents in the clusters. In this study, we had found that initial capital, technology support, and human capital are the critical resources those institutes had tried to provide according to the potential entrepreneurs need. And entrepreneurial network built through the institutional network structure is also important for the new ventures to gain necessary resources.

Table 4.6 The function of universities and research institute during the entrepreneurial process in Leuven

	Entrepreneurship process		
Research institutes	Opportunity recognition	Resource/capability building	Growth and innovation
LRD, K.U Leuven	"Researchers are guided step by step through the process of transforming a business idea into a business plan by internal and, if necessary, also external advisors [...] the technological expertise of the researchers is combined with the business savvy of the LRD staff to produce a business plan that will serve both as an instrument to help convince investors and as an internal guiding tool for the entrepreneurs [...]"—Leuven R&D	"The university, in partnership with two major private banks—KBC Private Equity and BNP Paribas Fortis Private Equity—has created its own seed capital fund: the Gemma Frisius Fund. The aim of the Gemma Frisius Fund is to provide seed capital in the early phases of innovative, research-based spin-off companies. Investment is not restricted to a specific technology domain"—Leuven R&D	"LRD's Intellectual Property Rights Service offers researchers support with respect to all aspects related to intellectual property and the protection and *commercialization* thereof"—Leuven R&D "The first years after foundation, LRD maintains close ties with the spin-off company, especially for the development of a strategic vision. In addition, LRD also helps to manage the various growth phases of a company. Via a mandate in the Board of Directors and a meticulous monitoring of the business activities, LRD gives advice for strategic decisions which have an influence on the international growth process. Moreover, the services of independent external managers are also sometimes availed of in order to consolidate this growth process"—Leuven R&D
IMEC	"Imec actively supports the creation of spin-off companies. This presents opportunities for investors as well as for entrepreneurs"—IMEC "Imec's spin-offs are an	"We offer you group and web-based courses to help improve your soft skills: project management, communicative skills, conference techniques, speaking	"After the completion of an internal feasibility study and incubation phase, a typical imec spin-off raises seed money to develop its first product and to get commercial traction.

(continued)

Table 4.6 (continued)

Research institutes	Entrepreneurship process		
	Opportunity recognition	Resource/capability building	Growth and innovation
	opportunity for young as well as for experienced entrepreneurs [. . .]we are constantly looking for people with the right entrepreneurial spirit to complement or lead our spin-off teams[. . .]"	in public, time management, managing people [. . .] We also help you understand non-European cultures, which isn't a luxury in an international environment like ours"—IMEC	Throughout the complete start-up process, imec partners with collaborative VC's (CVC's), which help the start-up's business plan with their expertise and network"—IMEC

Although the conclusions that we have drawn in this paper are built on a single case only and, therefore, may not be seen as representative, they nevertheless offer guidance for future research. As institutional issues are mentioned in this study, proposition extension should be based on further deep-level case analyses on a cross-nation level. More specifically, those analyses should not only deal with one specific cluster in a certain country but should also extend the focus on developing countries with a different institutional environment. Using cross-country data as an object of analysis seems to be a promising way future research can take as most research in international business is centered on entrepreneurship, especially when focusing on emerging markets like China where data on high-tech new ventures is scarce or even missing. In addition, and to gather more data, such research should focus on a broad level of high-tech industries. This is needed for extending our knowledge to the origins of learning and capability building by applying a micro-foundation to derive findings and insights (e.g., Roth and Kostova 2003).

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Chapter 5
The Impact of Inter-firm Cooperation on Performance: A Two-Region Experience

João J.M. Ferreira, Mário L. Raposo, and Cristina I. Fernandes

1 Introduction

The management literature provides extensive coverage of the different motives and factors that encourage companies to cooperate and adhere to cooperative relationships. Nielsen (1988), who influenced a wide body of authors (Heide and Miner 1992; Parkhe 1993; Hagedoorn and Schakenraad 1994; Mohr and Spekman 1994; Gulati 1995; Browning et al. 1995; Holm et al. 1999; Afuah 2009), seeks to demonstrate that cooperative strategies may ethically boost organisational efficiency in various circumstances. Taking a multidisciplinary approach, he sets out the utility of cooperative strategies within the scope of concepts such as the environmental life cycle, generic strategies and aggregating value before concluding that strategies involving cooperation between major corporations may be more efficient than external market mechanisms. Hence, cooperative strategies are susceptible to enhancing organisational efficiency in various different market scenarios.

The majority of empirical studies approached the factors determining cooperation (Belderbos et al. 2004a, b; Fritsch and Lukas 2001; Hagedoorn and Schakenraad 1994; Heide and Miner 1992; Kleinknecht and Reijnen 1992; López 2008; Mention 2011; Mohr and Spekman 1994; Tether 2002; Ring and Van De Ven 1992). Ring and Van de Ven (1992) analyse the way in which cooperative relationships between organisations are actually structured and, based on economies in transaction costs, strive to demonstrate just which drivers lead

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organisations into seeking out cooperative relationships with other companies and which mechanisms are available for handling these types of inter-organisational relationships. Hagedoorn and Schakenraad (1994) seek to interrelate organisational performance and the adoption of cooperation-based strategies and seek to explain to what extent inter-company strategic technological partnerships impact on the profitability of those entities engaged in such joint efforts.

Mohr and Spekman (1994) deal with the characteristics of successful partnerships, focusing on the vertical relationships between companies and identifying four areas as of potential relevance to cooperation: flexibility, the exchange of information, shared problem solving and restrictions on the use of power.

The key finding of more recent contributions proposes that the factors determining the partnerships differ depending on the cooperation and partnership types (Belderbos et al. 2004a, b; Fritsch and Lukas 2001; Mention 2011; Tether 2002). Fritsch and Lukas (2001) conclude that innovative efforts targeting the improvement of processes display a greater probability of involving cooperation with suppliers, while product innovations are associated with cooperation with the clients themselves. Tether (2002) finds that cooperation is primarily the domain of companies seeking more radical innovation rather than that resulting from incremental innovations. In distinguishing between partnerships between competitors, suppliers, clients, universities and research institutes, Belderbos et al. (2004a, b) identify substantial heterogeneity in the determinants of cooperation between different partnerships. Mention (2011), meanwhile, places the emphasis on the propensity of cooperation practices to lead to companies launching new innovations into the market.

The core question as to whether cooperation has the positive expected impact on company (innovation) performance has remained broadly unexplored in the literature (Tether 2002; Das and Teng 2000). A series of research studies adopt a cooperation variable for empirical models explaining differences between the results of company innovation efforts (Klomp and van Leeuwen 2001; Lööf and Heshmati 2002; Monjon and Waelbroeck 2003). However, the majority of these studies were principally interested in the impact of R&D investment on performance and did not systematically examine the difference of the impacts generated by the various cooperation types. Management studies hitherto have restricted their analysis to specific performance indicators in particular industries, for example, the effect of alliances on the performance of hi-tech start-ups in the biotechnology sector (Baum et al. 2000), or the effect of alliance-based learning on performance in terms of market share in the global automobile industry (Dussauge et al. 2002).

Mention (2011) finds that companies involved in science-based partnerships designed to bring about product innovations are more likely to actually roll new innovations out into the marketplace, while information arriving from the competition seems to bear a negative influence on the actual newness of innovations. The probability of cooperation with a particular partner type generally rises in accordance with its perception of the other as an important source of knowledge for innovation processes, while knowledge deriving from universities and research institutes positively influences all these cooperation types.

According to López (2008), the sharing of cost risks was identified as the most important determinant to cooperation. This fact may potentially highlight a lack of private external financing for innovative activities and a shortfall in risk capital investment. He furthermore refers how company size and the availability of technological know-how inside companies return a significant and position correlation with cooperation. As regards cooperation with different partners, the results are not so clear as the majority of companies prove to have reached practically simultaneous agreements with different types of partners rendering identification difficult. Future research should thus deepen our levels of understanding about the knowledge transfer process and its respective effects on innovations produced by companies engaged in partnerships (Hernández-Espallardo et al. 2011).

Within this context, this empirical study makes a dual contribution. Firstly, we seek to analyse the practical nature of cooperation across different sectors in accordance with their respective specific characteristics. Secondly, we simultaneously explore the role of the different cooperation types deriving from the various sources driving the propensity of companies to improve their performance levels. In summary, this research aims to examine just which acts and practices of cooperation undertaken by companies in border regions are able to impact on performance.

The rest of the article is organised as follows: Sect. 2 puts forward a review of the theoretical and empirical literature discussing the impact of cooperation on company performance. Section 3 describes the research, the methodology and the empirical model adopted. Section 4 discusses the empirical results before Sect. 5 sets out our key conclusions, limitations and suggestions for future lines of research.

2 Literature Review

2.1 Relational Networks

Given the difficult prevailing economic conjuncture in addition to the pressures imposed by competition and the constant changes taking place in the surrounding environment, organisations seek to foster relational networks able to boost their innovative capacities and generate new business opportunities.

According to Håkansson (1987), the concept of organisational networks, while embracing a broader concept, refers to two or more organisations involved in long-term relationships with the key objective of optimising different organisational processes to drive the level of competitiveness in increasingly turbulent environments.

In general terms, we may define an organisational network as a structure within which companies participate as otherwise, due to scale, structural and financial

limitations, they would not be able to ensure their own survival and future sustainability. Networks display the greatest variety of configurations, portraying the specific characteristics and the objects involved. From Håkansson's (1987) perspective, the network dynamic derives from two core processes: structuring/heterogeneity and hierarchy/externalisation. Through the first process, the network is structured according to the investment necessary with relationships established in accordance with the heterogeneity of the resources. Networks gradually evolve over both a long series of initiatives and adaptations of their activities and resources and over the scope of the mutual commitment between actors.

According to Ernst (1994), the majority of activities undertaken in the most important economic sectors are organised into one of five different network types: supplier networks, producer networks, client networks, coalition-standard networks and technological cooperation networks. Each of these network types characterises the diverse range of network utilisation formats in effect.

Networks also involve a broad process of joint activities and covering a great range of variations and applications to the organisational context, ranging from the flexible networks of small- and medium-sized companies, top-down networks (or subcontracting/outsourcing), relational networks, information networks, communication networks, R&D networks, innovation networks and strategic networks, among others (Ernst 1994).

Reputation is recognised as an important asset, fostering relationships of trust, confidence and reciprocity. Within the framework of the analytical narratives of organisational analysis put forward by Reed (1999), network theory may be approached within the framework of the market model, taking into perspective the theory of firms, the institutional economy (Brock 2002; Coase 1937, 1960, 1998; Commons 1931), transaction costs (Coase 1937; Williamson 1975, 1979, 1981, 1985, 1991, 1994), resource dependency (Pfeffer 1987; Pfeffer and Salancik 1978) and population ecology (Hannan and Freeman 1977; McKelvey and Aldrich 1983). This throws into emphasis the issues surrounding the adaptive adjustments ongoing at organisations within the objective of coping with the pressures to maximise efficiency in their internal and external transactions in addition to the competitive pressures that drive companies into selecting and maintaining relationships with certain organisational types.

According to Powell (1987), the cooperation established inside a network may lead to important organisational transformations at participant entities. The presence of a dense network of cooperative relationships may change perceptions about the competition. Organisations may reach the conclusion that they no longer need private and exclusive ownership over an asset to extract value from it. Network participants begin to be perceived as partners and no longer as competitors.

Correspondingly, there is a need for methodologies guiding the creation, definition, implementation and maintenance of networks. Hence, this once again highlights the role of new approaches to the management of networking organisations. Clearly, this new form of company interaction, across both its internal and external facets, takes place with the objective of becoming more competitive.

The factor most commonly referenced in the literature as explaining why companies opt to set up and develop diversified networks and also with greatest impact on organisations is certainly access to a range of information, skills, capacities and knowledge that would otherwise be difficult to develop or acquire (Hall 2005; Uzzi and Dunlap 2005). As a consequence, networks prioritise the development of coordination and cooperation between companies (Nahapiet and Ghoshal 1998; Gopalakrishnan et al. 2008), enabling better, easier and cheaper access to the resources necessary for ongoing activities (Nahapiet and Ghoshal 1998), avoiding making the mistakes that other network members have already made (Gopalakrishnan et al. 2008), helping leverage the creativity of new products and their marketing programs (Kirwan et al. 2007), thus improving company performance levels (Wicks et al. 1999), and helping develop more efficient financial strategies (Uzzi and Dunlap 2005).

Networks also foster other advantageous factors for companies that while gaining less profile are no less important and including promoting the development of executive power within the company hierarchy (Uzzi and Dunlap 2005), easier access to financial capital, cooperation in promotion and innovation and the gaining or losing of reputation (Hall 2005).

The organisation's actual capacity to establish competent networks is limited by the attractiveness of the company to potential partners and by the level of uncertainty surrounding attaining the responses desired (Hall 2005). Therefore, companies should seek to establish and enhance the value of its network through strong relationships. The characteristics determining the expectations and behaviours of network members are the extent of the jointly shared objectives, the exchange and receipt of information of value to the company and the levels of trust among network participants.

Trust between partners shapes the relationship in two different ways (Kim et al. 2010): (1) a reduction in the perceived risk of opportunistic behaviour and (2) a reduction in the transaction costs inherent to relationships of exchange. However, just what is this trust? Morgan and Hunt (1994) define trust as the conviction and certainty as to the honesty of a commercial partner while Zaheer et al. (1998) define such as the collective confidence that all members of an organisation place in another commercial partner.

Trust is believing in the existence of a functional continuity to whatever one is familiarised with, thereby enabling the freedom to act as if uncertainty levels have been reduced even where not actually the case (Steensma 2000). Wicks et al. (1999) argue that trust is an expectation with entities assuming ethically justifiable behaviour on behalf of the other entity, that is, that partner decisions are morally correct and that actions are based on ethical principles, thereby in the belief, there will be a joint effort or mutual economic exchanges. Steensma (2000) states that trust is the adoption of a belief that one party will not deliberately act against the interests of the other party and this belief is maintained, without undue doubts, suspicions and without seeking out detailed information on the actions ongoing at the other party. On the contrary, Muthusamy and Margaret (2005) define trust as a deliberative activity that proves somewhat uncomfortable to the entity.

Wicks et al. (1999) propose that companies should try and identify the best level of trust they should hold in their commercial relationships and hence there should correspondingly be an optimal level of trust in a networking relationship. Nahapiet and Ghoshal (1998) also affirm that a specific combination of social trust, norms and targets shared between members of network facilitates coordination and cooperation to mutual benefit.

Trust is thus an important issue to strategic choices managers make when seeking to foster and enhance optimal trust levels in relationships with interested parties, thereby improving the company's own performance (Wicks et al. 1999).

According to Smith and Lohrke (2008), only at an initial phase do business managers depend on the levels of their affective trust in partners. Furthermore, to the extent that the company proceeds, its network should steadily be less based on levels of affective trust and become more based on cognitive trust. Hence, at the beginning of company activities, the entrepreneur develops emotional bonds that involve concern over the well-being of partners; nevertheless, over the passage of time, the entrepreneur begins to take more aware decisions based upon the knowledge accumulated in the meanwhile. Companies that remain mired in relationships based purely on affective trust may hold back and hinder the growth of their networks given the essential role played by growth in the company's social capital. Hence, entrepreneurs and managers who develop relationships of cognitive trust with their most critical suppliers may be able to attain higher success rates and prove able to more swiftly overcome problems associated with new events and technologies.

Smith and Lohrke (2008) go so far as to state that the larger the company and the greater its power, then so much the greater should be its responsibility. Hence, large companies and corporations should do whatever is morally acceptable so as not to lose reputation. However, the development of trustworthy networks may in turn lead to barriers being raised to accessing a diversified range of information as people inherently tend to set up networks with people and companies similar to their own and effectively with identical life experiences. In this way, networks with identical partners find it difficult to come up with new information and insights as regards more efficient financial strategies (Uzzi and Dunlap 2005).

These relationships with external entities represent an essential factor to the development of entrepreneurial companies. Various researchers (Lechner and Dowling 2003; Uzzi and Dunlap 2005; Wicks et al. 1999) even propose that investment should go into developing networks competent at developing more efficient financial strategies. Hence, setting up a company network should be a proactive task for managers and its construction should be approached from a long-term perspective (Lechner and Dowling 2003).

The existence of a common objective is the point of departure for setting up a network (Gopalakrishnan et al. 2008) while this factor, however, is not in itself sufficient to founding networks. From the perspective of these authors, what is also required is keeping the members of the network satisfied through actions of cooperation that encapsulate exchanges of information beneficial to both parties.

Network relationships allow for organisations to obtain access to resources that may prove difficult to develop and acquire through alternative means (Hall 2005). Therefore, we may state that these relationships are crucial sources of information for the company that may be developed with the purpose of fostering the interchange of relational inputs between network members. The networked relationships enable better, easier and cheaper access to the resources necessary to ongoing company activities (Nahapiet and Ghoshal 1998).

Kirwan et al. (2007) also find in favour of network ties proving an important factor for social capital based upon how these relationships define the degree of reciprocity and proximity between an organisation and its suppliers and proving useful within the framework of generating a richer and deeper view of the marketplace and the different technologies able to stimulate the development of both new products and creativity. Thus, these authors conclude that companies invest their resources and their time in building up strong bonds characterised by trust and the sharing of objectives and visions with the respective partners within the overall framework of acquiring new technologies and knowledge from the market able to subsequently leverage creativity and competitiveness.

2.2 Inter-firm Cooperation

The management literature has tended to significantly focus more on the motivations for cooperation than the effects of cooperation on company (innovative) performances.

According to Mention (2011), innovation is seen as the result of an interactive process between the company and its surrounding environment while also stemming from cooperation between a major variety of actors and located both within and beyond the company. Cooperation is considered a driver of innovation and is expected to bring benefits such as obtaining economies of scale and product range economies, reducing the level of uncertainty and accessing both new markets and complementary knowledge. Companies that cooperate, on average, return higher performance levels than companies that do not cooperate (Abramovsky et al. 2009; Mention 2011). Furthermore, success at innovation and the global performance are also influenced by the nature of cooperation partners (Mention 2011).

Explanations for the reasons companies adopt cooperative strategies have been subject to broad-ranging debate (Belderbos et al. 2004a, b; Benfratello and Sembenelli 2002; Das and Teng 2000; Hamel 1991; Kogut 1988a, b; Nakamura 2003; Pisano 1990; Roberts and Berry 1985; Tyler and Steensma 1995). While having found that as a rule a substantial percentage of alliances fail (Harrigan 1986; Kale et al. 2002; Kogut 1988a, b, 1989; Porter 1987; Barkema et al. 1997; Park and Ungson 1997; Mora-Valentin et al. 2004; Reuer and Zollo 2005; Okamuro 2007), they still prove a source of competitive advantage and generate long-lasting effects on company performance. For example, Teece (1980) argues that organisational practices do have an effect on company performance and may explain the sustained

performance differences within industries due to the slow diffusion of best practices and the difficulties inherent to imitating complex organisational abilities.

That the different types of cooperation may have different end purposes has also been proposed within the framework of innovation objectives being either reducing costs or expanding market share. Von Hippel (1988) recognises how cooperation with clients is important to reducing the risk associated with introducing innovation into the marketplace, in particular, when the products are either new or complex and require adaptation by clients, such cooperation may prove critical to guaranteeing market growth (Tether 2002). As regards cooperation with suppliers and competitors, Belderbos et al. (2004a, b) conclude that cooperating both with suppliers and with competitors may have a significant impact on raising workforce productivity. Lhuillery and Pfister (2009) also come out in favour of how cooperating with competitors may considerably boost the knowledge base in effect at the company as such competitors generally have similar needs in terms of product or process development and hence the knowledge base in the meanwhile built up may be particularly relevant to competitors in the same field. Various other empirical results (Belderbos et al. 2004a, b; Lööf and Heshmati 2002) confirm how cooperating with competitors boosts certain measurements of company innovation performance.

Furthermore, cooperation with universities and research institutes and, once again, with competitors has a positive effect on both product sales and new services for the market. Cooperation with universities and research institutes is generally more designed for innovations able to open up completely new markets or market segments (Tether 2002; Monjon and Waelbroeck 2003). For example, Lööf and Brostöm (2008) find evidence that cooperating with universities boosts the innovative performance of major Swedish industrial firms in terms of sales of new products per employee. Belderbos et al. (2004a, b) conclude that engaging in R&D in conjunction with universities (as well as with competitors) raises growth in sales attributable to new market developments.

As Mention (2011) refers and as earlier reported by EUROSTAT (2008), 26 % of innovative companies are involved in cooperation with other companies, universities, public research institutes, suppliers, clients and competitors in the European Union. In member states, the most common cooperation partners are suppliers followed by clients, while the least common prove to be universities and research institutions. According to Marchi (2011), cooperation with suppliers, knowledge intensive companies and universities is more relevant for other innovations, while cooperation with clients would not seem to attain differentiating significance.

A number empirical studies have reported cooperation generates a positive impact on innovation performance levels (Belderbos et al. 2004a, b; Faems et al. 2005; Klomp and van Leeuwen 2001; Lööf and Heshmati 2002), patents (Vanhaverbeke et al. 2002), and sales growth (Cincera et al. 2004). Some of this research has also examined the effect of different cooperation types while returning only ambiguous results. Faems et al. (2005) conclude that there is a positive association between cooperating with universities and the company's market

share of sales of innovative new products while an aggregated measurement of other cooperation types was positively associated with the sales level of innovative company products (but not with market share). Monjon and Waelbroeck (2003) describe a mixture of negative and positive impacts of cooperation and its spillover effects. Cincera et al. (2004) find spillovers generate a positive impact on productivity but a negative impact on cooperation. Lööf and Heshmati (2002) report how cooperation with competitors and with universities has a positive impact on innovation output levels but a negative impact on clients.

Although the overall level of cooperation on innovation related activities is similar between industrial and service sectors, Mention (2011) observes significant discrepancies in the choice of cooperation agreements and the level of information supplied between these different sectors. Cooperation with competitors takes place more frequently at service companies than in the transformative industrial sector, while the opposite holds for cooperation with universities. This observation leads to the supposition that the cooperation practices and supply of information may also differ somewhat between the different sectors of activity.

According to Faria et al. (2010), cooperation activities with other companies or institutions are opportunities to access complementary technological resources (through the sharing of skills and knowledge) that may nurture swifter innovation development, better access to markets, economies of scale and range, the sharing of costs and the diversification of risk.

Browning et al. (1995) make recourse to the theory of complexity to analyse the construction of cooperation in competitive industries and provide interesting insights into the formation of alliances and specifically identifying the factors preceding the establishment of cooperation as ambiguity and disorder. However, to the extent that a shared morale is built up between the actors and firms involved, without expecting any individual or immediate return, this contributes towards consolidating the alliance. The instability present in strategic alliances has already been highlighted by Parkhe (1993), who adopts economies of transaction costs and game theory as his framework of reference for analysing the structuring of strategic alliances.

According to Parkhe (1993), some alliance structures display a greater propensity to fraud, to highly unpredictable behaviours and lower levels of stability before warning that structure is directly bound to performance. Other authors (Gulati 1995; Holm et al. 1999) have placed the emphasis on the importance of the structure being built up through actions of cooperation. Gulati (1995) shares this feeling and explores how such factors explain the choice of governance structures in inter-organisational alliances while emphasising the costs of transaction dimension. The author concludes that the choice of contractual format for the alliance does not only depend on the scope of partnership activities and their associated costs of transaction. Instead, he emphasises that the choice of governance structures depends on the trust and the bonds built up between organisations over the course of time.

Holm et al. (1999) propose and test structural models of business relationships with the objective of studying the interconnection between interaction, interdependence and the creation of value by networked business relationships. These relationships

are conceived as a causal chain linking businesses up in networks involving a mutual commitment not only regarding mutual dependence but also a relationship actually able to create value. The results demonstrate that relationship development has a strong effect on the returns from this value creation. According to Afuah (2009), this value creation derives from the differentials arising out the benefits perceived by clients and the costs of these benefits as appropriated by their components as well as the sum of the different added values accruing to each organisation participating in the network.

In summary, the literature suggests that analysis of the different types of strategies and cooperation agreements should take into consideration the respective different objectives of collaborative efforts. We explore this issue through empirically examining the effects of cooperation on financial performance measured through business turnover. Furthermore, we follow the recommendations set out in the literature in advocating how cooperation impacts on company performance.

3 Research Design

3.1 Regions Under Analysis

The Portuguese *Centro* region and the Spanish *Castilla y León* region are geographically adjoining and benefit from a strategic location within their respective countries and the Iberian Peninsula (with its extent in excess of 600,000 km) as a whole. With the opening of markets, these border regions became progressively closer with the creation of strong connecting bonds within the framework of attempts to leverage strengths in order to deal better with the challenges posed by competitiveness and the internationalisation of the economy.

The geographic positioning of these two regions is considered strategically favourable to the extent that the regions form a link between Portugal and Spain and the rest of Europe and between the northwest of the peninsular and the two Iberian capitals. Both regions are criss-crossed with international standard transport infrastructures, both road and rail, which is duly recognised at the European level through integration into the Trans-European Transport Network.

The *Centro* region, with an area of 28,200 km^2, covers 31.7 % of mainland Portugal, is home to 2,385,911 inhabitants and distributed across 100 councils. In terms of the private sector, the *Centro* region has close to 239,840 companies, of which 5,236 are exporters, employing a total of 706,270 members of staff and responsible for generating annual turnover of around €55 million. These companies specialise in the chemicals sector, automobile components, moulds, cellulose and paper, textiles, ceramics, agro-food industry (dairy, olive oil and meat products), viniculture as well as the extractive (gold, lead, wolfram and tin) industries (INE 2009).

Castile and León is one of the four Spanish autonomous communities that border Portugal. Located in the northwest of Spain, the region covers 94,224 km^2, inhabited by around 2,560,000 citizens, around 5.5 % of the country's total population. Average GDP per capita in the region stands at €23,361 per annum, around 97 % of the Spanish average. The road network spans 32,448 km, of which 1,619 correspond to major thoroughfares. Relative to trade between Portugal and Spain, the Spanish region is the fifth largest recipient of Portuguese exports with a market share of 7.1 % and is the seventh largest supplier with a share of 5.9 %. Among the main products exported from Portugal to *Castilla y León* are automobile components and accessories, semi-manufactured aluminium products, home furniture and furnishings, steel products, raw materials and semi-manufactured plastics, preserved vegetables and meats, wood and food oils.

The main products Portugal imports from this region are automobile equipment, components and accessories, fresh meat, steel products, personal hygiene products, cereals, animal foodstuffs, pulp and paper, fresh vegetables and biscuits. The *Castilla y León* region enjoys a geographically favourable relationship as in addition to bordering nine other Spanish regions; it is considered a key border crossing to and from Portugal. Hence, it is deemed of strategic importance for trade between southern Europe and the rest of the continent and guaranteeing the proximity of its business community to other regions and markets.

There are already important protocols in effect for business-level cooperation between these two regions, of which the 1998 agreements signed by the Centro Business Council and the Confederation of *Castilla y León* Business Associations and the protocol between the Confederation of Business Owners of Salamanca and the Business Cluster of *Centro* Region of Portugal signed in the same year (Pérez 2006) are good examples.

3.2 Sample

The present research is supported by the ACTION project. The ACTION project is an international project designed to promote cooperation among cross-border regions, among firms in different industries and also among scientific and technological entities to enhance the productivity of regional innovation. This project is co-financed by the POCTEP—program of cooperation in border regions, axis I (joint cooperation and management for fostering competitiveness and the labour market). The geographical scope of the project is the NUT II, which includes the *Castilla y León* region (Spain) and Portugal's *Centro* region. A questionnaire was drafted with the objective of gathering data on the cooperation activities ongoing at project participant companies. Sixty-one firms from the logistics and agro-business sectors were surveyed with Table 5.1 below detailing the main sample characteristics.

Table 5.1 Survey data collection

Geographic area	*Castilla y León* region (Spain) and *Centro* region (Portugal)
Analysis unit	Logistics and agro-business sector firms
Data recollection	In-person questionnaire
Population	61 Firms (26 Portuguese firms and 35 Spanish firms), ACTION project members
Response rate	61 Valid questionnaires Response rate: 100 %
Questionnaire date	October–December 2010

3.3 Methods

The data obtained was subject to analysis by SPSS software version 18.0. The numerical variables are summarised in accordance with the average, the median, the minimum, the maximum and the standard deviation while qualitative variables are summarised by recourse to their absolute and relative frequencies. The comparative bivariate analysis of Portuguese and Spanish companies applied the Mann–Whitney test and the T test for continuous variables and the chi-squared test for the categorical variables. In multivariate terms, linear regression was the methodology adopted for analysis of the ways cooperation influences financial performance (sales turnover) and the respective differences between the two regions under analysis.

We deployed ordinal regression (with a probit link) models to ordinal (average, high average and high) business turnover with these associations proving statistically significant with p-values below 0.10. The calculated coefficient of determination (pseudo R^2) applied was Nagelkerke's. The bivariate analysis of p-values below 0.05 returned significant differences and in the multivariate analyses this value was 0.10. We adopted this latter value given the sample size was made up of only 61 companies.

4 Results

4.1 Descriptive Statistics

We returned statistically significant differences ($p < 0.05$) between the Portuguese and Spanish company respondents as regards their core business activities. In the Portuguese case, the most common company business is transport and logistics, amounting to 46.2 %, while a majority of Spanish companies (54.3 %) are engaged in production and distribution activities. There are equally statistically significant differences ($p < 0.05$) regarding the number of company employees with the majority of Spanish firms no larger than micro-companies with fewer than ten

employees (60 %) while small-sized companies prevail in Portugal as a clear majority employ between 10 and 49 members of staff (61.5 %).

Business relationships with partners in the North, *Centro* and Lisbon and Tagus Valley regions of Portugal have expanded significantly ($p < 0.05$) and more at Portuguese companies than at their Spanish peers. Nevertheless, and understandably, Spanish companies have seen significantly greater growth ($p < 0.05$) in their ongoing relations with companies located in the *Castilla y León*, *Centro*, South and other regions of Spain.

As regards informal relationships, the results reveal how Portuguese companies have registered a significantly higher increase in the Portuguese regions of *Centro*, North, Lisbon and Tagus Valley and the Algarve while Spanish companies record this significance only in the *Castilla y León* and North regions of Spain.

The level of cooperation engaged in by the respective business participants displayed no statistically significant differences ($p > 0.05$) between Portuguese and Spanish companies.

Regarding the level of agreement over the advantages resulting from cooperation, Portuguese companies report significantly higher levels ($p < 0.05$) in terms of technical knowledge, how company management improves with cooperation, boosting turnover, enabling greater marketplace agility with overall company competitiveness enhanced by partnerships able to raise client satisfaction levels and strengthen the company's market position.

As regards the level of agreement about the overall benefits of cooperation, Portuguese companies once again return significantly higher levels ($p < 0.05$) as regards issues such as cultural differences between partners, the non-revelation of all company information to partners, greater client satisfaction levels following cooperation, the non-interference of cooperation in the company's own independence and avoiding unnecessary expenditure.

A comparison between the two countries in terms of the cooperation types subject to analysis is set out in Fig. 5.1.

4.2 Variables Influencing Cooperation Type Differences Between the Two Countries

The variables incorporated into the linear regression model applied to analyse just which variables influence the various cooperation types in effect at Portuguese and Spanish companies are presented in Table 5.2.

The results obtained from the multiple linear regression model for means of cooperation (Table 5.3) set out the difference between the two countries.

The level of importance attributed by Portuguese companies to cooperation with suppliers is significantly associated with the importance attributed to the supplier factor ($B = 0.64, p < 0.05$). The greater the importance attributed to suppliers, the higher the value attributed to this cooperation typology. In turn, the level of

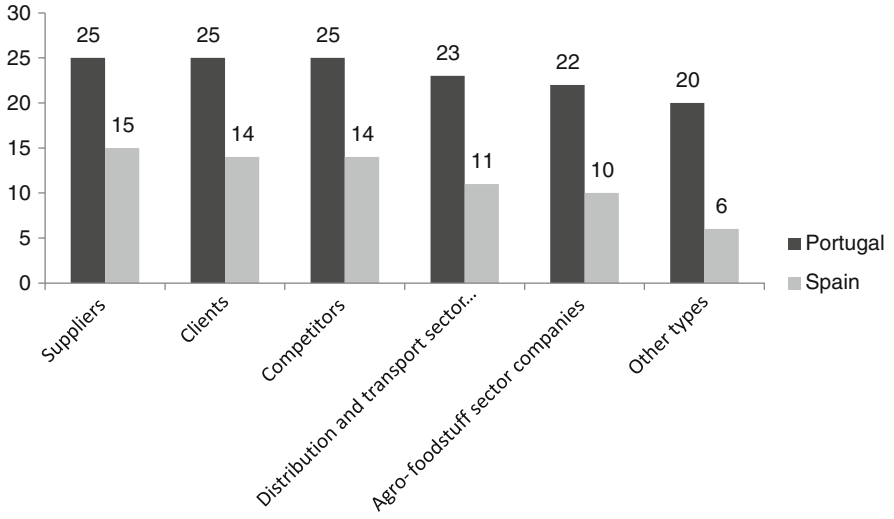

Fig. 5.1 Comparison between cooperation types in Portugal and Spain

importance of cooperating with suppliers by Spanish companies is significantly associated with the importance attributed to qualified human resources ($B = 0.77$, $p < 0.05$) and state support for economic and technological development ($B = -0.73$, $p < 0.05$). Furthermore, the greater the importance attributed to human resources, the greater the importance attributed to cooperation with suppliers with the contrary proving the case regarding state support with the latter potentially viewed as some kind of obstacle to this cooperation type.

As regards the level of importance attributed to cooperating with clients by Portuguese companies, this is statistically significantly associated with the importance attributed to suppliers ($B = 0.77$, $p < 0.01$) and consultants ($B = -0.48$, $p < 0.05$). The greater the importance attributed to suppliers, the greater the level of importance attributed to this cooperation type. In the case of consultants, the inverse holds and thus potentially viewed as an obstacle to this cooperation type. In the case of the Spanish companies, the level of importance paid to cooperating with clients did not attain statistical relevance across any variable.

As regards cooperation with the competition, no variable attained statistical significance in terms of the level of importance attributed by Portuguese companies while at Spanish companies the level of importance awarded to cooperating with competitors is statistically significantly associated with the importance endowed to the risk capital factor ($B = 0.49$, $p < 0.01$). The greater the level of importance attributed to this factor, the greater the importance awarded to cooperating with competitors.

The level of importance attributed to cooperation with distribution and transport sector companies in the case of Spanish companies is significantly associated with company age ($B = 1.39, p < 0.05$) and with the importance paid to the risk capital

Table 5.2 Model variables

Model	Means of measurement
Dependent variable:	Intensity of company participation in different cooperation agreements
Cooperation types	
Suppliers	Likert's scale:
Clients	1 = "not at all important" to 5 = "very important"
Competitors	
Distribution and transport sector companies	
Agro-foodstuff sector companies	
Factors of cooperation	Level of importance of different company cooperation factors
State support for development	
Consultants	Likert's scale:
R&D	1 = "not at all important" to 5 = "very important"
Suppliers	
Local qualified labour	
Clients	
The company engages in productive activities	
Qualified human resources	
Cooperation configuration	Cooperation configuration type
Improvement to business processes	Likert's scale:
Exports	1 = "not at all important" to 5 = "very important"
Distribution agreements	
Outsourcing	
R&D agreements	
Company characteristics	
Company age	1: <5 years; 2: [2–15]; 3: [16–35]; 4: [36–70]
Number of employees	1: <10 employees 2: [10–49] 3: [50–249]

factor ($B = -0.45$, $p < 0.05$). Companies with track records of less than 15 years attribute significantly greater importance to cooperation with these firms and the greater the importance attributed to risk capital, the lesser the risk attributed to cooperation with this factor deemed an obstacle to this cooperation type. In the case of Portuguese companies, the importance of cooperating with firms in this sector of activity gained no statistically significant relevance whatsoever.

Finally, the level of importance awarded by Spanish companies to cooperating with agro-foodstuff sector companies is significantly associated with company age ($B = -1.22$, $p < 0.1$) and with the importance attributed to qualified regional human resources ($B = 0.38$, $p < 0.1$). Companies with less than 15 years of business experience attribute significantly less importance to cooperating with agro-foodstuff sector companies and the greater the importance attributed to qualified human resources then the greater the importance attributed to cooperation. For Portuguese companies, the level of importance of cooperating with agro-foodstuff sector companies holds no statistical significance for any variable.

Table 5.3 Multiple linear regression model for means of cooperation

Dependent	Country		*B*	Std. error	Beta	*T*	*p*	R^2
Suppliers	PT	(Constant)	1.01	0.84		1.20	0.253	0.382
		Suppliers	0.64	0.24	0.62	2.73	0.018**	
	SP	(Constant)	4.06	1.27		3.20	0.008***	0.506
		Qualified H. resources	0.56	0.20	0.61	2.82	0.017**	
		State support for economic and technological development	−0.73	0.31	−0.51	−2.37	0.037**	
Clients	PT	(Constant)	2.56	0.72		3.57	0.004***	0.618
		Suppliers	0.77	0.18	0.96	4.22	0.001***	
		Consultants	−0.48	0.20	−0.55	−2.41	0.034**	
Competitors	SP	(Constant)	4.12	0.75		5.51	0.000***	0.328
		Risk capital	−0.49	0.20	−0.57	−2.42	0.032**	
Distribution and transport sector	SP	(Constant)	4.17	0.63		6.63	0.000***	0.541
		Company age ≤15 years	1.39	0.53	0.54	2.64	0.023**	
		Risk capital	−0.45	0.17	−0.54	−2.61	0.024**	
Agro-foodstuff sector	SP	(Constant)	2.61	0.63		4.13	0.002**	0.510
		Qualified human resources	0.38	0.18	0.48	2.20	0.050**	
		Company age ≤15 years	−1.22	0.62	−0.43	−1.97	0.074*	

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

4.3 Cooperation Type's Influence on Financial Performance

In order to analyse the influence of the various cooperation types on financial performance, ordinal regression models were generated for each country taking financial performance as the dependent variable and the cooperation agreement types as independent variables (Table 5.4).

In Portuguese firms, we find there is no statistically valid association ($p > 0.10$) between the intensity of the different cooperation levels and sales volumes while the level of intensity attributed by Spanish firms to cooperating with clients does statistically correlate with business turnover ($B = 0.97$, $p < 0.1$). Hence, the importance attributed by these Spanish companies to cooperating with clients is statistically associated with a greater probability of recording higher sales levels.

We should therefore highlight that despite cooperation with clients not relating to any specific factor, this type of cooperation does imply better financial performance.

Table 5.4 Ordinal regression—turnover and level of cooperation-type intensity

		B	Std. error	Wald	*p*	R^2
Portugal	Suppliers	0.20	0.33	0.36	0.551	0.095
	Clients	−0.24	0.36	0.44	0.508	
	Competitors	0.07	0.27	0.07	0.798	
	Distribution and transport sector companies	−0.21	0.34	0.40	0.527	
	Agro-foodstuff sector companies	0.15	0.32	0.23	0.633	
Spain	Suppliers	0.35	0.30	1.40	0.237	0.427
	Clients	0.97	0.58	2.75	0.097	
	Competitors	0.17	0.33	0.27	0.602	
	Distribution and transport sector companies	−0.46	0.46	1.00	0.318	
	Agro-foodstuff sector companies	−0.13	0.10	1.52	0.218	

5 Conclusion

The rising competitive pressures on companies encourage their managers to seek out opportunities and encounter means of improving their own competitiveness and future viability. In particular, companies located in border regions, by definition generally peripheral to their respective national contexts, are very often at a disadvantage when compared with their competitors in metropolitan locations. In these circumstances, cooperation between companies from different countries may represent an important strategic option in order to counterbalance the effects of distant location and thereby strengthen the local economy, stimulate innovation and positively contribute to enhancing the performances turned in by participant companies.

The research undertaken within the scope of this chapter involved border region-located companies in Portugal's *Centro* region and Spain's *Castilla y León* region and belonged to the distribution and transport and agro-foodstuffs industrial sectors. The research objective involved analysis of the involvement level of different companies in different types of cooperation agreement and ascertains the influence of such partnership-style agreements on company's financial performance. In particular, clear differences were identified between the behaviours of Portuguese and Spanish companies.

The empirical results also reveal that companies participate through various different configurations of cooperative activities. In descriptive terms, we demonstrate that companies not only cooperate within their respective region but also with companies from other regions and in both countries. Considering the cooperation types in themselves, there are no statistically significant differences between Portuguese companies and Spanish companies, although the latter do return higher average participation results.

As regards the advantages to cooperation, Portuguese firms return statistically higher confirmation of a relationship between boosting turnover and improving competitiveness.

Taking into account the cooperation types and volume of sales registered by companies, the data does not return any statistically significant association at Portuguese companies while in the case of Spanish firms, these do statistically affirm that cooperative relationships with clients are susceptible to generating higher financial performance.

The results of this research project therefore seem to indicate that companies in the regions under study perceive cooperation as a valid instrument for boosting their level of competitiveness.

However, the variations verified between companies from each country may also be interpreted as a sign of how cooperation is stimulated or restricted by the different prevailing levels of development. Thus, cooperation depends on the level of specialisation, the scale of markets and the level of openness of the respective different participant actors.

The results of this study bear implications for managers, consultants and political decision makers at any entity engaged in organising, supporting or fostering the terms and conditions appropriate to cooperation among border region companies. While the influence of cooperation practices on company's financial performance is not a generalised current practice among such companies in border regions, our results clearly point to cooperation agreements positively impacting on company's financial performance and as such should be intensified.

Furthermore, managers and entrepreneurs need to be aware that cooperation types should be defined in accordance with the desired objective and whether designed to generate new products for the marketplace or the development of new products and processes for the company. Political decision makers might therefore opt to strengthen such policies and establish incentives for companies to engage in cooperative partnerships with clients, suppliers, competitors, universities and research institutions and thereby foster higher overall levels of innovation and competitiveness.

This empirical study, nevertheless, does display a series of limitations. Firstly, the analysis focuses on a single point in time and the sample does not contain a large number of companies. Consequently, the possible effects of any time lag between establishing cooperation agreements and raising financial performance are not incorporated into the scope of this research. Establishing a database covering a wider timescale or, for example, undertaking a longitudinally based study represents potential areas for future development and analysis. The second limitation of this study derives from the questionnaire being structured around the declarations of individual managers on their ongoing cooperation activities. Thus, some questions may have proven slightly subjective and depend on the knowledge of the respondent as well as his/her direct or indirect involvement in cooperation activities.

Competition represents another highly interesting area for new research as that carried out thus far has provided contrasting results on its effects. Understanding the influence of competition on a company's actual capacity to cooperate would be of relevance to political decision makers given this would endow them with a substantiated vision on not only the feasibility of expanding this policy and the best means of implementation as well as what results might reasonably be expected. Finally, the study is strictly restricted to three sectors of activity and does not consider the influence of cooperation on the full extent of industry across the two countries subject to analysis.

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Part II
Entrepreneurial Activities, Innovation and Regional Networks

Chapter 6
Transition Regions: Green Innovation and Economic Development

Philip Cooke

1 Introduction

This chapter has three main aims. The first of these is to discuss and critique the main spatial and non-spatial theories that address methods by which societies may transition from a hydrocarbon to a post-hydrocarbon technological regime. It is argued that the first approach, which combines urban regime theory of politics with ecological modernisation theory, is ultimately contradictory and rooted in an inadequate "sustainability" discourse. The second approach is more interesting, not least because it adopts an evolutionary rather than a conflict perspective, it visualises the problem as "climate change" rather than "sustainability" and it conceptualises change beyond the level of mere technological regimes of a Schumpeterian kind. It allows the strategist to progress from the potential of building a "green" market *niche* that includes the urban governance stimulus but is not limited by it. Then it facilitates thinking about how such niches may coalesce to form an intervening "green" technological *paradigm* Schumpeter-style. Finally, it opens out a co-evolutionary process by which all social, political and economic sub-systems become synchronised long term into a post-hydrocarbon socio-technical *landscape* of a kind that would mitigate anthropogenic global warming. Its weakness is a lack of spatial sensibility regarding how this process would work, an underdeveloped notion of the role of governance in niche, regime and landscape co-evolution, and an inadequate appreciation of how innovation operates in facilitating these processes. To overcome this we propose the theoretical and practical concept of *Transition Regions*.

Second, this chapter seeks to demonstrate how a more theoretically informed framework based in regional innovation systems thinking, allied to evolutionary

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economic geography and development analysis, produces a superior transition model. This is particularly in reference to its basic idea of economic development caused by interactions between elements in regional economies displaying *related variety*. Finally, it is shown how his concept has the following powerful theoretical implications. First, applying the notion of related variety has led to new insights in the externalities literature. Second, it has provided additional insights to the question whether or not extra-regional linkages matter for regional growth. Third, relatedness is now also investigated in network analysis. Fourth, the notion of relatedness enriches the literature on labour mobility, which is often regarded as one of the key mechanisms through which knowledge diffuses. Fifth, relatedness may also show its relevance through entrepreneurship dynamics. Experienced entrepreneurs (those that have acquired knowledge in related industries), as opposed to spinoff companies, may play a crucial role in the regional diversification process. Each aspect of this advocacy of the use of an evolutionary conceptual framework is examined below in discussion of the form and content of theoretically and actually existing *Transition Regions*.

2 Theoretical Perspectives

Fundamentally, there is a strictly limited literature on economic geography or regional innovation from a "green" perspective (Bridge 2007). However, three sub-fields that engage with sustainability issues tangential to green innovation exist. Two of these begin from a clearly aspatial embarkation point, while the other takes its position from an urban viewpoint and seeks to *spatialise* the first of these aspatial approaches, namely "ecological modernisation" theory. The second aspatial approach is known as "co-evolutionary transition theory" which has some strengths, among which is an evolutionary perspective and an overt compatibility with neo-Schumpeterian innovation systems thinking, but many weaknesses that are moderated by fuller engagement with regional and national innovation systems theory. The three approaches involve, respectively, urban regime theory, ecological modernisation theory and a co-evolutionary socio-technical transition framework. Because economic geographers attempt a synthesis between the first two, we shall here conflate them as and discuss two broad themes: the "urban ecological modernisation regime" and co-evolutionary transitions approaches. The former is a complex and ultimately contradictory synthesis of regulationist school (see Footnote 1) political economy, which has an established application in the urban geography literature, itself influenced by neo-elitist urban governance research, which takes the form urban regime theory (e.g. Broomhill 2001). The second is initially a more self-contained perspective, which nevertheless takes its inspiration from evolutionary social theorising to which its adherents give the designation "system innovation". The tradition is therefore related to but distinct from neo-Schumpeterian innovation systems thinking. The former concerns the co-evolution of social, political, economic and scientific systems on a grand and lengthy scale while the latter is more narrowly focused around national, regional or technological

modes of transforming laboratory knowledge into commercial product, process or organisational novelty in use—on the market. While the former claims (Geels 2006) to be compatible with NIS/TIS perspectives, this is not entirely accepted by critics such as Hekkert et al. (2007) and Hillman et al. (2008) who take a more embedded national (NIS) and technological (TIS) innovation systems approach in their research.

2.1 *Urban Regime and Ecological Modernisation Theory*

Governance and regulation are pronounced in both elements of this perspective. Regarding the former, as the study of urban politics evolved towards a popular focus upon urban *governance* in the 1990s (Stoker 1999), it engaged with older regime theory, particularly urban regime theory (Stone 1989, 1993; Stoker and Mossberger 1994). A research group addressing UK urban sustainability governance deploys regulationist[1] class analysis and urban regime theory (Gibbs et al. 2002; While et al. 2004). They conclude that a presumed contradiction between a pro-growth and a pro-green urban governance agenda may be illusory. Their focus is on the implications of environmental challenges for the composition and strategies of urban regimes. Their position and findings are as follows. Arguing against a fundamentalist perspective that saw economic globalisation facing urban governance with mounting pressure on protected open space, regulatory dumping, increased levels of consumption, negative environmental externalities and increased material flows into and through the built environment, often at the expense of poorer residents and communities, they have sought to uncover evidence that environmentalism is not simply a matter of the demands placed on local state regulation by national government, business or pressures from upper and middle-class residents. Moreover, they suggest the apparent contradiction between

[1] Regulation theory analyses capitalist economic development in terms of a relationship between two key sub-systems. The first is the "regime of (capital) accumulation" and the second is the "mode of (capitalist) regulation". It is also a theory of transition, albeit Marxist in inspiration, which was utilised particularly penetratively in analysing the 1980s transition in the predominant way of organising factory production. This had been based on Fordist mass production means, involving repetitive work and a strict division of labour producing standardised goods for mass consumption markets under a Keynesian welfare state mode of state regulation. A transition period denoted neo-Fordism with intense automation was a prelude to post-Fordism, which was a transition to a more flexibly specialised, even customised mode of production, with outsourcing to supply chains under a neoliberal or so-called "Schumpeterian workfare state" mode of regulation. It captured the way in which the Reagan–Thatcher "small state" ideologies synchronised with western capitalism's crisis of productivity and competitiveness arising from Asian rivals, notably the Japanese "lean production" model in an ideological context focused on ending the Cold War by the "creative destruction" of the Soviet bloc. Interestingly, lack of innovation was seen by many observers as a key factor in the demise of the Soviet model (Lipietz 1987; Halliday 1990; Cooke 1990; Amin 1994; Jessop 1995; Peck 2000).

a pro-growth and a pro-green urban governance agenda may be illusory. Their focus is on the implications of environmental challenges for the composition and strategies of urban regimes. A sustainability perspective can provide a range of theoretical and empirical insights into urban entrepreneurialism, the changing context for urban politics and, to some extent, the social contradictions of urban environmental regulation under a regime of "ecological modernisation".

Ecological modernisation is a by now rather dated perspective, well critiqued by Desfor and Keil (2007). A key proponent of the conjoining of economic geography and ecological modernisation is Gibbs (2006). His commendable starting point is to assist economic geography to be more "real world" problem-focused and policy relevant. He holds that ". . . . . .ecological modernization, at least in its stronger formulations, can offer a substantive political challenge to neoliberal ideologies" (Gibbs 2006, p. 195). The relevant stiffening is applied by reference to Gibbs' group's adherence to regulation theory, as noted above. This seems questionable given that the basic idea is that a "technological fix" can be found to the ecological degradation inflicted by modern capitalism. This is at the heart of ecological modernisation and along with it goes an optimistic outlook on the achievability of that aim (e.g. Mol 1999). But its optimism has been belied by neoliberal consumption politics and financial services "innovations" such as consolidated debt obligations (CDOs). These, as is by now becoming clearer by the day, influenced the accumulation of enormous sub-prime mortgage and car loan debt that caused the freezing of global inter-bank lending and associated bankruptcies in 2007–2008.

A final issue, notably a flawed element in one of the few spatial articles to advance a system of innovation perspective on a "green paradigm" for economic geography (Hayter and Le Heron 2002), is that the massive and overarching problems associated with climate change and "peak oil" demand, as has been suggested, rather more than the "technological paradigm" perspective associated with that literature. That is, the present ecological crisis requires that the hydrocarbon "paradigm" or "regime" that has underpinned industrial capitalism from the outset, itself, needs transcending in a transition to post-hydrocarbon "landscape" (see below; Kemp 2002; Smith et al. 2005). Accordingly, the ecological modernisation perspective tends nowadays regularly and justifiably to be critiqued for its "reformism", failure to step outside the dominant western, neoliberal consumptionist paradigm and essential philosophy of "cleaning up after capitalism" as a means to approaching broad sustainability goals (Desfor and Keil 2007).

These contradictions make it difficult to square the regulationist critique of capitalism's evolving regimes of accumulation and modes of regulation, with its implicitly revolutionary objective of overthrowing the whole mode of production, with an attempt to utilise a far more reformist urban "ecological modernisation regime" to achieve it. That is not to dismiss either the role of cities as "policy lighthouses" contributing to the envisioning of a future "green paradigm" on a wider scale or the efforts of economic geographers to formulate a synthetic theory to illuminate progressive practices. The next stage of theoretical development of value to the achievement of such an objective, a spatialised co-evolutionary transitions model, ignores regulationism while seeking to transcend the conceptual

limitations of ecological modernisation. This approach removes the key contradiction in urban ecological modernisation in developing an approach to theorising transition to a post-hydrocarbon paradigm that rejects also the view that a sustainability perspective is also complementary. This is because "sustainability", in the sense of husbanding resources for future generations, has no explicitly or implicitly inherent critique of the fossil fuel origins of climate change. Rather "sustainability" advocates "economising on their use so they are available for succeeding generations to, in effect, continue degrading the earth's atmosphere". Hence, to the extent it can provide, as it claims, a range of theoretical and empirical insights into urban entrepreneurship, the changing context for urban politics and, to some extent, the social contradictions of urban environmental regulation under a regime of "ecological modernisation" (While et al. 2004) its real contribution is mainly descriptive. Thus many of the empirical findings of this work are interesting but have relatively little theoretical purchase even on an urban regime approach, largely because the use of the regulationist-regime metaphor still over-narrows the research perspective to a classic and irremediable social conflict causality.

Nevertheless sensitivity to city and county governance is an advance contributed by the urban regime approach comparing favourably to the overtly aspatial ecological modernisation model and the co-evolutionary transitions approach to be discussed. It will be argued, as noted, that the latter lacks any serious *governance* analysis with no municipal, regional or national/federal or, as appropriate, supranational perspective in its theory of change. It is demonstrated in the subsequent empirical sections below that the most recent "green innovation" and "green governance" approaches, especially when combined, offer superior insight into how transitions occur. Hence, a "co-evolutionary innovation systems transition" model transcends the naïve way in which current transition models rely on a notion of "markets". These are, rather uncritically, expected to bring forth green technologies through "strategic niche management" presumably by, in the main, firms. Just as the "ecological modernisation" model betrayed a rather touching optimism about that, the transitions approach offers little clear guide, except an undefined process of "experimentation" as to how that happens. Nevertheless two redeeming features of the co-evolutionary transitions model are that it has demonstrably evolutionary tendencies and that it makes claims to be compatible with a system of innovation approach. Usefully, in the context of the necessary macro-level conceptualisation of a post-hydrocarbon landscape, it also transcends current "innovation systems" thinking by reaching beyond "technological paradigms". Hence, preferable for this approach to a narrow urban regimes perspective is an approach in which, for example, innovative "clean technology" interests or social movements or networks including those of a "counter-cultural" nature may be observed to have impacted upon, for example, raising "green consciousness" such as green politics, "green growth", organic farming and catering, green urbanism, climate change and/or "peak oil" analysis (Wolch 2007; Guthman 2004; Manning 2004; Kunstler 2005; Strahan 2007; Kahn 2007). This as we have seen is because such a perspective moves beyond the obvious limitations of established "sustainable development" and "ecological modernisation" perspectives. It prioritises

anthropogenic climate change through atmospheric emissions and post-fossil fuel issues in the context of the planetary need to mitigate emissions through transition to a post-hydrocarbon economy and society. This improves upon a structural weakness of the more traditional *sustainability* discourse where, as noted, it is possible to construct an argument for sustainable utilisation of, for example, hydrocarbons so they are available for future generations to use, whereas this is not possible from a climate change perspective. This is clearly because their exploitation is seen as the cause of the potential destruction of the earth's atmosphere. This chimes with the predominance of a theoretical and practical *climate change* discourse, increasingly animating social scientific and political interests, while nevertheless not totally rejecting but rather encompassing many traditional sustainable development concerns.

2.2 Co-evolutionary Transition Theory

This approach, focused upon "system innovation" as distinct from "innovation systems", moves us forward by injecting rigour into the manner in which "development" has to be reinvented (e.g. eventual removal of greenhouse gas emissions from production and consumption; see Tukker et al. 2008). As noted, much of the newer social scientific discourse on environmental issues is governed by a climate change perspective and one that moreover questions the adequacy of long-term technological change concepts and analytical instruments as never before (see Geels 2004, 2006; Smith 2006). At issue here is the question of which social scientific theoretical perspective is best at capturing the long-term implications of a global response to climate change? Smith and Geels as well as Tukker and colleagues (see also Weber and Hemmelskamp 2005) hint at the need for a broader conception of the implications of policy intended to mitigate increases in global warming. That is, the established discourse of technological regimes (Dosi 1982; Freeman and Perez 1988) that explains economic change in terms of disequilibria forced by the evolving replacement of one technological regime by another, in a Schumpeterian (1975) process of "creative destruction", seems to work well in relation to "long waves" of development (Manning 2004). However, the technological *regime* literature from innovation studies has not received the level of scrutiny and critique seen, for example, in the international relations regime perspective. One clear cavil already noted is that all Schumpeterian regimes depended upon hydrocarbon energy. Stabilisation and subsequent reduction of hydrocarbon emissions requires innovative, clean technologies across the board.

The *co-evolutionary* perspective tentatively tackles the meta-system implications of policies to reduce utilisation of hydrocarbons. This introduces novelty in the selected field of governance of climate change issues by associating them with the co-evolutionary idea of "strategic niche management". It presents a dynamic multi-level perspective on *system innovation*, here "system" involving the co-evolution

of social, economic, political, scientific and technological sub-systems beyond that of the specific technological regime (Smith et al. 2005). Co-evolutionary thinking of this kind identifies three conceptual levels: niches; regimes; and landscapes (Rip and Kemp 1998). These contribute to a technological regime change that may be envisaged as "sustainable" and conceivably evolving into a new socio-technical, production–consumption "landscape" denoted here as "post-hydrocarbon". Our focus on the niche level is also because this is where innovations, which may influence regimes and ultimately co-evolutionary socio-technical "landscapes", begin. However, and from a critical perspective, the "niche" approach focuses only on how innovations are adopted in markets, a process involving uncertainty, experimentation, market probing and learning. It pays little or no attention to governance, as we have seen (Voss et al. 2006). In existing research, known cases of, for example, introduction of widespread renewable energy (Taylor 2008) or combined food, energy and recycling-related climate change strategies are utilised to explain how "niche" innovation is mediated by governance, including local, entailing early uptake in some settings (Jensen and Tollin 2004). Second, the transitions approach appears little interested in the extent to which ground up and top-down processes influence the possible emergence of regional or national technological regimes. Hence the novelty of innovation systems research in this context is that it investigates the roles of governance (government plus NGOs) and markets (enterprises and technological innovation) as drivers of "strategic niche management", whereas, as Voss et al. (2006) noted, hitherto these have been disconnected conceptually and empirically. Clearly, apart from the absence of a governance dimension, problems with this leading approach to understanding transition are its conceptual thinness, linear logic, equilibrium-mindedness and lack of spatiality. A fuller, interactive, partial or non-equilibrium transition governance model is accordingly required for reasons argued below.

Since the transitions perspective currently has no economic geography, evolutionary or otherwise, it cannot move forward satisfactorily until it does. As it has no concept space but it does embrace the concept of "innovation system", it is faced with a contradiction since much of the latter research focuses on spatial levels such as "national" and "regional" including notions of innovation leaders and laggards. Even the less overtly spatial "technological" and "sectoral" branches nevertheless focus on whether the, mainly, national level is eroding in the face of globalisation. A spatially informed co-evolutionary transitions model would insist on recognition that new "green" niches, regimes and ultimately the socio-technical landscape arise from an inherently asymmetric process of regional economic development. Accordingly, co-evolutionary transition authors fail to recognise why certain concatenations of institutional, entrepreneurial and innovative interactions occur where they do and for what reasons. This is far more than simply reading off the environmental implications of "economic geography" as Bridge (2007) notes, but this in turn means that for comprehensibility the notion of "environment" must be narrowed down from the multi-faceted and wide-ranging meaning implied in Bridge's critique of eco-environmental geography to suit the perspective denoted in the discussion so far. This does not propose to offer an overview of the spectrum

of environmental interests and objects that constitute geography; rather, it is interested in the ways in which consciousness and action, whether in relation to consumption of innovation meant to mitigate hydrocarbon emissions or its production, have a distinct economic geography and from the innovation perspective a pioneering practice in some regions and an absence of recognition of its importance in others. More will be said about this in the empirical subsections that follow. But for now, the three following concepts may be previewed. The first is *path dependence*, one of evolutionary economic geography's master concepts and one in which conceptual progress has been made by economic geographers seeking to escape the "endogeneity problem"[2] inherent in the earlier innovation economics literature (Martin and Sunley 2006). For many decades, regional economic theory and policy coincided as resource-based or resource-exploiting regional economies evolved with relatively narrow regional specialisations. Whether in the nineteenth century industrial "basins" such as Germany's *Ruhrgebiet*, Britain's northeast England, central Scotland or south Wales, Spain's *Basque Country*, or *Pennsylvania* in the USA or the *industrial districts* for textiles, ceramics and footwear that Marshall (1918) and later Becattini (1979) wrote about in *laissez-faire* Britain or, later, contemporary Italy, it was seen as benign that the market produced relatively narrow regional industrial specialisation. To counter that, when competitiveness defects brought industrial decline, an opposite discourse of regional economic development through industry diversification into often unrelated new sectors took over. Nowadays, a new discourse of regional evolution through the exploitation of *related variety* has been emphasised and, where observed, found to be associated with reasonable regional economic success

[2] The *endogeneity problem* is common to social sciences and economics, particularly in econometrics where it, for the moment, casts doubt on much econometric analysis that utilises secondary data not designed to tackle precisely the focus of the research problem being tackled. For example, in innovation studies, it is too tedious to begin listing the innumerable published papers that profess to "explain" the distribution of, for example, "regional innovation systems" by conducting sophisticated technical analyses of regionalised research and development (R&D) or patent data, which a moment's thought will bring realisation that they are not measures of innovation in any significant way. Innovation is defined by the neo-Schumpeterian school as, in simple terms, "the commercialisation of new knowledge (or sometimes 'new combinations of knowledge')" (see, e.g. Edquist 1997). Thus, such indicators not only mis-measure their object of interest but they also reveal that places with concentrations of such research and patenting activity are indeed the "innovation" capitals. However, a moment's further reflection reveals that in most countries, most R&D is conducted in the capital city because a governments pay for a large share of it and historic path dependence analysis shows many such research institutes were set up by governments in the capital city for reasons to do with easy access to important research intelligence. Private businesses often followed suit for similar reasons of knowledge access or access to skilled labour pools. Hence *endogeneity* is built into the statistical patterns being "explained" even if only "the geography of research" were the object of interest. Accordingly, nothing of significant interest is explained at all, but especially nothing regarding innovation, by such metrics. The endogeneity problem in more historical economic accounts such as that of David (1985) is that they seem to offer little opportunity for new combinations or novelties by which evolution may occur. In other words that kind of path dependence has a "locked-in" endogeneity pathway. As will be shown, "green innovation" presents a particularly clear opposite to this viewpoint.

(Boschma and Wenting 2007; Klepper 2002; Cantwell and Iammarino 2003; Buenstorf and Klepper 2005). Finally, consistent with the other key concepts is *proximity*, which has greater reach than simply its geographical dimension, which can involve cognitive and relational dimensions as shown in Carrincazeaux et al.'s contribution to this *Handbook* (see also Boschma 2005) and which facilitates rapid knowledge transfer through *lateral* absorptive capacity among entrepreneurs and managers in related industries, assisted by *knowledge spillover* external economies of scope where *cognitive dissonance* among sub-sectoral actors is relatively low. In these respects we envisage the rise of regional economic "platforms" of related industry activity, which is particularly clearly exemplified in the observed cases of "green innovation". "Green innovation" is defined as:

> . . .diverse new and commercial products, technologies and processes which, through improvements in the clean energy supply chain from energy source through to point of consumption and recycling, result in reduction in greenhouse gases. (Cooke 2008)

In what follows, we report some hopefully interesting and somewhat curious facts that arise when the "tipping point" of awareness or consciousness reaches the "green turn". As noted, the perspective from which this turn is observed is informed by evolutionary economic geography concepts that prove especially appropriate given the geographically uneven incidence of observably accomplished production and consumption practices. These are involved in what can be demonstrated to be convergent technologies often arising in diverse regulatory, institutional and organisational contexts. Hence the key concepts of related variety, path dependence and proximity are both clarified and exemplify the complexities involved in ways that facilitate policy-oriented reflection.

3 Further Conceptual Contributions of a *Related Variety* Perspective

The insights available from evolutionary economic geography in relation to regional economic growth were outlined in the introduction to this paper; here they are further elaborated. First, applying the notion of related variety has led to new insights in the externalities literature. Empirical studies tend to show it is not so much regional specialisation or regional diversification (Jacobs 1969) regarding externalities that induce knowledge spillovers and enhance regional growth, but a regional economy that encompasses related activities in terms of competences (i.e. regions well endowed with related variety). Second, it has provided additional insights to the question whether or not extra-regional linkages matter for regional growth. Adopting a relatedness framework, empirical studies on trade patterns tend to show that it is not inflows of knowledge per se that matters for regional growth, but inflows of knowledge that are related (not similar) to the existing knowledge base of regions. Related flows concern new knowledge that can be understood and exploited and, thus, be transformed in regional growth.

Third, relatedness is now also investigated in network analysis. For instance, studies show that collaborative research projects tend to create more new knowledge when they consist of agents that bring in complementary competences. Fourth, the notion of relatedness enriches the literature on labour mobility, which is often regarded as one of the key mechanisms through which knowledge diffuses. Recent studies show that neither inflows nor outflows of labour are properly assessed if not also considering how these knowledge flows match the already existing knowledge base of firms and regions. Fifth, relatedness may also show its relevance through entrepreneurship dynamics. Experienced entrepreneurs (those that have acquired knowledge in related industries), as opposed to spinoff companies, may play a crucial role in the regional diversification process. More generally speaking, longitudinal studies show that long-term development of regions depends on their ability to diversify into new sectors while building on their current knowledge base. The following section aims to exemplify these and the neighbouring insights from evolutionary economic geography in recently researched "green regional development" case studies. They focus on California, Jutland and Wales, but ongoing research demonstrates that processes of "cluster mutation" occur in Israel, Cambridge (UK) and elsewhere in Scandinavia. This is due to entrepreneurial translation of path dependent but convergent knowledge derived in proximity (geographic and relational) to emergent market niches. It is the innovative application of their and their related network partnership knowledge that enhances and evolves the emergent "green cluster".

4 Transition Regions: Emergence of Green Regional Economic Development Platforms

The idea of a *Transition* Region, which is wholly new and for which no publication yet exists that explores its validity, requires some identification at least in conceptual terms. We shall see below how it is characterised by displaying certain key emergent or existing properties. It will be a sub-national administrative area, with some power to support industry, especially in regard to regional innovation. It will have a *platform* of related variety sectors and sub-sectors. It will likely possess clusters expressing this relatedness in the variety of industry and these will provide much if not all of the possibilities for convergence and divergence of innovative opportunities. Finally, though this is demanding of much further and deeper study, it will have demanding users, consumers or customers both individual and institutional that stimulate the formation of green market niches as proposed in co-evolutionary transition theory. The concept of industries coexisting in a regional "platform" as a basis for mobilising regional evolution connects directly to the related variety argument of the previous section. Neither over-diversified nor over-specialised, and with opportunities present for revealed relatedness in "new combinations" of innovation at interfaces between industries, the accomplished

regional economy works with agility and flexibility to meet increasingly user-driven demand. That is not to say that innovation does not continue to be an interactive process between user and producer, rather it recognises that innovation studies in the past, perhaps echoing aspects of the practice of innovative businesses, have been overly "productivist", that is, during the years of excess firms competed on the basis of disruptive innovation (Christensen 1997). Thus the greatest novelty was the prize that competitors in ICT, from personal computers (PCs) to software, DVD and *BluRay*, *iPod*, *iPhone* and *BlackBerry* have sought in their quest to dominate markets. That many of the "bells and whistles" installed by the higher priesthood of software and systems engineers were scarcely used by most consumers and not understood by many was of little consequence. Following the credit crunch and widespread condemnation of the excess it bred in financial and technological innovativeness, the green turn signifies a new privileging of listening to consumer demand for more usable, less over-engineered and more sustainable goods and services.

So innovation remains interactive, but the asymmetry between demand and supply is re-balanced. This means that regional policies will have to change their colours accordingly. In the decades when "supply-side economics" ruled the roost, the role of policy became that of subsidising instruments to aid producers. Enterprise zones were an early exemplar, followed by other kinds of tax-free trade zones, subsidised technology parks, incubators and the like. Often these deregulatory measures did little to promote robust regional development; often they simply offered low-rent havens to out-of-town retail warehouses or lay empty.

4.1 Green Epiphanies

John Doerr is America's leading venture capitalist (VC). He is head of Silicon Valley's top investor, *Kleiner*, *Perkins*, *Caufield and Byers*. In a lecture to a Californian "green technology" forum *TED.com* in 2007 he reported how at supper one evening his 15-year-old daughter berated him and the rest of the VC industry for their contribution to the destruction of the planet, and, by the way, what was he going to do to put things right? This seems, judging from the lecture, downloadable at *TED.com*, to have caused Doerr to experience the kind of epiphany more normally associated with religious conversion. He immediately starts networking among his community of high-tech investors and entrepreneurs. He gets some of the smartest brains he knows to lobby the California legislature on tougher emission controls. He takes his network to Brazil to see its successful bioethanol industry. He even goes to Wal-Mart, arch-discounter of consumption goods, to observe the implementation of its new green strategy. He discovers how petrol can be made from algae, subsequently leading the charge, in harness with Al Gore's green investment fund, *Generation Investment Management*, to back numerous such Californian biofuel start-ups. Yet as each scene of this narrative closes, he assesses the likely outcome of all these niche activities, declaring "I don't believe it's going

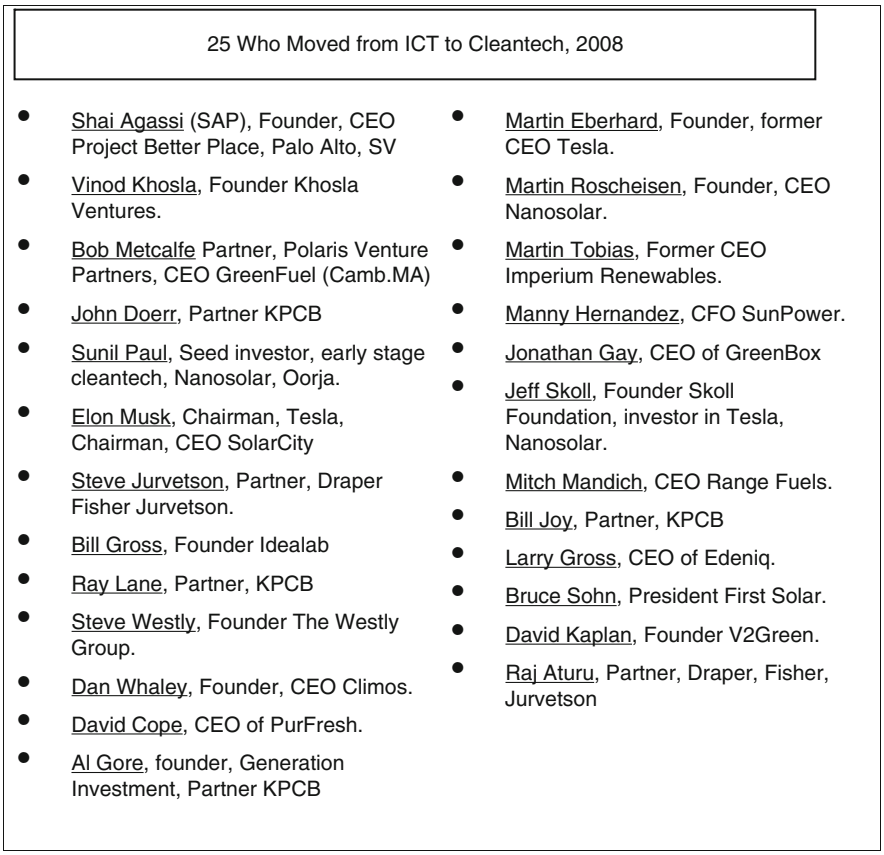

Fig. 6.1 Recent moves by California ICT Entrepreneurs into Clean Technologies. *Source*: earth2tech

to be enough" . . ..to save the planet, that is. Eventually, he breaks down on-screen at the thought that he has been complicit in irretrievably poisoning the earth's atmosphere, leaving the prospect of his daughter's generation having to survive in a world that only has that one source of oxygen. I have shown this performance to numerous audiences including hard-bitten environmentalists, and the consensus is that "he may be a venture capitalist, but he's a hell of a good actor". To which I now respond to the effect that whether he's acting having spotted a great market opportunity, or genuine in investing in a new "green moral economy", does it really matter? Doerr has visibly changed his practice and evidently interacted with many of his peer group, including persuasive Al Gore, to do the same, as Fig. 6.1 shows.

What is theoretically interesting and important about the data in Fig. 6.1 are the following: First, clean technologies of the kind these investors and entrepreneurs are keen to become involved in are convergent. Convergence here means that innovations in numerous apparently not too closely related industries may open

pathways to entrepreneurship in industries displaying what we may call "revealed related variety". We will see later how this operated in Wales, where revealed relatedness among organic food producers, biofuel producers and theme park tourism, not normally considered close business bedfellows, produced a successful developmental outcome. It is important to note that these entrepreneurs were initiating start-ups not being hired as "big names" in pre-existing firms. Second this relatedness works because of two important, subsidiary concepts. These are, first, "absorptive capacity" and, second, "knowledge spillovers". In regional economic development terms, absorptive capacity is lateral, whereas in industrial economics it is vertical. Lateral "absorptive capacity" means that entrepreneurs in adjoining and/or "revealed relatedness" industries can understand each others' business models and focus and apply tacit knowledge or even "routines" from the one business type or model to their own. In this way innovations might cross-fertilise and migrate from one industry to a related or revealed related one. The means by which such cross-fertilisations occur rely upon "knowledge spillovers"—external economies that spill over accidentally from firms located in geographical proximity that have the absorptive capacity to translate such tacit knowledge into explicit, codified, usable and repeatable knowledge in a new business context. Where a regional economy is over-diversified, as that of Wales became by the turn of the millennium, there are few knowledge spillovers and little absorptive capacity except of the generic kind that was promoting, for example, the virtues of outsourcing to "supply chains" in a context of "lean production". Such generic knowledge is by no means useless but nor does it offer specific opportunities for novelty since it is available to all competitor firms. Equally, where it is over-specialised, everyone is so familiar with the fundamentals that knowledge spillovers are ubiquitous but absorptive capacity absorbs less and less novelty accordingly. Michael Porter's example of the alloy golf club head cluster in Carlsbad, California, is an example of such an over-specialised, by now not especially innovative sub-sector dominated by *Callaway*, the firm that once conceived innovative opportunity from aerospace materials and skills to revolutionise the last bastion of wood in the drivers of that Royal and Ancient game (Porter 1998).

4.2 From Clusters to a Green Regional Innovation System

In the user-driven green economy subsidies are increasingly to be found being made to consumption rather than only to production. Probably the most celebrated case of the success of consumer subsidy as a successful policy regime is to be found in the history of Denmark's world-leading wind-turbine industry. From the beginning in the early 1970s, government subsidies were made available not to the producers but the users of first-generation wind turbines. This sustained the industry, initially based largely upon domestic demand, and enabled the north and mid-Jutland-based cluster to out-compete its main rivals in California. The user subsidy stimulated

experimentation, knowledge spillovers and niche market evolution in regionally "path-dependent" trajectories in both Jutland and California. But Ronald Reagan jettisoned his predecessor Governor Brown's subsidies while in Denmark they continued until a right-wing coalition entered government in 2000. By which time the Danish design had evolved considerably from its roots in agricultural and marine engineering where the plough and the ship's propeller were the inspiration. Meanwhile the Californian design atrophied around its inspiration, propeller driven aircraft. Already something of an anachronism, the two-blade, pointed upwind turbine design proved inferior to the three-blade, point it downwind Danish solution and for once Californian ingenuity was defeated. *Vestas*, Denmark's national champion, has 40 % of the world wind-turbine market and has been joined in its Aarhus–Aalborg cluster by the likes of Germany's *Siemens*, acquiring the other main Danish companies, S*uzlon* from India and *Gamesa* from Spain. Including home market production of turbines in Germany and Spain, these European producers, along with Denmark have 70 % of world turbine production capacity with employment of 133,000 and global demand far from saturated.

To continue with small-country, moderately peripheral Jutland a little longer, it is instructive to find that interspersed within the wind-turbine cluster is another with a comparable 1970s "alternative energy technology" genealogy. This is its solar thermal cluster consisting of some twenty firms of varying sizes and types, ranging from manufacturers of solar-powered water pumps for use in developing countries to consultants designing massive solar power stations and those that simply supply heating systems for communities, factories, offices and individual homes. One of these is *EnergiPlan*, whose founder Per Alex was one of a number interviewed by this author about the green energy "platform" in North Jutland. *EnergiPlan* designed as one of the first local solar power stations at Skorping, near Aalborg, a communal housing scheme of some thirty houses. It is a simple mirror collectors, pipes and covered swimming pool arrangement that supplies communal free heat and power for 9 months of the year. Thereafter the commune, which operates communal dining and laundry facilities, resorts to the local biomass District Heating station in the village, which commune members can access at a discount. Per Alex described how in 30 years these combinations of distinctive alternative energy technologies have helped evolve one of the first "green regional innovation systems" in the world.

The demanding customers for District Heating in Denmark are the municipalities, most of whom run local energy supply companies, and some 60 % of Denmark's citizens rely upon it. Municipalities seek a balanced supply and order customised mixes of biomass, biogas, wind, solar and marine energy depending on location and the type of solution required. Enormous export markets for District Heating have opened up in mature and emerging markets faced with climate change and "peak oil" constraints. Within North Jutland is a community of some 100–150 specialist renewable energy firms, many of which are innovative. He cited the case of *Logstor* a District Heating company in North Jutland that had innovated a pre-insulated dual pipe system that minimised heat loss by fitting the cold water input pipe inside the hot water pipe.

- 'Innovative Region: Flexible District Heating' Platform
- Biogas, Biomass, Solar Thermal, Wind - 'plug-ins'
- 'Social Network' >100 'system' & 'solution' firms
- Aalborg U, Municipalities, DTI, VåkstForum Fund (40 mn.DK bid).
- 'Aggregators' or 'system integrators' include:
- Arcon Solar (Velux VHK), Xergi, Logstor (Pipework), Baracon (Biogas), Grundfos
- Humvel, NIRAS, EnergiPlan (consultants)

Fig. 6.2 North Jutland's Green Regional Innovation System. *Source*: Centre for Advanced Studies

Together, the District Heating firms, municipalities, university laboratories and technology transfer agencies created an association entitled *Innovative Region: Flexible District Heating* with characteristics described in Fig. 6.2. It is important to note that there was no cluster or other industrial promotion policy behind this "green innovation" emergence.

This echoes the 2007 regionalisation of Denmark's administration into five, one of which is North Jutland. It warrants the regional innovation system designation precisely because it consists of a commercialisation sub-system and a knowledge generation sub-system. The former consists of networks of firms in supply chains focused around the District Heating engineering platform while belonging to distinctive renewable energy business segments. These are, nevertheless, capable of being system-integrated by lead "aggregator" firms such as solar thermal specialist *Arcon*, biogas contractor *Xergi*, green engineering firm *Grundfos* or consultants *NIRAS* into consortia for plant assembly. Supporting this sub-system is a knowledge and enterprise support sub-system consisting of public laboratories, regional development agency, municipalities and technical agencies such as the Danish Technological Institute. In 2008 the business office of Aalborg had taken responsibility for leading a €5 million platform bid to the Danish Growth Fund—*Väkstfonden* for "user-driven design and innovation" support (Ministry of Foreign Affairs of Denmark 2008).

Finally, it should be recalled that the regional platform described above has evolved from the earlier development of a number of clusters such as those focused on wind turbines, solar thermal and photovoltaics, pipework and green engineering. With the cross-fertilisation of innovative ideas such "Jacobian" clusters (after Jane Jacobs' stress on variety in economic innovation and growth; Jacobs 1969) offer, the rise of a green regional innovation system based on the convergent and related variety platform described can be expected, as in California. Both have strong aspects of "collective entrepreneurship" in the form of the venture capital and entrepreneur networks "mutating" from ICT to *GreenTech* in the former while in the latter there is a greater emphasis on communal associativeness among firms and

support organisations with a pronounced degree of "informal investment" by successful entrepreneurs in interesting start-up businesses.

The tenacity of entrepreneurial practice in North Jutland's "green" RIS is testified to by the activity of *Grundfos*, one of the "aggregators" mentioned above. The company is among the world's largest manufacturers of pumps, employing some 15,000 to produce 16 million pumps a year. In 1992 *Grundfos* embarked on an innovation initiative to improve the performance and energy efficiency of circulation pumps used in household heating and cooling systems. *Alpha Pro* is the result, an "intelligent pump" with sensors to assess current heating requirements; the performance of the pump is adapted according to the actual heat demand. By 1998, determined to commercialise this technological innovation, *Grundfos* embarked upon a political lobbying process to seek a ban on the least efficient circulation pumps on the market. Lobbying was conducted through *Europump*, the European Association of Pump Manufacturers in order to reach a wider regulatory audience. Through *Europump*, *Grundfos* raised their issue at the highest EU levels and simultaneously lobbied Danish politicians to raise it in their EU dealings. The EU Directorate General for Energy took interest and commissioned studies under the EU Specific Actions for Vigorous Energy Efficiency (*SAVE II Programme*). This resulted in a pump energy efficiency classification scheme based upon energy consumption in use, formulated as an energy efficiency index (EEI). When the classification scheme was launched in early 2005, *Grundfos*, as we have seen, had a product ready for market launch.

4.3 A Green Turn in Wales?

The preceding account demonstrates three key features of probably the world's two leading green regional platforms, with Jutland, if anything, the premier of the two due to its systemic aggregative capabilities at related variety business interfaces. First, California, with its benign green innovation support regime and climate, is less concerned with communal heating and more with substitutes for oil. In Sacramento, home to former Governor Schwarzenegger's California Fuel Cell Partnership, a network among numerous infrastructure suppliers and the major vehicle producers has burgeoned since 2005. Here exacting users like the State of California fuels its fleet of hydrogen fuel cell (HFC) vehicles at this Sacramento station or at nearby partnership member University of California, Davis. This is part of the governor's hydrogen highway initiative. It is indicative of the renewable automotive fuel emphasis that underpins much of the federal and regional subsidy regimes for renewables in the USA. However informed judgement suggests HFCs will not be the preferred alternative to hydrocarbons in this market. Second, although many US municipalities run fleets of cars and buses fuelled by hydrogen, indicating the role of city and county administrations as lead markets for niche renewable products and services, "plug-in" electric hybrid vehicles of the kind Shai Agassi (Fig. 6.1) builds through his *Better Place* company in Israel are a better bet. Silicon Valley start-up *Tesla* is also a leader in the electric car market (Fig. 6.1).

But, third, announcements in 2008 by *GM* regarding a hybrid *Volt* car, hitherto an HFC prototype, and *Ford* that its new low emission and higher mileage *EcoBoost* engine is to be built at Bridgend were in the balance, given the Bug Three's request for a $25 billion bailout from the US government t stave off bankruptcy.

In Wales, there has long been a close relationship with HFC technology since the technology, the predominant motive force in rocket engineering, was invented by Swansea scientist William Grove in 1857. Accordingly, Wales is identified as one of Europe's top 16 HFC regions in research by Nygaard (2008). Among achievements warranting that status are the prototype *Tribrid Bus* developed at the University Glamorgan, the *H2Wales* network based at Baglan Energy Park, Port Talbot, and the car-design work of *Connaught Engineering* and the *Naro* car company. But HFC is not the most prominent technology design in the Welsh renewable energy equipment spectrum. That accolade probably belongs currently with the production of energy from biomass. Here is a sphere in which Welsh research is at the global forefront, mainly through its grassland research institute IBERS (formerly the Institute of Grassland and Environmental Research—IGER) since 2008 part of the University of Wales, Aberystwyth. In 2004 I.E. opened a biofuel research and commercialisation division due to its evolving expertise in understanding improving the calorific content of feedstock plants by experimenting with ryegrass, short-rotation willow and *miscanthus* (Asian elephant grass). This connects to our earlier point regarding "revealed related variety" because this research institute manages to combine innovation at interfaces among organic food, biofuels and tourism promoting indigenous entrepreneurship in three industries on which Wales has been path dependent for centuries.

IGER conducts much industrial contract research and advisory activity. This interweaves with the three noted sectors in the following ways. First, IGER advised the tourist theme park business *Oakwood Leisure* in Pembrokeshire on a green tourism plan for a new leisure complex named *Bluestone* for the uniquely coloured stone quarried nearby of which many Neolithic monuments like Stonehenge are composed. The €130 million leisure park consists of 340 sustainably sourced wooden chalets and a Celtic village of 80 adjoining buildings part-located in the Pembrokeshire Coast National Park. Additional facilities include a Snowdome, Waterworld park, indoor tropical garden and sports centre. It houses 2,000 residents and receives 5,000 day visitors. *Bluestone* directly employs 600 catering and hospitality staff and indirectly supports 100 jobs with its suppliers. By offering a "green tourism" solution *Oakwood* finally achieved planning permission to go ahead with such a development, which included building on two fields that were inside the National Park boundary. The project was grant aided by the national park authority through its Sustainable Development Fund and by DEFRA's carbon-neutral crops scheme. University of Wales, Bangor's Centre for Alternative Land Use (CALU), was also consulted. IGER advised *Bluestone* on its renewable energy strategy, which consists of 3 MW of biomass burning combined heat and power (CHP) units. Initially IGER favoured *miscanthus* but opted finally for short-rotation willow wood chips as the main fuel source. These are grown by 50 farmers in a localised supply chain managed by an energy company called *Pembrokeshire Bioenergy*.

Completing the green symbolism of this tourism project is the *Bluestone* culinary strategy, which is to supply tourist food from a localised food network of mainly but not exclusively organic farms. Among its suppliers are successful food "aggregator" firms such as *Castell Howell Foods* based at nearby Cross Hands Food Park, a major west Wales centre for food processing and packaging. One of *Castell Howell's* affiliates is a meat supply firm called *Celtic Pride Ltd*. This firm specialises in premium Welsh-grown meat supply and is a joint venture between *Castell Howell Foods* and *Wynnstay Group plc*, Wales' largest quoted agricultural supplies company. A regional network of 85 farmers supplies Welsh beef to *Celtic Pride*. The IGER connection is important for its advice on an innovative, consistent feed quality system called *Celtic Pride Feed*. In cooperation with *Wynnstay* this resulted in an oil-based cattle feed, important since protein balance must be correct for the last 60 days before slaughter. Thus high vitamin E is known to give best colour and texture to meat and increases the shelf life. Matured for 21 days before consignment, the product is born, reared, finished, slaughtered and processed in Wales, warranting the European Union PGI (Protected Geographical Indication) brand, achieved by the joint venture in 2003.

Wales now has 15 biomass power stations, including two in the pipeline and three co-firing arrangements with large coal burning power stations. Among these is Europe's first commercial scale biomass power station in Port Talbot, where construction work started in July 2006. The £33 million station was scheduled to be fully operational by June 2008. Producing 13.8 MW of renewable energy the station will generate 104 GWh per year, sufficient to meet the needs of around 31,000 homes. The Cardiff-based renewable energy company *Eco2* designed and managed construction of the power station, for a project originally proposed by the *Western Log* group, which secured planning permission in 2004. The plant is fuelled with 16,000 tonnes per year of clean wood which has come from sustainable, managed forests and saw mills. With trees drawing carbon dioxide from the atmosphere as they grow, the carbon dioxide produced in combustion results in no net increase of the gas. By generating electricity in this way, some 47,000 tonnes of equivalent fossil fuel carbon dioxide emissions are avoided. This will help reduce the negative effects of global warming.

Eco2 is probably Wales' number one eco-innovator business and a global leader in tidal energy systems. Most of Cardiff-based *Eco2*'s contracts are with UK and increasingly European clients. Interviews conducted with David Williams, CEO of *Eco2*, reveal the company to have a business model said to be common in eco-business, whereby the firm calls on a group of ten or so investors to fund projects and take a return subject only to capital gains rather than corporation tax. This is realised when the project is sold or a project client makes final payment. This enables *Eco2* to be a tax-efficient, knowledge-based research, development and innovation vehicle. Among its clients is the *Sleaford Renewable Energy Plant* which received the go ahead for a straw-fired power station in late 2008. *Eco2*'s first such plant, generating 38 MW was built at Ely, Cambridgeshire for *Energy Power Resources Ltd*. The new one is the UK's largest straw-fired biomass burner and first in *Eco2*'s new £1 bn programme to develop up to ten biomass facilities

across Europe. It will create 80 jobs, bringing £6 m a year to local farmers in fuel supply contracts and £20 m for local construction firms. It will power the equivalent of 65,000 homes, one quarter of all houses in Lincolnshire. Having begun in the wind farm business, of which the firm owns a number with two awaiting planning permission, wind energy has now scaled up beyond *Eco2*'s capacity, hence the move into biomass. The company's most recent development is in tidal energy as it partners fellow Cardiff firm *Tidal Energy Limited* to develop DeltaStream—an innovative technology designed to generate electrical power from tidal stream resources. A 1 MW tidal energy turbine is currently being trialled in Milford Haven, Pembrokeshire in partnership with *Carbon Connections Ltd.* along with Cardiff and Cranfield Universities.

5 Conclusions

In this paper, three key aims were set and the text demonstrates that to a large extent they have been successfully accomplished. First it was considered important to discuss some weaknesses in the main theoretical approaches to understanding transitions in production–consumption paradigms. One of the main criticisms of the predominant perspective in co-evolutionary theory of transitions is that it lacks any spatial content. We discovered by empirical analysis that spatiality is crucial to an understanding of how transitions occur and we coined the term *Transition Regions* to capture these specificities. This applies also to cities and city-regions and the urban regime approach to this issue offers some insights into how this may happen at the urban governance level, though in truth it is not helpful in relation to innovation or the production side more generally and it is unhelpful in attempting to align urban regime and ecological modernisation approaches, which have contradictory explanatory aims.

The second aim was to demonstrate how these problems are overcome by the adoption of an evolutionary economic geography approach that is rooted in regional innovation systems and related variety concepts, both closely allied to the neighbouring concepts of path dependence and proximity (geographical and relational). Where these phenomena converge sectorally and geographically we found the notion of regional *platforms* useful because the concept captures the multi-cluster manner in which "cluster mutation" among related variety industries actually occurs in such settings. Evolutionary mutation occurs as entrepreneurs take knowledge from their own and their firm's path-dependent evolution in one sector and finds ways in combination with network partners from related but distinctive industry clusters to form a new or emergent cluster built from these knowledge convergences. Such skills in the labour market are thus crucial to such regional innovation and economic development. Finally, to test the theory, it was exposed to some detailed case analysis in different settings in different parts of the world where, nevertheless, "green innovation" could be seen to be flourishing. Remarkably, in different ways the insights of theory were almost completely vindicated and

it may be concluded that this effort has made a major contribution not only to understanding of "transition regions" in themselves but also the theory of evolutionary economic geography and development more broadly.

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Chapter 7
Clusters, Learning, and Regional Development: Theory and Cases

Roel Rutten and Dessy Irawati

The economy today is more globalized than ever before in the history of mankind. While the limits of electronic communication are continuously pushed beyond new horizons, globalization can only be expected to increase further (Friedman 2005). Paradoxically, perhaps, the economy is at the same time increasingly an economy of regions (Morgan 2004; Scott and Storper 2003). Obviously, there are stark contrasts between regions that have successfully linked up to the global economy and those that have not. Which begs the question why some regions perform better than others in the global economy? True to Porter's (1990) adage that not nations (or regions) compete but companies, and given the fact that successful companies are often embedded in strong regional clusters of companies (Dupuy and Torre 2006; Spencer et al. 2010), the question is more accurately rephrased as: why do some clusters perform better than others? The answer to this question must be sought along two related but distinct lines of inquiry. First of all the characteristics of clusters are important with regard to their success or failure in the global economy. Secondly, the characteristics of the region wherein a cluster is embedded must be considered. This chapter addresses both lines of inquiry based on the assumption that economic performance is fundamentally driven by innovation, learning, and knowledge creation. Therefore, the degree in which a cluster is successful in creating new knowledge and converting the outcomes of that process into innovations is of crucial importance for the understanding of the economic performance of that cluster. Similarly, the degree in which a region offers a favorable social and institutional environment for learning and innovation offers an important explanation for the economic performance of its companies.

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This chapter is structured as follows. The first section discusses recent theoretical considerations regarding clusters and their contribution to regional economic development. It does so against the background of the knowledge economy, where knowledge creation, learning, and innovation are of ever greater importance for economic development. This section discusses the conditions under which clusters may contribute to learning and innovation. The section pays specific attention to social capital. The second section discusses the regional dimension of clusters from a theoretical perspective. First it argues how the regional business environment is important for clusters. Secondly, it argues how spatial proximity between cluster partners may facilitate learning. Thirdly, it discusses norms and values in relation to learning. Certain values or more conducive for learning and regional development than others and the fact that norms and values differ from one region to another partially explains differences in regional development. The question is how these regional norms and values are enacted in clusters to facilitate, or compromise, learning. The third section discusses two examples of clusters: the Indonesian automotive cluster on West Java and the example of the Eindhoven region cluster scheme. These are in many respects very different clusters, but because of that they highlight different important aspects of clusters and their contribution to regional development. The final section sums up the conclusions on the role of regional clusters, or learning networks, with regard to regional economic development.

1 Clusters and Regional Development

Although various definitions of clusters feature in the literature, this chapter approximates Porter's (1990) original idea of clusters as networks of related companies that are geographically concentrated. Clusters may often be linked to various public and private institutions. A cluster provides a constructive and efficient opportunity for discussion among related companies, their suppliers, government, and other institutions (Breschi and Malerba 2005; Nooteboom 2006). Because of externalities, public and private investments to improve cluster circumstances benefit many firms. Close linkages with buyers, suppliers, and other institutions are essential, as they facilitate learning and knowledge creation through intended and unintended knowledge spillovers (Best 1990; Cooke and Morgan 1998; Spencer et al. 2010). Because they are geographically concentrated clusters have a considerable impact on a region's economy and vice versa (Asheim et al. 2006; Boschma 2004). Being part of a cluster may provide companies with important advantages, such as:

– Access to specialized inputs and employees. Clusters can provide superior or lower cost access to specialized inputs such as components, machinery, business services, and personnel compared to vertical integration, formal alliances, or importing inputs from distant locations (Boschma 2004; Porter 1998).

- Access to information. Proximity, supply, and technological linkages and the existence of repeated personal relationships and community ties fostering trust facilitate the information flow within a cluster (Dupuy and Torre 2006; Uzzi 1997).
- Complementarities. Clusters increase productivity not only through the acquisition and assembly of input but also through facilitating complementarities between the activities of cluster participants (Hoen 2002; Maskell et al. 2006).
- Access to institutions and public goods. Firms within a cluster can access specialized infrastructure, or advice, from experts in local institutions at very low cost (Asheim et al. 2006).
- Incentives and performance measurement. Clusters improve the incentives within companies' (1) competitive pressure, when the pride and desire to perform well in a local community motivates firms to compete with each other, and (2) clusters also make it easier to measure the performance of in-house activities because there are local firms that perform similar functions (Kitson et al. 2004).

Several of these advantages, such as economies of scale, can be traced back to Marshall's work on industrial districts (Oerlemans et al. 2007), while others are more clearly connected to knowledge and innovation, such as knowledge spillovers. The value of the concept of clusters for the present discussion is that it aims to make a connection between geographical concentration and innovation. This connection follows from colocation as a convenience for knowledge creation and innovation as well as from hard (e.g., availability of venture capital) and soft (e.g., social capital) regional institutions that support, or hamper, knowledge creation and innovation (Lorentzen 2008; Oinas 2000). On the other hand, important as geographical concentration may be, knowledge creation and innovation have an important trans-regional (international) dimension as well (Malecki 2010; Scott and Storper 2003). Successful regions are increasingly nodes in global knowledge networks combining regionally embedded, indigenous knowledge with global knowledge. Given their spatial concentration, clusters may thus be at the crossroads of local and global knowledge, feeling the effect of both regional characteristics as well as global competition.

As argued, a key soft institution is social capital, which may be defined as the relations between individuals and the social and economic benefits that result from them (Westlund and Adam 2010). Social capital performs two key functions, that of a glue and that of a lubricant. As glue, social capital binds people together in relations of mutual dependency. As a lubricant, it facilitates social interaction through shared norms and values (Rutten and Gelissen 2010). In general, social capital is argued to be a good thing; however, some forms of social capital can have highly detrimental effects on individuals and on economic development. Particularly close-knit and inward-looking networks are often considered to have negative social capital. On the other hand, there seems to be a clear relation between social capital and knowledge creation and innovation (Hauser et al. 2007; Rutten et al. 2010). That is because knowledge creation and learning is a matter of interaction

between human beings. And social capital allows more individuals to engage into more intense interaction. The benefit of social capital for learning is obvious, since learning is a matter of interaction between individuals. Social capital, thus, is one of the factors explaining innovation and economic performance. The structure of relations between the individuals can be used to identify two different types of social capital: bonding social capital and bridging social capital (Burt 2005; Coleman 1988; Field 2003). Bonding social capital refers to a situation where there are strong linkages between individuals. That is, (nearly) all of the individuals in a network share a direct relationship. Bonding social capital works in a way first described by Durkheim (1893/1997), who argued that: "It is impossible for man to . . . be in regular contact with one another without their acquiring some feel for the group . . . without their becoming attached to it . . ." (p. xliii). In other words, bonding social capital produces higher levels of trust and shared norms and values which, in turn, are helpful in learning and innovation. Innovation, which may be seen as the outcome of a process of learning and knowledge creation, is a risky and uncertain process, and it is competitively sensitive in that companies do not like to see the fruits of their innovation efforts leak away to competitors. Consequently, companies prefer to conduct innovation with trusted partners with whom they share strong and durable relations. A cluster with a high level of bonding social capital thus provides an environment where companies are likely to find a substantial number of trusted partners to engage with in innovation efforts; moreover, the innovation process itself—that is, the interaction—will be smoother because of the higher level of shared norms and values in the cluster. Put differently, clusters with a higher level of bonding social capital are more likely to conduct innovation, which may result in a better economic performance compared to clusters with lower levels of bonding social capital.

Higher levels of bridging social capital also have a positive effect on learning and innovation. Bridging social capital refers to a situation where a limited number of individuals in a cluster have strong relations to individuals in other clusters. In other words, these individuals act as bridges between two (or more) clusters, which are extremely relevant to transfer new knowledge and ideas into the cluster. Innovation, based on Schumpeter's definition, is a matter of making new combinations (Morgan 1997; Rutten 2003). In today's knowledge economy this specifically includes new combinations of knowledge, which means that a cluster must have linkages to other clusters in order to access knowledge and ideas not available inside the cluster. It is important that not too many individuals in the cluster have strong ties to other clusters as it may lead to knowledge overload. In sum, clusters that have both high levels of bonding and bridging social capital are the most conducive organizational environments for companies to engage in learning and innovation. Given this trans-regional dimension, social capital in clusters is increasingly a combination of regional social capital, for example, norms and values that are connect to their home region, and cluster social capital, that is, norms and values that have developed within the cluster.

2 The Spatial Dimension

As argued, talking about clusters begs the question to the importance of the spatial dimension. The answer to this question must be found along two lines. In the first place the role of the regional context must be considered, that is, the characteristics of the region in which the cluster is located. Secondly, it is important to consider the relevance of spatial proximity between network partners with regard to learning and innovation. The question regarding the relevance of the regional context is easily answered: It matters substantially (Best 1990; Morgan 2004). The regional business environment plays a crucial role in the economic performance of a regional cluster as some business environments are more conducive to firm competition and innovation than others. Four elements may be distinguished in the regional business environment (Scott and Storper 2003; Porter 1990; Teece 2000):

1. The provision of a physical and digital infrastructure and the tax and legal systems provide the bare basics for companies to operate in the twenty-first century capitalism.
2. The education levels of the regional workforce and the presence of public and private knowledge centers are of critical importance in today's knowledge economy.
3. High-quality demand of local customers (both companies and consumers) forces companies to innovate in order to meet that demand.
4. Rivalry among regional firms also encourages companies to be innovative in order to stay abreast of their competitors.

The economic geography literature offers ample evidence that clusters perform (much) better in regions with a favorable business environment than do clusters in regions with a less favorable business environment. In fact, much regional economic development policy is aimed at putting in place or improving the above characteristics (Asheim et al. 2006; Spencer et al. 2010). However, the effectiveness of such regional development policy crucially depends on the willingness of the local business community to take initiative for economic development. Effective policy has to be tailored to the needs of the local business community, which requires that it participates in policy making (Morgan 1997). Moreover, a local business environment that is sufficient but not great may actually be helpful to the development of companies. The so-called selective disadvantage may trigger companies to be innovative in order to overcome them. Similarly, a business environment that is very comfortable may actually make companies somewhat complacent (Porter 1990; Teece 2000). The key argument, thus, is that there is a relation between the level of sophistication of the local business environment, on the one hand, and the performance of regional clusters, on the other hand, but the ambition of the companies within a regional cluster to be innovative is the main driver of company performance and regional economic development (Nooteboom 2006).

Regarding the second issue, the relevance of spatial proximity with regard to learning and innovation, the answer is much more elusive. The debate on this issue falls within two equally problematic extremes. One extreme argues for the "geography of knowledge," which argues that tacit knowledge can only be effectively communicated in face-to-face interactions and that face-to-face interactions can only be efficient on the long term when partners are colocated. This argument has been refuted because, on the one hand, temporary proximity allows for effective face-to-face communication as well as permanent proximity (Grabher 2002). On the other hand, knowledge is no longer regarded as being tacit (or codified) but as context dependent (Amin and Cohendet 2000; Morgan 2004). To the extent that partners share this (social) context, they can communicate even highly complex knowledge via digital methods, while the transfer of this knowledge to individuals outside the (social) context, indeed, does require intensive face-to-face communication. The other extreme position concerns the argument of the "death of distance," which claims that digital means of communication are now so advanced that all knowledge can be exchanged between all people, regardless of their geographical location (Amin and Cohendet 2004). This argument, too, fails to appreciate the role of (social) context. For example, it is not difficult for a banker in Amsterdam to acquire knowledge from bankers in London because this knowledge is tacit. In fact, bankers anywhere in the world will have largely the same knowledge base. Nor is it difficult because Amsterdam and London are far apart; on the contrary. It is difficult because the banking communities in Amsterdam and London represent different social contexts with different practices, norms, and values. Being in the same place, therefore, facilitates knowledge exchange and learning because network partners share the same local (social) context and its accompanying norms and values. It allows for a richer exchange of knowledge and deeper learning (Morgan 2004).

In criticizing the two extreme positions it becomes clear that there is a role for spatial proximity between network partners with regard to knowledge creation and learning and that social context in the form of norms and values plays an important part in this role. However, it would be a mistake to see norms and values (social context) as characteristics of a region. Even though norms and values differ from one place to another they are characteristics of social and economic relations first of all. Norms and values are connected to places because the individuals in the relations are largely spatially sticky. Most human beings are connected to the places where they live, work, and have their friends and relatives, that is, to the place they call home. Consequently, social interaction (inclusive knowledge creation and learning) is also spatially sticky. However, human relations frequently cut across different spatial scales, which make it difficult to connect norms and values to places. Nonetheless, certain norms and values are more conducive to learning and innovation and others. Even though, as argued, norms and values are characteristics of relations rather than regions, given that relations are formed of spatially sticky individuals, certain norms and values may be more prominent in some regions than in others. In fact, research shows a relation between the presence of certain types of norms and values and

innovation and economic development of regions (Huntington and Harrison 2000; Inglehart and Baker 2000; Rutten and Gelissen 2010).

The effect of norms and values on regional economic development cannot be separated from more conventional variables to explain the regional economic development, such as innovation, human capital, and urbanization. Regional innovation has proved to be a solid indicator of regional economic development in a large number of studies. It underlines that today's economy is a knowledge economy and that economic development is fueled by learning and innovation (Morgan 1997). Regional human capital, often measured as the percentage of the regional workforce with higher education, is an obvious complement to the above argument as learning and innovation is predominantly carried out in occupations that require higher levels of education. In many studies, therefore, regional human capital shows a strong correlation with regional economic development. Urbanization is another factor that is directly related to regional economic development. Cities are the hubs of the economy; it is where most economic activities take place and where most of the wealth is created. Nonetheless, norms and values matter. In a recent study, Rutten and Gelissen (2010) found that regional economic development, measured as gross domestic product (GDP) per capita in purchasing parties, is largely explained by innovation, human capital, and urbanization. Norms and values only have a limited direct effect on GDP. However, they found norms and values to have a considerable effect on innovation. This is an important finding given the crucial role of innovation for economic development. It means that regions where norms and values are present that favor innovation are likely to be more economically developed than other regions.

The kind of norms and values to favor innovation as identified by Rutten and Gelissen (2010) corroborate with the findings of other research (Beugelsdijk and Van Schaik 2005). In general, norms and values that reflect a cosmopolitan attitude, self-expression, a move away from traditional and religious values, and a readiness to embrace new developments are the kind of norms and values that encourage innovation. This is because such norms and values encourage creativity, which is a key element of innovation (Florida 2002). Tolerance for nonconformist behavior and tolerance for sociocultural and ethnic diversities represent another set of norms and values that are strongly related to innovation. The kind of diversity that results from a mixed regional population in terms of social and cultural backgrounds and ethnicity and nonconformist lifestyles produces a social climate that is argued to be attractive for knowledge workers, that is, the kind of workers that produce innovations during their day jobs. But this kind of diversity also contributes to innovation directly in that it produces a richer pool of ideas and, therefore, creativity and in that it represents a more diverse market with specific needs (Florida 2002; Rutten and Gelissen 2008). Finally, participation in various social networks—such as professional, leisure, religious, political, and voluntary organizations—is related to both innovation and GDP. Although social networks do not represent norms and values as such, they are nonetheless an important soft factor in economic life. Social networks may reduce transaction costs in economic life because of the trust and reputation effects that such networks generate. Social networks may also encourage

the exchange of knowledge and ideas and thus contribute to creativity and innovation (Uzzi 1997). In sum, Rutten and Gelissen (2010) conclude that cosmopolitan norms and values and tolerance for diversity are beneficial for innovation in a region and through their effect on innovation contribute to economic development. Their findings are in line with those of others (Beugelsdijk and Van Schaik 2005; Florida 2002; Inglehart and Baker 2000).

The norms and values that feature in clusters, thus, are important factors in the explanation of learning and innovation within them. However, the relation between norms and values, on the one hand, and the performance of clusters, on the other hand, is not straightforward. This is because healthy clusters are connected beyond their home region as well and because norms and values are characteristics of human relations rather than regions. Nonetheless, regional differences in norms and values do exist and they have an impact on economic development. Of course, economic development does not drive on norms and values but on learning and innovation. However, as argued, certain norms and values are more conducive to learning and innovation than others. City regions seem to have an advantage in this regard over more peripheral regions for several reasons. The population of cities tends to be more diverse and cities are often more strongly linked to the international economy. Modern, cosmopolitan lifestyles are also more likely to be found in cities than in peripheral regions. The role as hubs of the (international) economy that cities already enjoyed in the industrial economy seems to be reinforced in the current knowledge economy given the importance of norms and values for learning and innovation.

3 Case Studies

In the following two sections the Java automotive cluster (Indonesia) and the Eindhoven region cluster scheme (the Netherlands) are discussed, respectively. In spite of the obvious differences between the two clusters, such as their size (large versus small) and their origin (created from the 1970s onwards versus organically grown since the early twentieth century), they make an interesting comparison. Given the different development phases these clusters are in, the comparison highlights the role of different types of linkages between the cluster companies and the role of regional social capital and cluster social capital in the clusters.

4 Case Study: The Java Automotive Cluster

An interesting example to look at the role of social capital in a cluster is the West Java automotive cluster in Indonesia. From the 1990s onwards, the cluster has developed from a low-cost production facility for Japanese car makers to a technologically advanced cluster that now exports parts and sophisticated

subassemblies to other automotive clusters in South East Asia, South America, and the Middle East. The cluster has strong linkages between the Japanese-owned car plants in the region, their local subsidiaries, and local suppliers. Based largely on Japanese FDI, the cluster hasdeveloped in the 1970s as a cheap production facility for, in particular, Honda and Toyota. From the 1990s onwards, FDI from Honda and Toyota increasingly included technological and managerial knowledge in order to upgrade the Indonesian companies from low-cost producers to codevelopers. While this helped the Indonesian automotive cluster to slowly upgrade and become an exporter of automobile subassemblies, Honda and Toyota in fact created two separate clusters, one for each company, that are organized very hierarchically with the two lead companies firmly in control of their respect clusters. Linkages between Indonesian firms in both clusters are actively discouraged by Honda and Toyota, which reduces the ability of the cluster to create knowledge and develop innovations (Irawati and Charles 2010). So while the Indonesian automotive cluster may be a geographically concentrated network of related firms, it differs from its counterparts in Europe and North America in that it is not as deeply embedded in its home region. The Japanese domination has reduced the degree in which regional social capital affects social and economic relations within the cluster. The cluster receives its social capital largely from norms and values handed down from Japan. The cluster does have strong linkages to several leading public and private knowledge centers in the region, as well as intermediary organizations and government agencies. This is largely the result of a policy effort from the Indonesian government to upgrade regional characteristics so the cluster can benefit from the knowledge created in regional knowledge centers—in the hope that this leads to more innovation in the cluster that will benefit the regional economy (Irawati 2011).

The cluster thus has strong internal linkages (i.e., bonding social capital) but in an incomplete way given the existence of two subclusters for Honda and Toyota. The cluster also has strong external linkages (i.e., bridging social capital) but only with Japan. These external linkages have exposed the cluster to the inflow of new knowledge and have enabled the cluster to develop and implement innovations resulting in its upgrading from low-cost production facility to international exporter (Irawati 2011; Irawati and Charles 2010). But obviously the cluster is also limited. It is overly hierarchical with the Japanese car makers in a dominant position. As argued, there are actually two clusters, one Toyota cluster and one Honda cluster and the leading companies of these clusters discourage relations across their networks. Horizontal linkages within the Toyota and Honda networks are also few and far between. Consequently, bonding social capital in West Java automotive cluster is insufficiently developed which prevents the cluster from developing and exploiting its potential for innovation. The hierarchical relations proved very useful in the upgrading of the cluster as it took place since the 1990s because it allowed for a quick dissemination and absorption of much more advanced Japanese knowledge, skills, and technologies. But it now prevents the cluster from internal learning and knowledge creation that are necessary for innovation and further economic development (Irawati 2011; Irawati and Charles 2010).

The case study of the Java automotive clusters shows first of all that not all social capital is beneficial for cluster development and the contribution of the cluster to regional development. Moreover, the case study suggests that different forms of social capital may be beneficial in different phases of a cluster's lifetime. The cluster's social capital has been very helpful so far in upgrading it from a low-cost producer to a knowledge-based international exporter. But its social capital has prevented the cluster from developing innovations of its own. To accomplish that, the cluster needs to develop stronger linkages between its firms and allow economic transactions to benefit from the regional social capital.

5 Case Study: The Eindhoven Region Cluster Scheme

The name cluster scheme is somewhat misleading as the "clusters" that were formed under this scheme were composed of only two to five companies, most of them small- and medium-sized enterprises (SMEs), although many clusters included a large company or a knowledge center. Moreover, the clusters that were formed under this scheme existed for only 2 years on average: the time it took to develop a new product. This was the aim of the cluster scheme: to form temporary networks between regional SMEs for product development. The hope was that, once SMEs had learned how to collaborate on product development, they would continue to do so after the completion of their projects, either with the same or with new partners, and thus contribute to regional development. In other words, the cluster scheme did not so much build a new cluster as it attempted to strengthen the relations between the SMEs in the already existing metal and electronics industry cluster. The cluster scheme was operational from 1994 through 2006 during which time just over 100 clusters were created (Rutten and Oerlemans 2009).

In terms of its general outcomes, the cluster scheme was very effective. Of all the companies involved, 90 % reported that the innovation they set out to develop was actually realized. This means that the immediate objective of the cluster scheme was overwhelmingly realized. An outcome that is somewhat puzzling at first sight is the fact that only 61 % of the companies reported that their competences had improved as a result of their participation in the clusters scheme, and only 40 % argued that their collaboration skills had improved. The explanation for these relatively low scores is that the cluster scheme predominantly attracted SMEs that were already innovative and were already engaged in networking. In other words, their competence and skills were already developed. It is interesting that of the 40 % of the companies that argued that their collaboration skills had improved to a (very) high degree, 63 % argued that in particular their collaboration management skills had improved. This finding illustrates that networking is difficult, it is a skill that needs to be developed and that even relatively experienced networkers have room to improve their collaboration skills, particularly with regard to how to manage a collaboration project.

Developing the technology does not necessarily mean that this technology also materialized into a product that was subsequently introduced on the market. Of the companies involved, 76 % reported that they introduced a product on the market as a result of their participation in the cluster scheme, while 24 % reported not to have introduced a product on the market. This is a very encouraging result from a policy-effectiveness perspective. However, the economic effect of the new products developed under the cluster scheme is not very strong. Few companies earned a substantial (more than 10 %) turnover with this product. On the other hand, 73 % of the companies that had a product on the market claimed that the product did contribute to their competitive advantage. This is a further indication that the companies that participated in the cluster scheme were already innovative, that they may have had more than one innovative product on the market that contributed to their turnover, and that the new product developed under the cluster scheme was part of broader innovation strategy to strengthen their competitive advantage.

A final outcome to be mentioned here is the effect of the cluster scheme on networking within the Eindhoven region business community. Of the companies involved in the cluster scheme, 42 % reported that they continued their collaboration with at least one of their cluster partners, while 39 % of the companies involved reported doing so with two or more of their cluster partners. Only 19 % of the companies involved no longer collaborate with any of their cluster partners.

The success of the Eindhoven cluster scheme thus was built on strong existing regional and cluster social capital in the form of linkages and shared norms and values. The Eindhoven region cluster scheme is a clear example of indigenous regional development based on knowledge creation and innovation in a cluster. On the other hand, non-innovative SMEs were not reached with this scheme. The scheme reinforced what was already there.

6 Discussion and Conclusion

Comparing the Java automotive cluster and the Eindhoven region cluster scheme shows how clusters in different phases of development contribute to regional development. While the Eindhoven case is a clear example of indigenous regional development based on knowledge that is embedded within the cluster, development in the case of the Java automotive cluster depends predominantly on Japanese FDI in the form of technological and managerial knowledge. In the Eindhoven region cluster scheme regional social capital as well as cluster social capital affected relations between the cluster companies as the cluster scheme built on existing economic and social relations. The Java automotive cluster scheme on the other hand depends heavily on cluster social capital and benefits from regional social capital (the overlapping of social and economic relations) only to a limited degree. This raises the question whether indigenous development is currently even possible in the case of the Java automotive cluster. Its insulated and hierarchical subclusters around Toyota and Honda substantially hamper the intended and unintended knowledge spillovers that characterize successful (innovative) clusters in Europe

and North America, as in the case of the Eindhoven region cluster scheme. The social capital in the Java automotive cluster helped bring it to its present state of development but seems to frustrate its further development. This example also shows the limits of cluster building in that it may only be effective in the initial development phase of a cluster. This suggestion is underlined by the failure of the Eindhoven region cluster scheme to involve non-innovative SMEs. In this more advanced clusters, government policy did not succeed in forging new linkages between innovative and non-innovative SMEs. Although the reasons for this failure were not explored in the case study, it seems likely that, albeit in a more subtle way, subclusters (of innovative and non-innovative firms) also exist in the Eindhoven region between which knowledge spillovers do not readily occur.

This chapter looked at knowledge creation and innovation in clusters. Our conclusions can be summarized as follows. In the first place, bonding social capital is very important for learning and innovation in clusters. It reflects many and strong linkages between firms in the cluster, which contributes to the emergence of shared norms and values that facilitate the flow of knowledge between the firms. Clusters with high levels of bonding social capital are also difficult to penetrate for non-cluster firms, which means that the knowledge of the cluster is less likely to leak away to competitors. Secondly, bridging social capital is also essential for clusters. It is vital for clusters to have linkages to firms outside their home region in order to secure access to new ideas, knowledge, and information and to expose the firms in the cluster to international competition. Both aspects are argued to contribute to learning and innovation. Put differently, there is nothing "regional" about successful clusters. Instead, they are firmly embedded in national and international networks. Thirdly, however, the regional context is still a crucial factor behind learning and innovation in regional clusters and their contribution to regional economic development. The availability of physical and digital infrastructure, knowledge centers, a highly educated workforce, demanding customers, and an enabling tax and legal system are as important in the current knowledge economy as they have ever been. Additionally, regional norms and values play an important role since some norms and values are more conducive to learning and innovation than others. Cosmopolitan norms and values, that is, openness and tolerance for socio-cultural and ethnic diversity and openness to new developments, technologies, and opportunities, facilitate the flow of ideas and foster creativity and experimentation which, in turn, fuels learning and innovation. City regions are more likely to host cosmopolitan norms and values than rural regions. Although ultimately people, not regions, hold cosmopolitan values, and since people holding cosmopolitan values are not exclusively located in cosmopolitan regions, it is certainly possible for rural regions to be a fertile environment for learning and innovation. Arguably, however, the challenges for rural regions are larger compared to city regions.

A more nuanced account of the effect of regional characteristics, such as bonding and bridging social capital, on cluster development is needed to understand the contribution of clusters to regional development. This chapter suggests that different forms of social capital may be beneficial in different phases in a cluster's lifetime, depending on the dominant form of knowledge spillovers (top down via FDI or horizontal).

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Chapter 8
Sociocultural Factors and Female Entrepreneurship in the Innovative Service Sector in Catalonia: A Qualitative Analysis

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1 Introduction

Female entrepreneurship has been considered an important and increasing element of economic development [Brush et al. 2006; Langowitz and Minniti 2007; Organisation for Economic co-operation and Development (OECD) 2004, 2009]. Currently, female entrepreneurship is at a disadvantage, as demonstrated by the significant differences between female and male entrepreneurial initiatives. The entrepreneurial activity in Spain has suffered a very significant downturn; in the last year the total entrepreneurial activity (TEA), one of the best-known indicators of the Global Entrepreneurship Monitor project (GEM), was 5.4 % for the male population and 3.2 % for the female population, with accumulated reductions of 33 % and 47 %, respectively, in the last 3 years (Güemes et al. 2010).

Previous literature on female entrepreneurship identified the main characteristics of female and male entrepreneurship, emphasising environmental factors such as public policy or access to financial resources. However, the influence of social and cultural factors on female entrepreneurship has been understudied.

Research into the relationship between sociocultural factors and entrepreneurship is not new (Aldrich and Zimmer 1986; Berger 1991; Davidsson 1995; Thornton 1999),

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but the focus has been more on economic and technical aspects than the significant role played by social and cultural factors in entrepreneurship. Nonetheless, in recent years, there has been an increase in this research (Audretsch et al. 2011; Hayton et al. 2002; Korsgaard and Anderson 2011; Steyaert and Katz 2004; Thornton et al. 2011), and the findings suggest that entrepreneurship is embedded in a sociocultural context, revealing that it is a societal phenomenon rather than a purely economic activity (Steyaert 2007).

Moreover, the environmental factors are more significant in female initiatives than in male initiatives (Alsos and Ljunggren 1998; Baughn et al. 2006; Carter 2000). Recent investigation reveals a secondary role of female entrepreneurship in society (De la Vega et al. 2009; Güemes et al. 2010) and reflects how social and cultural factors might have a greater impact on female entrepreneurship than on male entrepreneurship (Jennings and McDougald 2007).

The purpose of this chapter is to analyse the main sociocultural factors and their impact on female entrepreneurship in the innovative service sector in Catalonia (Spain) and to establish differences to male initiatives using the institutional approach (North 1990, 2005) as a theoretical framework. Based on a comparative case study, the principal findings suggest that social networks, role models, entrepreneurial attitudes and family context are important determinants of female entrepreneurship. Family context is, in particular, a crucial factor, which might have a larger impact on women than men.

The research contributes both theoretically, with the creation of knowledge in a less researched areas such as female entrepreneurship in Spain, and practically, through the development of sustainable support policies for female entrepreneurial activity.

After this brief introduction, the structure of this chapter is a follows. First, the conceptual background is presented along with the main characteristics of the institutional economics. Second, the research design and data method are described. In the next section, the main findings of the study are discussed. Finally, the implications, both theoretical and practical, are drawn in the conclusions.

2 Female Entrepreneurship and Sociocultural Factors from an Institutional Perspective

Nowadays, there is literature increasingly dedicated to the study of female entrepreneurship. These researches start from the moment in which the inclusion of women in the job market takes on greater importance and significance (Gofee and Scase 1990). Previously, research papers on female entrepreneurship were developed within the framework of feminist theories, with aims that were more pragmatic than academic, such as obtaining advantageous political and social results for women (Hurley 1999).

The study of female entrepreneurship has focused on a wide variety of themes among which a number predominate: (1) the principal characteristics of female entrepreneurs or their differences or similarities regarding intentions, motivations and self-efficacy as compared with those of their male counterparts (Brush 1992; Brush et al. 2006; Gatewood et al. 2003; Sexton and Bowman-Upton 1990; and Welter et al. 2006); (2) access to financial resources, where it is observed that, although the criteria for evaluation used by the financial institutions may be the same for women and men, there exist differences in the negotiation process or in the presentation of guarantees of return (Alsos et al. 2006; Brush 1992; Carter and Rosa 1998; Carter et al. 2007; Gatewood et al. 2009; Kim 2006; Marlow and Patton 2005); (3) management practices, growth and strategies for success (Carter and Cannon 1991); (4) economic and noneconomic entrepreneurship support programmes that, it may be observed, have had positive effects on female entrepreneurship (Alsos and Ljunggren 1998; Carter 2000; Nilsson 1997); and (5) social and cultural factors, given that in recent times there has been a marked increase in the study of gender differences in network structures, networking behaviour and the effect of social and cultural factors (Gatewood et al. 2009; Greve and Salaff 2003; Sorenson et al. 2008; Thornton et al. 2011).

The first researchers had tendency to underestimate the influence of social and cultural factors and overestimate the influence of personal and economic factors (Gartner 1995). However, there were authors who demonstrated feminisation in management qualities, establishing that "gender is not peripheral to a researcher's understanding of management; gender is part of the very conceptualization of management" (Fondas 1997: p. 275). These researchers recognised feminine qualities, even though the authors didn't define them as such.

There are currently an important number of academics who focus their entrepreneurship theories on the influences of environment. Within such a context, institutional theory provides an appropriate interpretive frame of reference to explain different issues related to entrepreneurship, more specifically the analysis of the environmental factors that condition entrepreneurial activity (Smallbone et al. 2010; Urbano et al. 2011).

North (1990, 2005) develops a wide concept of institutions, which are "a guide to human interaction". More specifically, institutions are "the rules of the game in a society, or more formally, institutions are the constraints that shape human interaction" (North 1990: p. 3). North distinguishes between formal institutions (laws and regulations, policies, economic rules and contracts) and informal institutions (codes of conduct, attitudes, values and norms of behaviour).

Informal institutions are transmitted socially, shaping part of that which is called culture (North 1990), and, as we have observed previously, within the context of female entrepreneurship, the importance of informal institutions is presented as a key factor to explain the differences between women and men with respect to the creation of businesses.

Many of the empirical studies on institutional economics have considered formal institutions in their research (Chrisman et al. 1990; Lerner and Haber 2001), but in the last papers published, we can see an increasing amount of research into informal

institutions (Krueger et al. 2000; Thornton et al. 2011; Urbano et al. 2011). However, there has been little focus on the specific field of female entrepreneurship (Amine and Staub 2009; Baughn et al. 2006; Brush et al. 2009; Pardo-del-Val 2010).

The premise of our research is that all entrepreneurship is embedded within a social context (Aldrich and Zimmer 1986; Davidsson 2003; Steyaert and Katz 2004) and that, in order to understand female entrepreneurship, it is essential to study societal values, norms, culture and expectations of the capacities of women entrepreneurs.

Various authors share the opinion that entrepreneurship is an embedded phenomenon and, as such, the perception the entrepreneur has of the environment is as important as her relative position within that environment (Díaz-García and Jiménez-Moreno 2010; Jack and Anderson 2002). The beliefs, attitudes or behavioural norms of society (Thomas and Mueller 2000; Zahra et al. 1999) may emphasise the importance of one characteristic or another which would be more appropriate for the success of the entrepreneurial activity (Marlow and Patton 2005).

Linking the existing literature on female entrepreneurship and institutional economics, our research suggests four key sociocultural factors as important determinants of female entrepreneurship: (1) *Social networks* research is a popular topic in entrepreneurship, regarded as the "perennial and potential sapling in women's entrepreneurship research" (de Bruin et al. 2007: p. 325). Yet, until recently, studies that considered women autonomously or compared them with male entrepreneurs were limited. The previous studies suggested that social networks normally facilitated the predisposition towards entrepreneurship, although not in the same way for both genders (Aldrich et al. 1989; Brush 1992; Greve and Salaff 2003; Kim and Aldrich 2005; Rosa and Hamilton 1994). (2) *Role models* research into entrepreneurship has confirmed the positive relationship between role models and entrepreneurship (Krueger et al. 2000; Scherer et al. 1989; Toledano and Urbano 2008); what remains to be seen isif the relationship is equal for both genders. Given the positive relationship between role models and entrepreneurship, BarNir et al. (2011) observed the effect role models have on self-efficacy while studying, at the same time, whether the effect is different for women as compared to men. Their results indicated that exposure to entrepreneurial role models is positively associated with entrepreneurial career intention, and they demonstrated that exposure to role models has a stronger positive effect on entrepreneurial self-efficacy for women than for men. Similarly, authors such as Schiller and Crewson (1997) suggest that there are differences between the effect that family role models have on men and women, observing that when a mother is an entrepreneur, the entrepreneurial intentions of women are affected, but not those of men. (3) Investigations into *entrepreneurial attitudes* have suggested many reasons to justify why women may consider an entrepreneurial career undesirable. One such reason is a perception that entrepreneurial activity belongs more to the male domain (Ahl 2002; Nilsson 1997), which may be disadvantageous for female entrepreneurial activity (Marlow 2002). In more recent studies, a change in tendency is observed: we can see that men and women with firm entrepreneurial intentions both perceive successful business people as possessing feminine attributes (Díaz-García and Jiménez-Moreno 2010). Similarly, it can also be

seen that the motivation and self-perception of women entrepreneurs is similar to that of men (Birley et al. 1987; Catley and Hamilton 1998; Fischer et al. 1993; Rosa and Dawson 2006; Schreier 1973). However, what is different is that society assigns higher management competence to men and more empathy, flexibility and communication skills to women (Brush et al. 2009; Fairlie and Robb 2009). Following this line, investigations have been conducted with the aim of determining whether the perceptions and beliefs regarding the empathetic attitudes of female entrepreneurs were due to physiological or intrinsic characteristics of women or whether they were determined by socialisation (Aldrich et al. 1989; Minniti and Nardone 2007; Shelton 2006; Yusuf and Saffu 2005).

Another reason that entrepreneurial activity is seen as less desirable for women than for men is found in the relationship between the perception of female entrepreneur's own capacities and the environment in which women or men must develop their entrepreneurship. In a society where the female role is tied up closely with family responsibilities, the idea that entrepreneurial activity is less desirable is instilled in women (Baughn et al. 2006; Langowitz and Minniti 2007). Kantor (2002) further comments on the existence of gender roles and responsibilities within society that limit female entrepreneurship but not male entrepreneurship. He defines the concepts of "women exclusive constraints", distinguishing them from others, such as "women intensive constraints", limitations which affect men as much as women, though they affect the latter in a more relevant manner. The fourth sociocultural factor that determines female entrepreneurship is (4) *family context*. The integration of family in entrepreneurship has been examined by various authors over the last decade, suggesting the need to include this dimension in conceptualisation and analysis (Aldrich and Cliff 2003). Prior to the inception of this concept, the embeddedness approach had ignored one of the institutions to which all entrepreneurs are related, the family.

Authors like Williams (2004) conducted studies on whether the family, in particular the maternal role, affects female entrepreneurship, observing that while it is not conclusive that the time dedicated to the care of children influences the success of a business, social responsibility is an important element in the decision to create a company.

The situation in Spain has changed greatly in the last century. The family context for the woman has been modified as her participation in the labour market has increased, allowing her to gain experience and finance, but placing unfair labour practices (the glass ceiling) in her path, all of which may motivate female entrepreneurs to create their own businesses. As authors such as Brush (1992) note, female entrepreneurship is often motivated by the failure to achieve the desired work situation.

Furthermore, the relationship between family members has undergone changes in the last half century: it has developed from the traditional family model that includes a father and mother and where the woman might work professionally, to today, where a widely diverse set of household types exist (with children, without children, children with just one parent, elderly fathers, etc.). As Bianchi (2000) pointed out a decade ago, all of these changes may cause variations in the time dedicated to a professional activity and to the family, as well as its influence on female entrepreneurship.

The new family relationships bring with them new needs (persons to take care of the children, of the parents, etc.), and, as various authors have pointed out, "these changes in the social bonds between family members are creating entrepreneurial opportunities" (Aldrich and Cliff 2003: p. 588), which may also in some cases promote female entrepreneurship.

3 Methodology

This research uses a qualitative methodology based on case studies following Eisenhardt (1989, 2007) and Yin (1989, 1994). It is worth noting that this methodology is being used more often within the field of new venture creation (Rosa and Dawson 2006; Urbano et al. 2011).

The methodology of case study, which involves the examination of a contemporary phenomenon within its real-life context, is the design recommended for studying a complex and under-explored area (Eisenhardt 1989, 2007; Yin 1989, 1994).

Case-study research can be based on single or multiple case studies (Yin 1989, 1994); to guarantee reliability and validity in the analysis of cases, multiple sources of evidence should be used to analyse the same factor. In order to fulfil the precept of reliability, a pilot phase is carried out before obtaining the final data: we analyse two companies (one created by women and one by men) to validate the designed protocol for the semi-structured interviews. We use the same protocol for all cases so to provide stable and consistent results while also obtaining information from secondary sources and developing a database with the information obtained from the analysed cases.

This research utilises a multiple case study design following a theoretical replication to explore the main sociocultural factors that influence female entrepreneurship in the service sector in Catalonia (Spain) and to establish the differences with regard to male initiatives.

The selection process began with contacts with ten entrepreneurs, who in the last 3 years had created their own businesses in the services sector in Catalonia, one of the regions in Spain with the largest number of businesses (18.5 %)[1] and one of the four regions with a services sector, which generates almost 70 % of its business volume, and with one of the highest entrepreneurship indices of European Union countries (De la Vega et al. 2009). From among these ten entrepreneurs—five women and five men—three women and three men were selected, and within these two subgroups we included one immigrant entrepreneur, with the goal of obtaining the greatest diversity of information (Eisenhardt 1989) from the point of view of the study on the effects of sociocultural factors on female entrepreneurship. Table 8.1 provides a summary description of participating cases.

[1] INE (2012).

Table 8.1 Characteristic and basic profiles of the cases of study

Case studies	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Entrepreneur profile	Female, 28 years old, single, Barcelona (Spain)	Male, 45 years old, married, one daughter, Salamanca (Spain)	Female, 31 years old, married, two children, Barcelona (Spain)	Male, 24 years old, single, Barcelona (Spain)	Female, 40 years old, married, two children, Santiago de Chile (Chile)	Male, 42 years old, married, two children, Qingtian (China)
Business activity, year of constitution and location	Publicity and brand communication strategies, 2009, Barcelona	Sales of computers and computer components, repair service and technical assessment, 2010, Abrera (Barcelona)	Fashion design and cosmetics products, 2009, Igualada (Barcelona)	Travel agency, 2010, Sabadell (Barcelona)	Food industry, 2008, Barcelona	Textile and accessories, 2010, Barcelona
Entrepreneurship support programmes	Makes use of noneconomic entrepreneurship support programmes	Makes use of noneconomic entrepreneurship support programmes	Makes use of economics and noneconomic entrepreneurship support programmes	Does not make use of entrepreneurship support programmes	Makes use of economics and noneconomic entrepreneurship support programmes	Does not make use of entrepreneurship support programmes
Education level, previous experience	University studies and masters. Previous experience in the sector	Professional studies and incomplete university studies. Without previous experience in the sector but possessing ample knowledge due to personal relationships and hobbies	Nonuniversity professional studies. Previous experience in the sector	Currently studying at university. Possesses some understanding of the sector, thanks to the work-study programmes he participated in at various companies	Basic, nonuniversity studies. Currently undertaking language studies. High level of previous experience in commercial activities	Basic, nonuniversity studies. Previous experience, related to current activity, gained in businesses owned by his fellow countrymen

(continued)

Table 8.1 (continued)

Case studies	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Reasons for entrepreneurship	Self-fulfilment and personal improvement, desire to create a business	Self-fulfilment and personal improvement and the desire to reconcile professional and family environment. His previous occupation kept him away from the family home	The impossibility of finding a financially satisfactory job and the desire for self-fulfilment	Started his business when opportunity presented itself	Difficulty finding adequate, reasonably paid employment	Aspirations of having his own business
Antecedents and key characteristics	Began her professional career working for an important advertising agency where she was assigned major brands, but she wished to apply her knowledge to small- and medium-sized companies and to have more direct contact with people and their needs	Worked as a salesman in multinationals. A year and half ago, he had a daughter and wished to spend more time with his family while doing something he enjoyed	For some time had already considered the idea of creating something which was her own, but it was not until she was without work and having trouble finding another job that she decided to start her own business	During his participation in the university work-study programme, he met a colleague and they made plans to start up a business once they had finished their studies. However, there was opportunity to obtain a well-located store and so they decided to advance their plans	Had worked in many businesses and diverse occupations—restaurant industry, domestic work, shops, etc.—but the moment arrived when finding employment became difficult and she decided to start her own business	Had been working at companies run by fellow Chinese, saving money in order to start his own successful business, which is the reason he moved from his country of origin
Interviews	November 2009 to June 2010	November 2009 to June 2010	November 2009 to June 2010	November 2009 to June 2010	January 2011 to July 2011	January 2011 to July 2011
Lasting	90–120 min on average	60–90 min on average	45–120 min on average	90–120 min on average	90–120 min on average	45–60 min on average

Data were collected over a 20-month period (November 2009 to July 2011), and the interviews were based on three sources of evidence. Firstly, men and women entrepreneurs complying with the basic guidelines were contacted. Secondly, the direct families and friends of the entrepreneurs were interviewed (parents, partners, children and friends) so as to be able to identify the influence of social networks and family context on entrepreneurship and to understand the interdependence between them.

Finally, three entrepreneurship experts offered their views regarding the influence of social and cultural factors on female and male entrepreneurship and the differences between them, lending themselves as a whole to the triangulation of the data obtained.

4 Findings and Discussion

The evidence obtained from the case studies, based on interviews, observations and secondary information, together with the knowledge provided by the literature on the subject, allows us to present a series of propositions on the influence of sociocultural factors, or informal institutions, according to North (1990, 2005), on female entrepreneurship, as well as to establish the existing differences between women and men entrepreneurs. Table 8.2 shows the main characteristics of sociocultural factors or informal institutions in the six case studies.

In the following, we discuss the sociocultural factors, from an institutional perspective (North 1990, 2005).

4.1 Social Networks

Evidence from case studies indicates similar points of view of the previous literature, reaffirming differences between the social networks created by women entrepreneurs and men entrepreneurs, as demonstrated by Case 2, in contrast to Cases 1, 3 and 5.

In these latter cases, one can observe that the social networks used most by these female entrepreneurs were family members, but in the case of male entrepreneurs, the importance of friendships, and above all professional contacts, obtained earlier on is reaffirmed, as in Case 2, where we note that:

> The contacts my previous job afforded me are something that cannot be bought; they have been of great use to me, especially when obtaining references in order to secure the money necessary to start the company (Case 2).
>
> We have relied exclusively on help from the family; we have to help one another, today for me, tomorrow for you (Case 3).

Table 8.2 Summary of sociocultural factors or informal institute

Case studies	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Social networks	Mix of networks made up of friends and colleagues, whom she has met in the course of carrying out her professional activity, and family networks. Diverse importance of each network according to needs, although the family networks have always been a constant factor with greater or lesser prominence	Social networks made up exclusively of friends and colleagues. Makes use of these networks in order to obtain financing and technical information	Social networks made up exclusively of family members. Few friends have their own businesses and fewer in the sector in question	Social networks made up exclusively of family members. There are no friendships involved	Social networks made up basically of family members and close friends	Social networks made up basically of family members and fellow countrymen who are entrepreneurs and have similar businesses
	Mixed networks (men and women)	Networks made up almost exclusively of men	Does not distinguish between networks according to gender and economic aspects. She consulted basically men	Basically, they discussed with men (father and professional consultants)	The people she consulted regarding economic aspects were basically males	Makes use of networks to obtain financing and labour for his company

	Belongs to a professional association	Does not belong to any professional association	Does not belong to any professional association	Does not belong to any professional association		
Role models	Her father, a businessman. Fundamentally male role models	Friends who are businessmen and colleagues and acquaintances in the professional environment. Fundamentally male gender	No noteworthy role models	Father, who is a businessman, and acquaintances through his father. Basically, male gender	She knows people from her community who have also created their own businesses (women and men)	Role models within his community of origin, friends and countrymen who have created similar businesses
Entrepreneurial attitudes	She has doubts about her capacities because she is young and a woman, traits associated with less experience. Society does not prepare a person for entrepreneurship, an aspect which lately, nevertheless, has greatly improved	Society values the "more social" professions, such as doctors	Society places high value on the activity	Highly values the activity of the businessperson, independently of gender, as a minimum in the sector dealt with	The stereotypes of the most common activities undertaken by women and more so by foreign women are quite fixed and in many cases limiting	At his country there are biases towards the creation of businesses. He has a high level of confidence in personal capacities
	Reluctant when faced with risks. She believes she makes use of all	Society basically generates workers who work for others. High	Society does not prepare us for entrepreneurship. Low expectations	High levels of self-confidence, vitality and enthusiasm	Women in this society are more inclined to work for others than	The current economic situation isn't important, he

(continued)

Table 8.2 (continued)

Case studies	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
	the existing opportunities. While highly skilled in communication, she lacks management skills, though these are improving day by day	levels of confidence in himself and in the idea that opportunities do not depend entirely on the general economic situation. A risk-taker by nature, but not impulsive—risk-taking in moderation	for the future and for the need to succeed. Knows how to work as part of a team and has confidence in herself		become entrepreneurs. Highly skilled in communication	considers that a person creates his own opportunities
	High level of confidence in personal capacities, low level of confidence in the current economic situation and its effect on business activities	Highly skilled in communication and management capabilities	High communication skills, low organisational skills	Consider highly the business profession	High levels of vitality, enthusiasm and capacity for work, which compensate for technical shortcomings in the area of management	
			Reluctant when faced with risk, but seeks to take advantage of opportunities as they arise	The creation of their company owes much to their taking advantage of an opportunity which presented itself		

Family context	The family context is basic; it may facilitate access to financing which otherwise would be quite difficult to obtain. It may also make it easier for many women to be able to create their own company and help cope with family responsibilities	The family context is important, especially with respect to motivation. An adequate family context should facilitate reconciliation with family	The family context is essential in order to be able to undertake any professional activity in today's world. Women have family responsibilities which, whether imposed on us by society or not, we desire to fulfil; it is not just an obligation	Dedication to family affects male and female entrepreneurs equally. The family context has been very important for the financing, information and support	The family context is basic; without help from family, both economic and general support, it would not have been possible to start her own business	The whole family has a responsibility to the business. The relationship family-business dissolves; one is not understood without the other
	She believes that women have the obligation and the need to combine their professional activity with the role assigned to them by society, namely, caretaker of house and family	This entrepreneur quit his previous job in order to be able to combine work and professional life. Nonetheless, he recognises that many women do not have the option to choose			Creating a business has not modified her dedication to her family; I still perform the same domestic. That my children are now older helps me greatly in combining activities	All that is achieved leads to the well-being of the family or of the community, above the interests of the person

The women's social networks tend to be smaller and consist basically of family members, and male entrepreneurs' social networks tend to be bigger and made up exclusively of men.

Men dominate the top positions in the financial systems, and this may be one of the reasons why women find it increasingly difficult to access financing for their projects and opportunities from their environment. For instance, in Cases 2 and 6, there are social networks that provide the support and financing necessary for entrepreneurship. This is an aspect which has been confirmed in previous literature (Aldrich et al. 1989; Brush 1992; Gatewood et al. 2009; Greve and Salaff 2003; Sorenson et al. 2008; Urbano et al. 2011). The above discussion gives rise to the following proposition:

Proposition 1. *Social networks have a positive effect on entrepreneurship.*

Proposition 1a. *The familiar social networks are more positively related to female than male entrepreneurship.*

Proposition 1b. *The social networks of women entrepreneurs have more gender equality among their members than those of men.*

Proposition 1c. *The strategic social networks are more related to male than female entrepreneurship.*

4.2 Role Models

In our cases of study, it is observed that the role models of the female entrepreneur are found basically within the family, rather than being sought outside the immediate environment, whether her town, community or society generally. As a motivating element, this aspect is fulfilled in Case 5, where role models are entrepreneurs already established in the community, or in Case 6, where role models are found in the family environment as well as among countrymen who have previously created businesses. In Case 2 we observe the importance of role models from outside the immediate family environment. The little influence of the nonfamily member role models is reaffirmed in the case of the Spanish female entrepreneur. This is an aspect mentioned by some of those we interviewed:

> Nobody from my family has created a business, we have always served others, but I do know colleagues from Chile and from other countries who have created business (Case 4).
>
> I have businessmen friends I met at my previous job and whom I really admire; I have always wanted to be like them (. . .) and one day I decided to (Case 2).
>
> I believe that had my father not been a businessman I would have found it more difficult to create my business, but it is what I have always lived (Case 1).

These findings are supported by previous studies, which analyse the positive correlation between the decision to become an entrepreneur and having parents who are entrepreneurs (Chlosta et al. 2010; Dunn and Holtz-Eakin 2000; Fairlie and Robb 2007; Hout and Rosen 2000).

They also point out that men and women are both affected by role models, but while these exist for men via the media, they are currently lacking for women, and therefore women need more personal role models (BarNir et al. 2011). Therefore, we suggest the following proposition:

Proposition 2. *Role models positively affect entrepreneurship.*

Proposition 2a. *Family role models are more positively related to female than male entrepreneurship.*

Proposition 2b. *Nonfamily role models are less positively related to female than male entrepreneurship.*

4.3 Entrepreneurial Attitudes

We emphasised in Cases 1 and 5 that management by women is more participative, communicative, empathetic and flexible, and there is more sharing of information and working together as a team. There are similar findings in previous studies (Brush 1992; Eddleston and Powell 2008). The women are of the opinion that their entrepreneurial education is quite reduced and that society generates stereotypes related to their capacities or the types of jobs for the women are prepared. For example:

> At times I have found that they have associated the fact that I am a woman and young with a reduced capacity, an aspect which changes once work has begun (...) the problem is getting the job (Case 1).
>
> The ideas that people have regarding the jobs which women, and especially women immigrants, are capable of carrying out may limit you at the moment (Case 5).

According to the analysed cases, favourable entrepreneurial attitudes constitute an important factor in explaining entrepreneurship (Cases 2 and 4–6, of which only one is a woman). It is noted that:

> Working at other companies I saw that I was missing something, and furthermore I have always worked freelance, helping friends who had businesses, and I had wanted to put something of my own together (Case 1).
>
> It was natural; when I had saved up enough money I would begin my own business (Case 6).

Therefore, we propose the following:

Proposition 3. *Favourable entrepreneurial attitudes have a positive effect on entrepreneurial activity.*

Proposition 3a. *The favourable entrepreneurial attitudes of women are more positively related with the creation of businesses than those of men, especially in non-technological sectors.*

4.4 Family Context

In our case, we observe that in Cases 1–3 and 5 all the female entrepreneurs and one male equally demonstrate the need to reconcile dedication to family and business. Some of their answers were:

> Women have the obligation and the need to combine their professional activity with taking care of the family (Case 1).
>
> Creating my own business has not altered my dedication to my family; I still do the same household chores, but at different moments, and, furthermore, having children who are older has helped greatly to combine everything (Case 5).
>
> The family context is basic; it can bring money or facilitate access to financing as in my case, or in others help in the care of the children (Case 1).

These findings are supported by previous studies, which suggest that working women still bear the main responsibility for household chores, even when they work full-time outside the home, and this fact is seen as discouraging female entrepreneurship (Aldrich and Cliff 2003; Williams 2004).

We observe that in the cases presented in this paper the importance of a family context, which favours female entrepreneurship, becomes essential, whether it be to provide the financing necessary to undertake a business venture, as motivation or help in taking care of the children. It is evident that the family context may have a greater impact on female entrepreneurship than on male entrepreneurship (Jennings and McDougald 2007), and the need for the family embeddedness perspective on entrepreneurship becomes essential (Aldrich and Cliff 2003; Brush et al. 2009). Therefore, we suggest this final proposition:

Proposition 4. *The family context conditions entrepreneurship.*

Proposition 4a. *The family context is more negatively related to female entrepreneurship than male entrepreneurship.*

Proposition 4b. *The traditional family context is negatively related to female entrepreneurship.*

5 Conclusions, Limitations and Implications

The aim of this paper was to analyse the main sociocultural factors and their impact on female entrepreneurship, as well as to present their differentiation among female and male entrepreneurship in the innovative service sector in Catalonia. The results reaffirm the importance of the influence of sociocultural context on the female entrepreneurship. Moreover, as we propose in consideration of the environment observed, informal factors benefit our understanding not only of female entrepreneurship but also of male entrepreneurship.

We have combined the literature on female entrepreneurship and institutional economics (North 1990, 2005) and the information obtained from the case studies

according to Yins's qualitative methodology (1989, 1994, 2003). Then we have suggested four propositions derived from our study, in order to propose a theoretical model to explain the influence of the sociocultural factors on female entrepreneurship (see Fig. 8.1).

Concerning the main findings of the study, it is observed that social networks are important to the promotion of entrepreneurship, and in the case of female entrepreneurs, these networks are basically made up of family and friends, who do not provide them with the necessary contacts to access easily financing or help in identifying opportunities. They must, for example, depend on the family in order to obtain the money that they do not obtain from financial institutions. There are strategic differences into social networks between female and male entrepreneurs. Of further importance are role models, who, in the case of female entrepreneurs, are from within the family; they are not found in their community or in society. This latter aspect differs from that observed among male entrepreneurs and female immigrant entrepreneurs. A third important sociocultural factor relates to the favourable entrepreneurial attitudes which Spanish society inculcates. As a result, the lack of entrepreneurship education (a problem, nevertheless, which is being gradually resolved with the inclusion of entrepreneurial skills in secondary and higher education) means that society continues to emphasise directly or indirectly attitudes and responsibilities tied to the family and which often instil in women the notion that entrepreneurial activity is less adequate or less desirable than other activities. This study found that family context is a crucial factor in the development of female entrepreneurial activities, one which, in light of the information obtained, may not be considered as simply another sociocultural factor of female entrepreneurship, but rather a factor which also affects the rest.

Different implications can, therefore, be drawn. From a political point of view, the research results may contribute to the creation of knowledge in an underexplored area such as female entrepreneurship in Spain, which could help politicians in the development of a sustainable entrepreneurial support infrastructure that might better meet the needs of female as well as male entrepreneurs. From the academic point of view, this study contributes to an understanding of sociocultural factors (Davidsson 2003; Downing 2005; Urbano et al. 2011) or informal institutions, based on the work of North (1990, 2005), which affect female entrepreneurship in the service sector in Catalonia (Aldrich and Cliff 2003; de Bruin et al. 2007; Brush et al. 2009). To conclude, we believe that the study presented here might provide a starting point for future research into female entrepreneurship. The limitations of the research project also indicate the next steps to take; for example, our framework could be applied to other contexts and other methodologies could be employed (Perren and Ram 2004). It might also be interesting to test empirically the propositions derived from this research, using quantitative techniques and wider samples of female and male entrepreneurs. It would then be possible to reach more generalised conclusions regarding the influence of sociocultural factors and especially of the family context on female entrepreneurship.

Another direction for future research, along the same lines as BarNir et al. (2011) and Díaz-García and Jiménez-Moreno (2010), would be the study of how gender

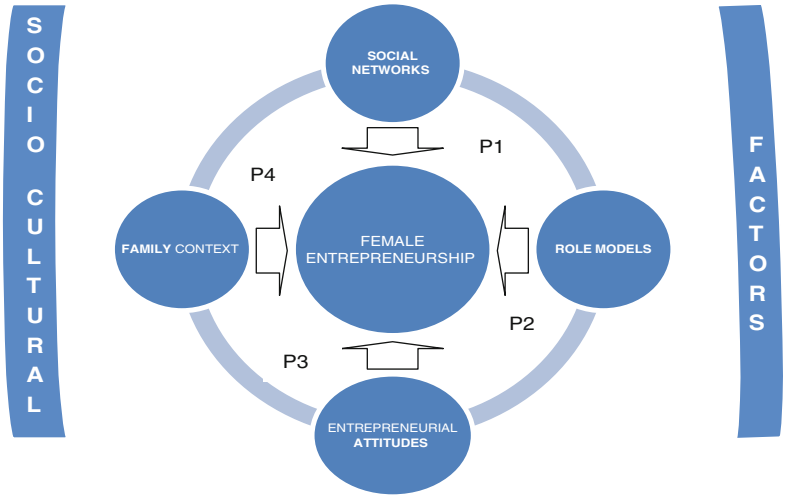

Fig. 8.1 Sociocultural factors and female entrepreneurship

interacts with the relationships between the various sociocultural factors studied and entrepreneurial intention.

Following the studies initiated by authors such as Brush et al. (2009), we wish to reaffirm the importance of establishing a framework which includes dynamic elements that move with the time and locus of research and dependent on the vital stage at which women starts an entrepreneurial process.

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Chapter 9
Academic Entrepreneurship Framework: The Best Practices of Bragança Polytechnic Institute

José Adriano, Paula Fernandes, Humberto Sampaio, and Joana Lopes

1 Introduction

Academics in the fields of entrepreneurship and innovation studies have long been interested in the entrepreneurial behaviour of higher education researchers and in the entrepreneurial activities of higher education institutions more generally (Chrisman et al. 1995; Stuart and Ding 2006; Rothaermel et al. 2007). Some academics are in agreement that the contribution of academic researchers to business activities solves some imperfections in the transmission of knowledge, and motivates researchers to undertake projects with greater economic and social relevance (Gittelman and Kogut 2003; Etzkowitz 2004).

Academic spin-offs are increasingly seen as important means of enhancing local economic development and encouraging successful researchers to become innovators. Enterprises created by academic researchers are crucial contributors to economic development and societal wealth (Nerkar and Shane 2003); it is also important to say that entrepreneurship is concerned with the discovery and exploitation of profitable opportunities (Shane and Venkataraman 2000). Thus, it is important that higher education institutions have a significant role in creating economic wealth both locally or regionally.

The literature on university–industry technology transfer defines an academic entrepreneur as a university scientist who engages in the commercialisation of the

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results of their research, principally by patenting and setting up a business. In the context of academic entrepreneurship, identification of a commercial opportunity is frequently equated with invention admission to university technology transfer offices and with academic patenting (Jensen and Thursby 2001; Colyvas et al. 2002; Lubango and Pouris 2007).

Although the core activities of any higher education institution are focused on training, this does not invalidate the process of downstream development of other initiatives that promote the inclusion of graduate students in the labour market, creating self-employment initiatives, whether these initiatives are technology based or not, as well as the creation of solutions that meet the needs of the economic, social and cultural development of the regions in which they operate.

In this regard, the Bragança Polytechnic Institute (IPB) made the strategic choice of creating an Innovation and Entrepreneurship Office, to promote the employability of students, to carry out internal entrepreneurship initiatives and to support the transfer of innovation and technology to the business world. These innovative experiences play an important role in the technological, economic and social development of the Bragança region. The lower the index of regional development, the greater the importance and responsibility of institutions of higher education to make an effective contribution to local and regional development, which at the European level is defined through the NUT (Territorial Unit Nomenclature). It should be noted that this region of Bragança is catalogued as NUT III, belonging to the group of less-developed regions of the European community and where the local municipalities, the Hospital Centre and Bragança Polytechnic Institute are assumed to be the main regional employers.

In connection to this, the present chapter is concerned with the issue of cooperation in higher education at regional and local development level mainly as regards the role that this type of educational institution must adopt in order to contribute efficiently to this propose. Therefore, this research aims to present the best practices developed within the Innovation and Entrepreneurship Office of the Bragança Polytechnic Institute, particularly in relation to a more effective contribution to the development of the socio-economic environment.

This chapter is structured as follows: after this Introduction, we present the methodological Academic Entrepreneurship Framework in Sect. 2. Section 3 specifies the conceptual model that integrates the most promising principles of a theory of learning, with the "demands" of entrepreneurial development, and summarises these in a multidimensional model. Sections 4 and 5 present our discussion and findings illustrated with examples from practice, and finally, the last section draws the conclusions of this study.

2 Framework

In the present context marked by the economic crisis, one particular concept is gaining in importance and relevance: higher education institutions as well as knowledge centres of excellence must develop new practices that result in a more

effective contribution to creating work and wealth. However, seeking the best formula to relate knowledge, work and wealth is not a recent concern, despite the fact that it is now more pertinent than ever. The dynamics of knowledge, work and wealth are complex as development agents relate to complementary interests often with different objectives. The complexity associated with the problem of economic development of regions requires a systemic approach.

It is believed in the present research that a systematic approach can be used as a tool in the search for best practices for addressing regional development and especially the potential contribution which higher education institutions can provide if they have an integrated view of the same.

The systemic approach is not a science, not a theory, nor a discipline, but rather a methodology to gather and organise knowledge, with a view to more effective action (Rosnay 1975). The methods and instruments used form a reference framework, in view of the discovery and study of systems, and can be easily applied by people of different cultures and education levels. The choice of a systemic approach in order to develop theoretical support for this work is due mainly to the fact that this is presented as a method especially directed towards dealing with uncertainty and complexity.

Bertalanffy (1984) defines a system as an entity that maintains its existence through the mutual interaction of its parts. That theory, around which great expectations were born a few decades ago, creates a galaxy of concepts, whose spectrum extends to the extreme mathematical formalism of sound forms, such as "the whole is more than the sum of its parts", "the whole is less than the sum of its parts", "the whole is more than the whole" (Morain 1982). These concepts have been promoted by biologists, neurologists, psychiatrists, computer experts, etc. The most general definition of the system was enunciated by Klir and Valach (1965) and is as follows:

$$S = \{U, C\},$$

where S is a system, U the universe of the system, and C is the system features.

According to the above, it can be concluded that any system is a result of the interaction of a set of components that share a common purpose, and it also can be defined, as an approach to problem solving, as viewing problems as parts of an overall system. Therefore and in order to frame the issue of this research, any socio-economic system can be modelled mathematically, as a three-dimensional function whose purpose is the production of wealth.

The mathematical formulation of the problem, on the basis of the theoretical foundations of the systemic approach, called attention to the systematic interaction of three basic components: higher education institutions, companies and people, towards the creation of knowledge, work and wealth, and consequently improvement of socio-economic conditions of the regions. Accordingly it is possible to write the follow mathematical expression:

$$\begin{aligned}\text{socio-economic system} &= f(\text{higher education institutions},\ \text{companies},\ \text{people}) \\ &\Downarrow \\ &\text{wealth generation}\end{aligned}$$

Fig. 9.1 Framework academic entrepreneurship

They thus released the fundamental postulates for the construction of the theoretical framework that should guide a set of practices developed in the education system, towards a more effective contribution to improving the socio-economic conditions of populations.

The Academic Entrepreneurship Framework results from an integrated view of the roles that different players in a socio-economic system should develop in order to achieve synergies. According to Brennan and McGowan (2006), the academic entrepreneurship may occur at the level of individuals or groups of individuals, acting independently or as part of a university system, which create new organisations, or instigate renewal or innovation within the university or outside the university via science and technology parks, university-owned corporate firms or research centres.

The synergies that potentiate economic development of regions and countries result from the cooperative interaction of different agents of this development (Fig. 9.1). Businesses, drivers of wealth generation, need competent people for excellence to look forward to innovative processes and products that will bring them competitive advantage over their competitors. People need work that allows them to sustain themselves, whether as an employee or on their own, in which case they opt for entrepreneurial practices that lead to the creation of their own business. The higher education institutions look to creating technically competent workers to ease their integration into the labour market. In this sense they create downstream of the formation process, models of action that promote employability and entrepreneurship, while trying to help companies to innovate. It's this set of dynamics that, if well done, results in corporate profits, jobs and success for higher education institutions (Fig. 9.1). Of course, Higher Education Institutions, companies and people are not alone in this process. The State through its various institutions is primarily responsible for supporting these key players, particularly with regard to

the granting of support to train people, the integration of graduates in the labour market, creating incentives for companies, and supporting Research Development and Innovation (RDI) activities.

Finally, the entrepreneurial university links its three primary missions: education, research and serving society. Institutionally that has meant having in a university structure besides traditional education and research functions, a technology transfer office and active patenting of own research results by the university (Baldini 2006).

3 Conceptual Model

On the basis of the theoretical framework proposed, a model of action was developed that is consistent with it. The conceptual model presents, especially, the areas of interaction of the framework where the Higher Education Institutions can make its contribution to solve this problem and it is important to know that it's based on a systemic approach.

The results of the proposed model, materialise in the design and conception of products or services, processes, organisational models and innovative marketing practices, the creation of new businesses or in achieving employment for graduates from the higher education systems (Fig. 9.2).

This framework provides an overview of the different dynamics generated in the context of the different drivers of performance. These, in turn, have their own dynamics which also becomes important to describe matter immediately. So, the next paragraphs will introduce and describe the various steps and players that integrate the model.

3.1 Technology Transfer

Potential technology financial support does remix some of the elements in interesting ways. Disruptive innovation is a revolutionary form of innovation that is changing the game which often requires a large infrastructure investment that is often supported by the public sector. The development of the Internet, computing, and space flight are examples of disruptive innovation. Disruptive innovation is often developed with government, foundation, or university support (Schulman and Rogoff 2011).

The process of technology transfer between Higher Education Institutions, research centres and companies is closely related to the concept of innovation. Innovation, while a creative process, adds a series of steps that go from idea to final product. The stages of any innovation process, according to the Oslo Manual, break down into three different moments, which are research, development

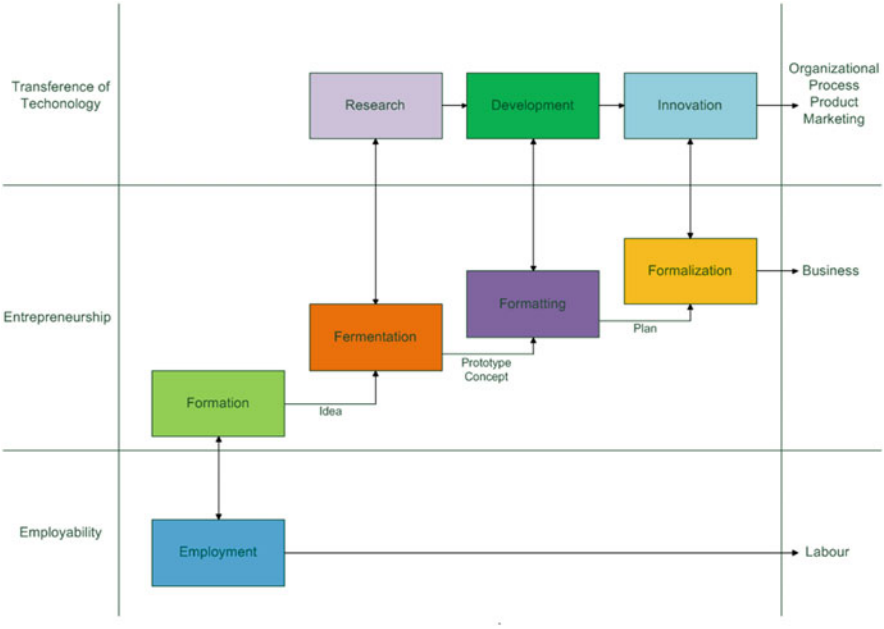

Fig. 9.2 Conceptual model

and innovation itself. Logically speaking, innovation processes are presented sequentially in the stages of research, development and innovation usually referenced by R + D + I or simply RDI.

The developmental step typically refers to the construction of a prototype of a pilot installation, a marketing concept or a new organisational approach; though not necessarily a process of research this is the time of practical realisation of an innovative idea. This step, a constructive step, is intended primarily to validate the objective of innovation, particularly in terms of operability and functionality.

This is the time at which the product, called a "proof of concept", is refined according to the assumptions of the target market. The final step in a process of innovation is related to the inclusion of the subject innovation into the market.

The object, be it product, process, new marketing concept or organisational practice, will have to be innovative, necessarily, to enjoy market acceptance. However, one should not confuse market acceptance and commercial success. Whatever the objective of innovation this will only be considered as such if it is directed towards the satisfaction of certain needs for a latent or eminent market. It will not necessarily be a commercial success, nor serve the needs of a large target market. Alternatively, the subject of marketing and innovation that allows you to enjoy the status of innovation lies in its licensing or registration. There are several registers of property in its most varied forms, and patents that were never marketed. However, they are not for that reason considered objects of innovation.

3.2 *Entrepreneurship*

Entrepreneurship is one of the main levers of the economy in modern societies and gained even greater importance with the current crisis in financial markets that emerged in the middle of 2007 and now extends to various parts of the economy. Throughout the world has focused on promote entrepreneurship. Such efforts are the result of relationship between this process and economic progress (Ferreira et al. 2010). Thus, academically entrepreneurial universities can play a high impact role in revitalising economies affected by the global economic crisis facing the world at this time.

In the literature, authors such as Schumpeter, Baumol, and Wennekers consider entrepreneurship as an important mechanism for economic development through employment, innovation and welfare effects (Acs and Amorós 2008). The dynamics of entrepreneurship can be immensely different depending on institutional context and level of economic development (Naudé et al. 2008). Some studies show that opportunity entrepreneurship has a positive and significant effect on economic development (Hall 2007).

Entrepreneurship offered many things that other economic development interventions did not. First, entrepreneurship is a local- and regional-level activity, and new firms can immediately begin to create benefits for their host locations, where for this reason, the idea of entrepreneurship was a perfect complement to an increasing focus on community-based economic development; second, economic development interventions focused on building hard infrastructure often neglected to consider how the infrastructure would be used, whereas entrepreneurship can work without a perfect system of hard infrastructure and often with minimal other resources (Etzkowitz and Klofsten 2005; Van Stel et al. 2007).

According to Van Stel et al. (2007), economic development depends on successful entrepreneurship combined with the force of established corporations. However, the beneficial value of this mechanism varies with the national income, as measured by GDP per capita. At low levels of national income, self-employment provides job opportunities and the possibility of market creation. As GDP per capita income increases, the emergence of new technologies and economies of scale allows larger and established firms to satisfy the increasing demand of growing markets and to increase their relative role in the economy (Van Stel et al. 2007).

To ensure the increase of GDP, are the new and small businesses that generate more jobs. However, the positive effects of entrepreneurship in society are not limited to job creation but also to its contribution to innovation. The new businesses generated in academic environments generally impose new technology-based standards of competition among established companies forcing them to improve processes and products, to be more efficient, effective and flexible in adopting new technologies and methods.

Entrepreneurship is understood, in the context of the present work, as the centre of action, from which it can leverage the remaining dimensions of the model adopted under the procedures developed at the Innovation and Entrepreneurship

Office of Bragança Polytechnic Institute. The proposed model of entrepreneurship is understood from the perspective of a value chain that integrates four distinct levels (4F: Formation, Fermentation, Formatting and Formalisation) that will be presented in the follow points.

3.2.1 Formation

Training refers to the entire educational process that is developed in institutions of higher education. Along with basic education, achieved through the undergraduate, masters and doctoral programs we are also interested now more than ever in promoting the acquisition of entrepreneurial skills, and promoting a culture and entrepreneurial spirit among the student population. The promotion of entrepreneurship will certainly motivate the development of projects, theses and research that are more practical, more applied, and more suited to market needs.

3.2.2 Fermentation

In general, the ideas generated in an academic context have a substantial technological load, needing to be worked on from the point of view of research. This is the stage where ideas are worked on, and especially concerns creativity. Despite the practical guidance that sustains this stage, at this point we are not concerned with the commercial interest, but rather with the mental conception or with the creation of prototypes.

3.2.3 Formatting

Having carried out a proof of concept, the functionality of the prototype or pilot installation measured against the aims of the project acquires new concerns. The phase of formatting submits the product to a market test in order to analyse the potential economic and financial benefits. This is the stage in which the business plan is drafted and one assesses the financial indicators, such as IRR (Internal Rate of Return), NPV (Net Present Value) and ROI (Return on Investment).

3.2.4 Formalisation

Formalisation is the stage of setting up and financing the business and results in the formal establishment of a company. The legal formalities and bureaucracy associated with the process of registration and licensing of businesses earn particular importance at this stage. Another aspect that is very important at this stage is to search for financing to establish the business either via equity or debt, to which you want to link incentives and external support.

3.3 Employability

Employability refers to the professional capacity to adapt to the new needs and new dynamics of labour markets. With the arrival of new technologies, globalisation of production, the opening of economies, the internationalisation of capital, and the constant changes that are affecting the environment of organisations, there is a need to adapt to such factors on the part of entrepreneurs and professionals (Minarelli 1995).

The conventional practices of employability need to be revised to the extent that the paradigm of employment has changed radically. The current reality of labour markets has become very volatile and insecure. To circumvent this problem, higher education institutions should define the strategic suitability of their study plans to the realities of labour market needs and develop strategies to facilitate and promote the inclusion of its graduates in the market place. The objectives at this level must include:

- To facilitate and promote the entry of new graduates in the labour market;
- Assist students in the process of training so that they can ensure the continuity of work;
- Develop training courses to update knowledge in order to promote continuous employment.

Nowadays, in order to get a job conventional processes include sending a CV, registering with an employment agency, doing interviews and similar procedures, but these are not at all effective. The latest developments which have occurred at the IT level, including social networking platforms typical of the Web 2.0 technology environment, are indispensable tools in that they facilitate the inter-relationship of employers and employees, in this way facilitating communication and access to information.

In conclusion of this point we present some real examples based on work carried out in 2011, but first a brief description and practical application of the 4F model is needed. On average 115 students, coming from different schools of IPB (ESTiG—School of Technology and Management; ESA—School of Agriculture; ESE—School of Education and EsACT—School of Public Management, Communication and Tourism), attend workshops and modules relating to entrepreneurship. These modules are taught by professors from different schools and specialists in the topics of the modules, and take place in the first semester of each academic year. This is the first stage of the model—formation. Thereafter in the fermentation stage, students are challenged to submit ideas and business plans to a competition, which are evaluated and defended publicly in the presence of a jury; in 2011 the competition included 17 business plans. Note that of these 17 business plans, five plans were asked to follow the remaining steps of the 4F model, where the ideas and business plans were consolidated and given "legs for walking", through the conviction of the students and the need to verify that there is satisfactory economic and financial viability to achieve the constitution and implementation of a business—the formatting stage. The idea/business plan that won first place was challenged to

submit the business plan to the national Portuguese competition 7.º Poliempreende (2010), and came in second place in the national competition (it was the 3DTech Pro company). Finally we have the last step—formalisation, which requires the business to be implemented under formal conditions and includes an appeal for financing through different means (Table 9.1 summarises the information of the last two stages of the 4F model).

4 Presentation of Results

In this section, we intend to present the work developed within the Innovation and Entrepreneurship Office at IPB, based on the theoretical framework and methodological process presented in the previous section. Note that all the work carried out in this office, over the last 3 years, has been seen as a success in the internal and external environment of the IPB and the Office, since it is unable to obtain satisfactory results for the different players. Thus, the description of the activities and results will be divided according to the three pillars of the Academic Entrepreneurship Framework (Transfer of Technology, Entrepreneurship, and Employability).

4.1 Transfer of Technology

In the context of technology transfer, the Innovation and Entrepreneurship Office at IPB fits especially the activities towards the provision of technical and scientific services in the context of the search for solutions to regional needs, requiring therefore an intermediate position between researchers and users, so that the processes of research are likely to generate innovations and added value to the region.

The proposed model related to the strategies and practices of RDI in IPB is currently being adjusted to fit the requirements of NP 4457:2007. The objective is related to the subsequent development of an electronic platform to support the processes of RDI.

The definition of policies in line with the real needs of the region and the need to create tools that facilitate interaction between academia and companies are critical factors that are worthy of greater attention by the responsible Innovation and Entrepreneurship Office at IPB within the redefinition of processes in progress.

It is hoped in the future to be able to provide remote support services to businesses in the region that have been provided with the platform to be developed, particularly regarding issues related to the management interfaces, surveillance technology, and market.

It is expected that the challenge of keeping both the research community of the IPB and companies informed of the latest scientific and technological developments,

Table 9.1 Results of applying the 4F model

Real name of company (formal register date)	Branch of activity	Investment	Financing	Situation	IPB schools	Jobs created
Eurico Alves (February 2011)	Collection of used cooking oil for biodiesel production	€35,148.00	–	Under appreciation	ESTiG	1
3DTech Pro (April 2011)	Prototyping	€186,534.00	–	Under appreciation	ESTiG	2
Anselmo Rodrigues (February 2011)	Production of spirituous liquors	€24,980.00	€12,490.00	Approved by PRODER[a]	ESA	1
Touchflowers, Lda (August 2011)	Production and processing of aromatic and medicinal plants	€186,846.00	€148,338.40	Approved by PRODER[a]	ESA	2
Pragamatico Aromas, Lda (August 2011)	Nursery aromatic and medicinal plants	€116,917.00	€110,817.80	Approved by PRODER[a]	ESA	2
Total		€550,425.00	€271,646.20	–	–	8

[a]Obs.: *PRODER* Programa de Desenvolvimento Rural/Rural Development Programme

both inside and outside the institution, in several areas of knowledge, will lead to a greater interest in the development of new products or services with commercial interest.

The work underway in this regard focuses on the design of processes and their supporting technology platform and should be completed in the middle of 2013.

One of the most emblematic projects of technology transfer in the area of electronic commerce carried out in Portugal was named RuralNet and was developed within the Ph.D. project of one of the authors of this chapter (Pires 2001).

The RuralNet Project has given rise to an academic spin-off, which was developed by a group of teachers and students of the Polytechnic Institute of Bragança. This project promoted the creation of an alternative distribution channel for marketing products and high-quality food. The basis of this project was the concept of business process reengineering, particularly in terms of commercial aspects, which were promoted by the creation of an alternative distribution and sales channel for regional producers. The service was later commercialised in the form of e-commerce and widely disseminated within the scientific community in the form of articles in journals, and through conferences and seminars (Pires et al. 1999, 2000). Afterwards, there followed the provision of consulting services to companies and the RuralNet trademark was registered.

In the context of technology transfer, processes have been developed and applications approved for Community funding for four projects to the amount of €1,718,000.00.

Academic spin-offs have been shown to be an important means of transferring technology from academia to companies (Prodan and Drnovsek 2010).

4.2 Entrepreneurship

The set of defined processes, with a view to achieving the above objectives, refers to four key activities, designated internally by the 4F model: formation, fermentation, formatting and formalisation of business.

The formation/training processes, as its name indicates, refers to the transfer of a set of basic skills in the fields of organisation and company management to the final year students of different graduations and fields of knowledge, wishing, or not, to create their own company/business.

Fermentation is a process associated with work done at the final stage of the graduations and corresponds to the phases of research and development in view of the RDI. The aim of all activities that are part of this process is directed towards the creation of a spin-off and its protection in terms of intellectual or industrial property, where appropriate.

Formatting covers the whole range of activities undertaken to assess the potential economic and financial business benefits of the concepts developed and is embodied in the design of the respective business plan.

The Formalisation step corresponds to the formal creation of the enterprise, the licensing and registration of the brand, domains, etc. It also includes the financing aspect of the business. In this sphere the IPB should carry out the creation of a regional network to promote entrepreneurship, with the participation of regional players with different responsibilities in terms of economic development, including: local authorities, state institutions (such as IAPMEI, IEFP, and CACE of Mirandela), banks, microcredit societies, banking associations, business angels, etc.

During the three year period of activity of the Innovation and Entrepreneurship Office at IPB the following results were obtained up to now from the aspect of entrepreneurship: 15 companies constituted, creating 45 direct work posts with an investment amount of around €1,029,023.00.

Thus, academically entrepreneurial higher education institutions can play a high impact role in revitalising economies and lead them out of the global economic crisis which the world is faced with at this moment.

4.3 Employability

The processes of promoting employability through actions developed in the context of the Innovation and Entrepreneurship Office at IPB are currently certified under the standard NP EN ISO 9001:2008.

Employability refers to the set of actions taken to promote and facilitate the entry of students into the labour market, preferably at a regional level, to ensure the inclusion of qualified human resources that contribute to the improvement of regional competitiveness.

With the purpose of improving the integration of students into the labour market, we are proceeding with the building of an electronic platform whose primary purpose is to facilitate communication between employers and students looking for their first job. This platform also serves to manage the curriculum vitae of individual students, enabling them to record the activities listed in the individual portfolio with the automatic generation of a digital document in PDF format, according to European standards of writing a curriculum vitae. The community platform IPB is found at www.comunidade.ipb.pt, dated 1 December 2011, with approximately 1,017 students and 92 registered companies. There are currently 102 pending job offers in the portfolio. According to the figures presented it is possible to say that the results, to date, are satisfactory.

5 Conclusions

Many scientific publications and government reports show quite clearly the impact that the use of knowledge generated in universities can have on the economy of a region or country. So a change in the model from university teaching/research to

university teaching/research/entrepreneurship seems inevitable. The capacity to adapt to these changes, absorbing, learning and stimulating entrepreneurship will be extremely important to higher education institutions over the coming decades.

International, national, regional and local competitiveness, innovation and economic growth depend on being able to produce future leaders with entrepreneurial skills and attitudes in their professional lives, whether they create their own companies or innovate in larger organisations. Academic entrepreneurship perhaps is the first and questionably most important step for embedding an innovative culture.

The aim of this work was to report the strategies and best practices adopted by the Innovation and Entrepreneurship Office at Bragança Polytechnic Institute, during its short three years of existence. Consequently, in order to reach a better understanding of the entrepreneurial process, we redefined the traditional linked university/industry knowledge transfer process by creating a new entrepreneurial process solution. The developed model deals with a conceptual framework for triumphant entrepreneurial learning in terms of how higher education institutions can facilitate knowledge growth in this area and thereby become more entrepreneurial. The results indicate that the academic entrepreneurship framework and model is an original and valuable contribution to the study of this phenomenon and the knowledge generated in this academy is now more focused towards the social and economic interests in the region.

It is important to note that the employability of students is promoted by processes developed in the context of actions taken by the Innovation and Entrepreneurship Office of IPB that are currently certified under ISO 9001:2008. The processes of employment promotion include employees assisting with the admission of students into the labour market, and entrepreneurship which promotes self-employment. In the context of the current economic crisis these processes are increasingly difficult to achieve, especially in an economically depressed area with a weak business environment, for example Trás-os-Montes and Alto Douro, Portugal. Accordingly, the group of services provided by the Innovation and Entrepreneurship Office of IPB are focused on three fundamental objectives, namely: stimulation of an entrepreneurial culture within the academic community of the institution, stimulation of business start-ups involving students and teaching staff, and boosting the competitiveness of businesses by provision of technical services relating to financial consulting, quality, and RDI.

In conclusion, academic entrepreneurship and entrepreneurial development not only contribute to organisational growth, profitability and wealth creation in the institution of higher education but will also impact on the external environment and economy as a whole by increasing productivity, improving best practices, creating new industries and enhancing international competitiveness, therefore strongly contributing to the growth and development of the economy and society.

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Part III
Knowledge Transfers Between University and Industry

Chapter 10
Academic Interactions with Private, Public and Not-for-Profit Organisations: The Known Unknowns

Maria Abreu and Vadim Grinevich

1 Introduction

An increased emphasis on the role of innovation in economic development has focused attention on the university as an important contributor to the innovation process. Universities are engaged in research and education and, therefore, provide critical resources for innovation such as skills and knowledge. They are one of the main organisational elements of the innovation system (Cooke et al. 1997; Lundvall 1992; Nelson 1993) and one which is involved, through market and non-market linkages, with other innovation agents including business, government and non-governmental organisations.

While there is a growing recognition that the engagement of the university with the economy extends well beyond the private sector (Etzkowitz et al. 2000; Etzkowitz 2003; Belkhodja and Landry 2007), most of the current literature tends to focus on knowledge transfer processes, which involve the private industry only. To no small degree, this is due an ongoing emphasis, in both the academic and policy discourse, on market-based activities, such as licensing of patented academic inventions, spin-off formation and other commercialisation activities (Baldini et al. 2007; Christman et al. 1995; Kenney and Goe 2004; Klofsten and Jones-Evans 2000). These are most relevant for private profit-driven firms, with not-for-profit and public sector organisations being rarely considered to be an appropriate partner in such context.

In this chapter, we explicitly aim to bring the public and third (not-for-profit) sectors into focus of the debate on the university engagement with the economy. These sectors of the economy are important providers of public goods and social welfare. The university is closely interlinked with both of them and the private sector.

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It, therefore, has an important role to play not only in business innovation but also in public and social innovation. The latter is often overlooked by the university technology transfer offices (TTOs), which are primarily charged with the task of commercialisation of the university research. Although the performance of TTOs is now judged by a few community engagement indicators (HE-BCI 2007), the TTO support mechanisms rarely extend beyond for-profit activities oriented towards the private sector. As we identify the extent and factors of academic interactions with the private, public and third sectors, we provide a balanced picture on the socio-economic role of the university and further inform university policies on a range of instruments that can be deployed to enhance that role.

Our unit of analysis is an individual academic who is engaged, via both formal and informal channels, not only with private firms but also with public and third sector organisations. We cover all academic disciplines and all academic and research positions within the higher education system of the United Kingdom. We also introduce a spatial dimension to investigate the role of academic location on different types of interactions.

The rest of the chapter is organised as follows. Section 2 provides an overview of the key concepts of the university engagement with the economy. Section 3 examines in detail the main determinants of academic engagement with industry and other non-academic partners and presents a number of hypotheses. Section 4 describes the data and methodology used in the paper, followed by a discussion of the empirical results in Sect. 5. Section 6 discusses the key findings and concludes.

2 Understanding the Interface Between the University and the Economy

Since at least the 1940s when Vannevar Bush, then director of the US Office of Scientific Research and Development, published his strategic view on the relationship between science and industry (Bush 1945), the conceptualisation of the role of universities in the economy has been firmly positioned within the innovation policy debate. However, the linear model of innovation advocated in Bush (1945) is no longer popular with policymakers and academics. It has been heavily criticised for presenting a simplistic one-way relationship between academic science and innovations developed by applied industrial research (Cohen et al. 2002; Jacobsson 2002; Kline and Rosenberg 1986).

The development of innovation systems approach in 1980s and 1990s led to a richer and more sophisticated conceptualisation of university–industry relationships, involving multiple feedback loops between science and industry (Freeman 1987; Lundvall 1992; Nelson 1993). There are a number of definitions of the innovation system, but the literature generally defines it as the actors and institutions that affect the creation, development and diffusion of innovations (Mowery and Sampat 2005). As one of these actors, the university is actively involved via formal and informal

channels in iterative and interactive relationships with other innovation system players. The links between the university and other organisations can take the form of flows of knowledge, information, investment funding, policy as well as more informal arrangements such as networks, clubs, forums and partnerships (Cooke et al. 1997).

An interactive characterisation of the innovation process resonates well with the concept of the university as an institution that combines activities related to both considerations of use and the pursuit of fundamental understanding (Stokes 1997). In practice, the distinction between these two dimensions of university activity is rather blurred, with the paths between scientific discovery and industry innovation involving multiple feedback loops and interactions. These can be realised through a variety of channels such as educating students and workers, increasing the stock of codified knowledge, technological problem-solving, spin-out formation and different public space functions (Lester 2003).This view is strongly supported by the extensive literature on the extent and variety of university–industry interactions, which can be approached from the point of view or business or academia (Agrawal and Henderson 2002; Arundel and Geuna 2004; Cohen et al. 2002; D'Este and Patel 2007; Faulkner and Senker 1994; Schartinger et al. 2001).

The increasing engagement of the university with industry and other non-academic partners is often referred to as the "entrepreneurial university phenomenon" (Etzkowitz et al. 2000; Etzkowitz 2003). It is interpreted as a natural development of the university mission to address the needs of a modern, knowledge-based economy. In a major survey, Rothaermel et al. (2007) identify several broad streams of existing research on the concept of university entrepreneurship. These relate to university policy and incentive systems in place to promote technology transfer (Friedman and Silberman 2003; Powers and McDougall 2005);university status and identity; cultural, historic and geographical context (Etzkowitz 2003; Jacob et al. 2003; Mansfield 1995; Thursby et al. 2001); the role of intermediaries such as TTOs and incubators (Collins and Wakoh 2000; Del Campo et al. 1999; Markman et al. 2004); government policies, industry conditions and the technologies involved (Agrawal and Henderson 2002; Gulbrandsen and Smeby 2005; Harmon et al. 1997; Mowery et al. 2001); and, finally, the characteristics and roles of the faculty members (Christman et al. 1995; Louis et al. 2001). Essentially, the notion of the entrepreneurial university incorporates three key components, the individual entrepreneur, the immediate institutional environment and external factors.

Most recently, several studies including Azagra-Caro et al. (2006), D'Este and Patel (2007) and Gulbrandsen and Smeby (2005) have demonstrated that focusing on individual academics and contextual factors, the latter of which define the way in which academics interact with industry, represents a very efficient analytical framework to analyse the relatively fragmented literature on university–industry interactions. In the UK context, studies by D'Este and Patel (2007) and D'Este and Perkmann (2010) find that the personal characteristics of individual academics have greater impact on explaining the interactions than institutional characteristics. Another interesting finding is that most academics engage with industry to advance their research rather than to commercialise it.

While providing important insights into the nature and motivations behind academic interactions with industry, one clear limitation of the existing literature is that it mainly focuses on academic interactions related to profit-generating activities, leaving out public and third sector interactions (Baldini et al. 2007; Christman et al. 1995; Kenney and Goe 2004; Klofsten and Jones-Evans 2000; Shane 2004; Roberts 1991). This is despite the fact that both the innovation systems and academic entrepreneurship literature have argued for some time that government and nongovernment organisations along with the university and private firms are all intrinsically intertwined in the process of generating economic value from innovation (Mowery and Sampat 2005; Etzkowitz et al. 2000; Etzkowitz 2003). Also, from the innovation policy perspective, the university is increasingly encouraged to enhance its capability to address the needs of both business and the wider community. Still most of the efforts of the university and TTOs focus on translating academic research into the marketplace only.

We aim to overcome this narrow interpretation of the interface between the university and the economy by analysing interactions of academics with the private, public and third sectors. In each case, we imply that individual academics are engaged with non-academic partners via variety of formal and informal channels such as licensing, spin-outs, consulting, contract research, testing, meetings, conferences and joint publications. We cover all academic disciplines, all academic and research positions and the entire range of the higher education sector in the UK. By doing so, we aim to provide a balanced picture on the engagement of the university with all key sectors of the economy and contribute to the policy debate on the development of so called "third stream" (i.e. beyond teaching and research) activities of the university.

As discussed above, the literature on academic entrepreneurship has analysed the determinants of academic interactions as a combination of individual characteristics of academics, the immediate institutional environment and locational factors. In this chapter we deploy a similar framework. We next describe the existing research findings in relation to the commercialisation of academic research and the implications for academic interactions with the public and third sectors.

3 Determinants of Academic Entrepreneurship

Most studies of academic entrepreneurship have focused on the university as the unit of analysis, often using interviews with university officials and academics, or surveys of departments in a particular academic field (Murray and Graham 2007; Owen-Smith and Powell 2001; Seashore Louis et al. 1989; Siegel et al. 2003). This has gradually changed since the 1990s with the arrival of large quantitative data sources, such as the Survey of the Association of University Technology Managers (AUTM) in the United States (Rothaermel et al. 2007). The use of large surveys and new individual-level data sets has allowed the quantitative study of both individual traits and institutional factors.

When it comes to the definition of academic entrepreneurship, most studies adopt a narrow concept associated with patenting, licensing or spin-out activities only (Baldini et al. 2007; Christman et al. 1995; Kenney and Goe 2004). Others suggest a broader definition which covers any commercialisation activities outside teaching and personal research (Klofsten and Jones-Evans 2000) and may include less formal interactions such as meetings, conferences (D'Este and Patel 2007; Landry et al. 2005) and joint publications (Link et al. 2007). Most studies centre on a particular set of academic disciplines, such as science, engineering and medicine. A few studies do cover both the sciences and humanities, but may be selective in relation to other aspects of analysis such as the variety of interactions, the type and location of academic institutions, and the employment characteristics of its subjects (Campbell and Slaughter 1999; Azagra-Caro et al. 2006; Christman, et al. 1995; Gulbrandsen and Smeby 2005).

As we discuss the findings of the literature on individual, institutional and spatial characteristics of academic entrepreneurship, we note the unresolved issues with respect to the engagement of academics with the public and third sectors. We imply that interacting academics seek to generate some value for their research outside academia and capitalise on it either commercially or professionally, for instance, in terms of teaching content, further research and reputation.

3.1 Individual Characteristics

3.1.1 Life Cycle

Life cycle models of academic careers indicate that the academic engagement in commercialisation activities increases with age. Early career researchers are more concerned with publishing their work rather than commercialising it as they seek to establish their reputation in the field, while older, more experienced academics, with an established reputation, have more opportunities to cash in on their research (Carayol 2007; Levin and Stephan 1991; Stephan et al. 2007). However, a counter-argument can also be made, whereby commercial and other entrepreneurial activities have become more prevalent in academia over time, so that the time spent on these activities is greater among younger cohorts who are more familiar with the procedures involved and who look more favourably on them (Azoulay et al. 2007). The empirical evidence is mixed, with different studies identifying positive (Azoulay et al. 2007; Morgan et al. 2001; Stephan et al. 2007), negative (Ambos et al. 2008) or insignificant (Link et al. 2007) effects of age on commercialisation of research, while others identify an inverted U-shaped relationship (Levin and Stephan 1991; Thursby and Thursby 2005). In studies that account for both age and career status, age has been found to have negative effect on commercialisation, while status has a positive or insignificant effect (Bercovitz and Feldman 2003; D'Este and Perkmann 2010). Although commercialisation activities have now become a more widespread among younger academics, this is not necessarily the case for their interactions with the

public and third sectors, where experience, reputation and status can still be very relevant. We explore these issues in detail by studying the effect of age and career status on the probability to engage with profit-generating firms, public sector institutions and non-for-profit organisations.

3.1.2 Gender

A few studies have investigated the role of gender in academic entrepreneurship. The results suggest that female scientists are less likely to commercialise their work (Ding et al. 2006; Thursby and Thursby 2005; Whittington and Smith-Doerr 2005). A number of explanations have been provided, although none has been found to explain the entire effect. The risky nature of some commercialisation activities may deter female academics who may be more risk averse than their male counterparts (Stephan and El-Ganainy 2007). A number of studies have found that female academics are less likely to have commercial sector experience and contacts in industry-related networks, which can also limit the potential for commercialisation (Ding et al. 2006; Murray and Graham 2007). Female academics may also be less likely to work in fields that are conducive to commercialisation and may be deterred by venture capitalists who tend to operate in a male-dominated environment (Stephan and El-Ganainy 2007). It is also found that female academics are more ambivalent about the ethics and benefits of research commercialisation than their male counterparts (Murray and Graham 2007).

We analyse the role of gender in relation to academic interactions which go beyond commercialisation activities, to see whether the gender gap still persists there. We expect, however, some of the critical issues, such as risk aversion and the ethics of commercialisation, to be less relevant in the context of interactions with the public and third sectors. We also control for previous commercial, public sector and third sector experience and type of research when assessing the persistence of the gender gap.

3.1.3 Academic Discipline and Type of Research

The incidence of academic entrepreneurship is closely linked to the field of study. For instance, Murray (2002) describes how fundamental research and applied work in biomedicine tend to co-evolve, with many applications flowing directly from existing lines of research. In other fields such as theoretical physics, however, substantial additional work may be needed before an application can be commercialised. The type of intellectual property arising from research also varies across disciplines. For instance, in computer science, the creative arts, humanities and the social sciences copyright and trademarks are more common than patents. Stephan et al. (2007) argue that research in fields with high patent counts, such as the life sciences, readily lends itself to commercialisation because it is both fundamental and also inspired by considerations of use, in line with the typology developed by Stokes (1997).

We follow the same approach and distinguish between pure basic research, user-inspired basic research and applied research (Stokes 1997, p. 73). We also consider whether academics from disciplines which do not generally engage in formal commercialisation activities, such as the creative arts and humanities, have links with partners in the public and third sectors.

3.1.4 Previous Experience

The literature has identified the importance of prior experience, such as owning a small business or having an immediate family member who owns a small business, in encouraging entrepreneurial behaviour (Klofsten and Jones-Evans 2000). Similarly, Mosey and Wright (2007) show that inexperienced entrepreneurs find it difficult to match their technology to a market need, although some help is available in the form of TTOs, government advisors and proof-of-concept funding. They also struggle to breach the gap between their scientific research networks and industry networks, particularly with respect to equity finance, management and industry partners. Dietz and Bozeman (2005) also find that scientists with a substantial part of their career being spent in industry get more funding from industry and have a higher rate of commercialisation activity. We investigate the role of previous experience by testing whether prior work in the private, public and third sectors affects the likelihood of academic engagement with non-academic partners.

3.1.5 Multiple Roles

Another factor to consider is relationship between the traditional roles of teaching and research, and academic entrepreneurship. There is a substantial literature on the impact of research productivity and quality on commercialisation, which has mostly found that higher research productivity is associated with higher commercialisation activity (Carayol 2007; Stephan et al. 2007; Thursby and Thursby 2003), although Agrawal and Henderson (2002) find that the relationship is neutral, so that the publication and commercialisation are neither complements nor substitutes. This relationship may also be changing over time with the expansion of university-affiliated research centres and provision of grants linked to specific research projects (Dietz and Bozeman 2005). The effect of being employed in a more research-intensive position is ambiguous. On the one hand, having more research time is likely to result in more research that can be commercialised, but, on the other hand, the incentives to publish may be greater as researchers are judged on their academic output, which is necessary to secure a tenure-track position. Using data on researchers at a major French university, Carayol (2007) finds some evidence that full-time researchers commercialise more than those employed on teaching and research contracts.

The evidence with respect to teaching is less clear-cut. There is speculation that a greater focus on commercialisation will shift resources away from education,

but there is as yet little empirical evidence to support this, and possible benefits include access to materials and equipment as well as better student placements (Baldini 2008; Geuna and Nesta 2006; Stephan 2001). While it is unlikely that academics in teaching-only positions will be heavily involved in commercialisation activities, they may still be providing specialised courses and delivering lectures across private, public and not-for-profit organisations. We test the impact of university roles on academic interactions with non-academic partners by considering whether there is a difference between academics involved in teaching only, research only, and those involved in both teaching and research.

3.2 Institutional Characteristics

Institutional factors occur at both the department and university-wide level and include incentives, cultural norms, networks and organisational structures. The literature has mostly focused on the role played by the TTO, which is both in charge of protecting the higher education institution's intellectual property and helping academic staff to commercialise their research. This creates a complex set of incentives, whereby the academic staff members decide whether to disclose their findings to the TTO, and the TTO must decide whether to commercialise them and how, and negotiate with potential users (Jensen and Thursby 2003; Siegel et al. 2007). The role of the TTO is less well understood in relation to the public and third sectors and in the context of the wider diffusion of research in fields such as the arts, humanities and social sciences, where intellectual property is frequently in the form of copyright and is often retained by the original creator. We investigate this issue by considering the incentives faced by academic staff and the organisation of departments and units involved in knowledge transfer at each institution.

3.2.1 Incentive Systems

In a study of 115 TTOs in the USA, Link and Siegel (2005) find that universities that allocate a higher proportion of royalties to the academic inventor have higher rates of commercial output—a conclusion that was also reached by a study of 48 UK universities (Locket and Wright 2005). Non-pecuniary benefits are also important; Link et al. (2007) argue that credits towards promotion and tenure may encourage higher levels of participation and disclosure among academic staff. The literature has highlighted several additional issues, including the fact that many academics do not disclose their inventions to their university and instead rely on informal channels to interact with industry (Siegel et al. 2004; Thursby et al. 2001). This brings benefits such as access to specialised equipment and sponsorship for new projects and tends to occur when the process of commercialising through the TTO is too inflexible and bureaucratic, and incentive structures are not adequate to keep the inventor involved in the commercialisation process (Lee 1996; Siegel et al. 2004). We analyse the

importance of incentives and in particular the weight given to research and commercialisation in the context of career advancement and promotion by the higher education institutions and whether the university board has private, public and third sector participants.

3.2.2 In-House Facilities and Organisational Design

In their study of US TTOs, Link and Siegel (2005) find that academics are generally dissatisfied with the level of bureaucracy and skills of TTO staff. This is supported by qualitative studies, many of which find high levels of frustration with the university bureaucracy (Link et al. 2007; Siegel et al. 2004). Many academics cite problems related to the organisation of knowledge transfer, such as the high rate of turnover of TTO officers, their insufficient marketing and business experience and the need for incentive compensation schemes (Link et al. 2007). The literature has highlighted the importance of having a mix of skills and activities in the TTO, including support for contract research, licensing and spin-out creation and business, legal and negotiating skills (Debackere and Veugelers 2005; Markman et al. 2005). Improving the structure and performance of the TTO may lead to a temporary fall in commercial output; Macho-Stadler et al. (2007) show that TTOs may need to reach a critical size to be successful and may initially shelve some projects in order to build a reputation for delivering good projects. We analyse the importance of organisational structure for different types of the academic engagement with the economy by studying whether their incidence changes if the TTO provides services in-house, sources them from external providers or does not provide facilities for commercialisation.

3.3 Spatial Characteristics

3.3.1 Access to Potential Partners and Networks

The literature on the geography of innovation has identified the importance of personal contacts in developing collaborative relationships, since they facilitate knowledge exchange and the development of new ideas (Anselin et al. 1997; Arundel and Geuna 2004; Cooke 2001, 2002; Feldman 1994; Henderson et al. 1998; Jaffe 1989). University–industry links have also been shown to depend on the quality of the research institution (Mansfield and Lee 1996). Companies will often turn to the highest ranked university department in their field, sometimes searching globally for the ideal academic partner, unless the research is needed urgently or is of an especially confidential nature (Abreu et al. 2008). On the other hand, top quality universities may be more likely to attract interest from local businesses, particularly

for formal types of collaboration (Abramovsky et al. 2007; D'Este and Iammarino 2010; Laursen et al. 2010; Mansfield and Lee 1996). Academics working in remote universities may, despite the advances of modern technology, struggle to maintain contacts in industry and business or find it more difficult to identify potential users of their research. We analyse the importance of geography for academic interactions by considering the effect of population density and distance to London on the likelihood that an individual academic will be engaged with external organisations while controlling for the research intensity of the university and other individual and institutional characteristics.

3.3.2 Regional Government Policy

In the UK, as in most industrialised countries, there is a great deal of government policy interest in encouraging university links with businesses and impact on wider regional socio-economic development. Financial support for academic entrepreneurship (or "third stream funding") comes from a variety of sources. The Higher Education Funding Council for England (HEFCE) supports university outreach activities via its Higher Education Innovation Fund (HEIF), with similar support in Wales, Scotland and Northern Ireland being provided by the devolved administrations. The Department for Business, Innovation and Skills (BIS) promotes knowledge exchange through the Knowledge Transfer Partnerships, a UK-wide programme that allows qualified personnel (typically a recent graduate or university-based researcher) to spend a period of 1–3 years working in a local business, under the supervision of both the business and a university-based scientist. Until very recently, regional development authorities have included university collaboration with businesses and the wider society in their strategic plans, although the extent of support varies by region (and devolved administration). As gatekeepers of much of the European Regional Development Fund (ERDF) and European Social Fund (ESF), the regional authorities have encouraged academic interaction with the local community, particularly with respect to small and medium-sized enterprises (SMEs). While it is difficult to quantify the magnitude of different support programmes at a regional level, we investigate the overall effect of regional policy (and other regional variation) on the academic engagement with private, public and third sector organisations by analysing the variation of academic interactions by region.

4 Data and Methods

4.1 Data Sources

Our analysis is based on a survey of UK academics, conducted over 2008–2009 as part of a wider ESRC-funded research project based at the Centre for Business

Research, University of Cambridge (Abreu et al. 2009).[1] The aim of the project was to capture the wide range of activities that link universities and businesses and analyse the impact of these links on regional economies in the UK. As the project progressed it became apparent that many academic links were with public sector and not-for-profit organisations, and the survey of academics was subsequently designed to include these links in addition to links with business and industry. The data set, its documentation and survey instrument are available through the UK Data Archive.[2]

The sampling frame for the survey of academics included all academics based at UK higher education institutions who at the time of asking were involved in teaching and/or research. Because there is no unified listing of academic staff active in the UK, the sampling frame was constructed using information available on university websites, and the survey was administered through an online web-survey tool. The total number of survey recipients was 126,120, and the achieved sample was 22,556, which also includes a number of paper-based questionnaires, for a response rate of 17.8 %.[3] As far as we are aware, this is the first survey of its kind to cover all disciplines, institutions and job categories within a country's higher education sector. The survey includes questions on interactions with private, public and not-for-profit organisations, individual characteristics, views on the benefits and difficulties of academic entrepreneurship and the geography of academic links with external organisations. The questions in the survey cover the 3 year period prior to the survey (2005–2008).

In addition to the survey, we use institutional data provided by the "Higher Education—Business and Community Interaction Survey 2007–2008", which includes questions on third stream activities, funding and university resources over the period 2007–2008 (HE-BCI 2007).[4] Data on population at the local authority district/unitary authority level, used to construct population density estimates, are based on Office for National Statistics (ONS) population estimates for 2005 (ONS 2005).[5]

[1] The project was sponsored by Economic and Social Research Council (ESRC) in partnership with the Scottish Funding Council (SFC), Department for Employment and Learning (DEL) in Northern Ireland, the Higher Education Funding Council for England (HEFCE) and the Higher Education Funding Council for Wales (HEFCW). Further details on the project are available on the Centre for Business Research website: http://www.cbr.cam.ac.uk/research/programme1/project1-17.htm.

[2] The survey is listed on the UK Data Archive website http://www.data-archive.ac.uk under "Cambridge Centre for Business Research Survey of Knowledge Exchange Activity by United Kingdom Academics, 2005–2009", archive no. SN 6462 (Hughes et al. 2010).

[3] See Abreu et al. (2009) for further details.

[4] The "Higher Education—Business and Community Interaction Survey 2007–08" data are available through the Higher Education Funding Council for England (http://www.hefce.ac.uk/pubs/hefce/2009/09_23).

[5] Available through the Office for National Statistics (www.statistics.gov.uk/popest/).

4.2 Methods

As we consider the effects of individual, institutional and spatial factors on the engagement of academics with the private, public and third sectors, in a first stage of analysis we investigate whether involvement with these different sectors of the economy varies by academic discipline and by UK region.

In a second stage, we run a set of probit regression models to investigate the likelihood that an individual will engage in a knowledge-exchange activity with each of the sectors as a function of a set of explanatory variables. The dependent variable in all cases is binary and equal to one if the individual is involved in an activity with the sector and zero otherwise. Consistent with our discussion in Sect. 3, the explanatory variables included in the analysis are individual characteristics such as age and career status, whether the academic is female, the academic discipline that the individual represents, the type of research the academic is mainly involved in, whether the academic has previous experience in the private, public and third sectors, whether the academic is mainly involved in teaching, research or both teaching and research, as well as institutional support factors and spatial characteristics. A full list of the variables included in the analysis, with corresponding data sources, is provided in Table 10.4 of Appendix. We now discuss the empirical results in detail.

5 Patterns of Academic Interactions Outside Academia

5.1 Descriptive Statistics

As discussed in Sect. 2, the innovation literature has acknowledged the links of academia with businesses, government and nongovernment organisations. However, most of the empirical literature on the engagement of academics with non-academic partners is based on interactions with the private sector only. Based on the results of our survey, we argue that this approach may lead to a significant underestimation of the extent of interactions between academia and external organisations. Table 10.1 shows the percentage of academics who report their involvement with the private, public and third sectors. It shows that proportion of academics who interact with private firms (41 %) is noticeably lower than that for academics involved with public and not-for-profit organisations (52 % and 44 %, respectively).

Table 10.1 also breaks down academic interactions by discipline. The subjects with the highest percentage of interactions with the private sector are engineering and the physical sciences (55 %) and business and media (63 %). This result is as expected, although the value for business and media is very high, suggesting that there is a substantial amount of interaction between business schools and the private sector. The figures for the public sector are also as expected, with the health sciences (64 %), social sciences (63 %) and education (70 %) having the highest

Table 10.1 Academic interactions with external organisations, by subject and type of partner organisation (percentage of academics)

Subject	Private sector	Public sector	Third sector
Health sciences	38.5	64.3	56.8
Biological sciences	41.9	39.5	42.7
English and physical sciences	54.7	43.6	26.0
Social sciences	31.6	62.7	50.5
Business and media	62.6	52.9	41.0
Humanities	21.7	34.9	43.7
Creative arts	47.1	42.3	52.2
Education	28.8	69.9	49.9
All subjects	40.5	52.2	44.3

rates of involvement. The results for the third sector (including voluntary organisations, social enterprises and charities) are most interesting; the highest collaborators are academics in the health sciences (57 %) and the creative arts (52 %). In this context, it is useful to refer to a comment from an academic working in medical research, who remarked in our survey upon the increasing importance of funding from charitable organisations to support research in the health sciences. This is seen by the respondent and his peers as a better alternative to funding from private or public sector organisations, which may come with strings attached or otherwise be restrictive in terms of the type of research undertaken.

As we investigate the effects of location on the extent of academic interactions, Table 10.2 presents the patterns of activities by region. There are no significant outliers for interactions with the private sector, although the East of England region has a higher percentage of interactions (45 %). The results for the public sector reveal that Wales (55 %) and Northern Ireland (55 %) have higher than average figures. These are perhaps due to the high proportion of governmental organisations linked to devolved administrations in these regions, although the result for Scotland is slightly below the UK average, as is the result for London. Yorkshire and the Humber also have a noticeably higher than average percentage of interactions with the public sector (56 %). The results for the third sector indicate that a high proportion of London-based academics interact with third sector organisations (47 %), while the figure is also high for Northern Ireland (49 %). This last result is in keeping with evidence that suggests that the third sector plays a greater role in Northern Ireland than in the other UK regions (Donnelly-Cox et al. 2001).

5.2 Regression Results

We next explore the incidence of academic interactions with the private, public and third sectors as a function of individual, institutional and spatial characteristics using probit regressions. The results are reported in Table 10.3. The regression

Table 10.2 Academic interactions with external organisations, by region and type of partner (percentage of academics)

Region	Private sector	Public sector	Third sector
London	41.1	50.6	47.2
South East	38.8	51.2	45.1
South West	40.3	54.3	45.4
East of England	44.6	51.2	40.7
East midlands	39.6	49.0	38.9
West midlands	38.4	54.2	43.5
North East	38.8	52.3	46.5
North West	40.5	52.0	45.0
Yorkshire and the Humber	42.5	56.2	44.0
Wales	41.5	54.7	46.1
Scotland	39.6	51.6	41.2
Northern Ireland	40.8	54.8	48.5
All regions	40.5	52.2	44.3

coefficients are marginal effects, which can be interpreted as the change in the probability that an individual is involved in the activity as a result of a unit change in each independent, continuous variable. For discrete explanatory variables the coefficients report the discrete change in the probability as the variable changes from 0 to 1.

We argue in Sect. 3 that some of the obstacles to interactions with the private sector, for instance, career status, gender and the type of research, may not be relevant to activities with the public and third sectors. With respect to the career life cycle, we find that, with the exception of the 30–39 age group, age has no effect on interactions with the private sector. However, age is important for activities with the public and third sectors, with older academics being more likely to engage in these activities. The effect of status is similar to previous results; higher status is associated with more academic interactions, across all sectors.

When it comes to private sector activities, we find negative effects of gender which are consistent with the previous studies of academics. However, the gender effect is positive in the case of public and third sector activities, after controlling for other individual and institutional determinants. Combined these results provide support for our earlier discussion on female academics being less likely to work in profit-seeking segments of the economy and demonstrating a more benevolent approach in their interactions with external organisations.

The results for subject and type of research are as expected. Academics in the biological sciences, engineering and the physical sciences are more likely to interact with the private sector, while academics in the health sciences (the reference category) are more likely to interact with the public and third sectors. Being involved in applied or user-inspired research also leads to higher rates of interaction with all sectors, relative to basic research.

The literature on academic entrepreneurship has identified previous experience as an important determinant of subsequent ventures. This finding is further confirmed

Table 10.3 Probit regressions for different types of partner organisation, incorporating individual, institutional and regional characteristics (reporting marginal effects)

	Private sector	Public sector	Third sector
Individual characteristics			
Age: under 30[a]			
Age: 30–39	0.030*	0.046***	0.016
	(0.018)	(0.017)	(0.018)
Age: 40–49	0.021	0.065***	0.064***
	(0.018)	(0.018)	(0.018)
Age: 50 and over	0.005	0.081***	0.085***
	(0.019)	(0.018)	(0.019)
Position: professor	0.243***	0.261***	0.170***
	(0.022)	(0.019)	(0.022)
Position: reader, senior staff	0.138***	0.130***	0.088***
	(0.022)	(0.021)	(0.022)
Position: lecturer	0.079***	0.034	0.018
	(0.022)	(0.021)	(0.021)
Position: researcher	0.074***	0.076***	0.018
	(0.021)	(0.020)	(0.020)
Position: assistant staff[a]			
Manager	0.112***	0.127***	0.059***
	(0.008)	(0.008)	(0.008)
Female	−0.090***	0.014*	0.052***
	(0.008)	(0.008)	(0.008)
Subject: health sciences[a]			
Subject: biological sciences	0.099***	−0.136***	−0.051***
	(0.015)	(0.015)	(0.014)
Subject: English and physical sciences	0.170***	−0.100***	−0.230***
	(0.013)	(0.013)	(0.011)
Subject: social sciences	−0.075***	0.060***	−0.046***
	(0.012)	(0.013)	(0.012)
Subject: business and media	0.144***	−0.065***	−0.141***
	(0.018)	(0.017)	(0.016)
Subject: humanities	−0.109***	−0.161***	−0.069***
	(0.014)	(0.015)	(0.014)
Subject: creative arts	0.018	−0.132***	−0.039**
	(0.020)	(0.020)	(0.019)
Subject: education	−0.120***	0.068***	−0.094***
	(0.015)	(0.018)	(0.016)
Basic research[a]			
User-inspired research	0.183***	0.135***	0.086***
	(0.010)	(0.010)	(0.010)
Applied research	0.250***	0.230***	0.147***
	(0.010)	(0.010)	(0.010)
Other type of research	0.136***	0.061***	0.042**
	(0.022)	(0.021)	(0.021)
Employed in small company	0.089***	−0.020**	−0.019*
	(0.010)	(0.010)	(0.010)

(continued)

Table 10.3 (continued)

	Private sector	Public sector	Third sector
Owned small company	0.194***	0.029**	0.048***
	(0.011)	(0.012)	(0.012)
Employed in large company	0.105***	−0.046***	−0.029***
	(0.010)	(0.010)	(0.010)
Employed in public sector	−0.034***	0.166***	0.039***
	(0.010)	(0.009)	(0.010)
Employed in third sector	−0.033***	0.061***	0.337***
	(0.011)	(0.011)	(0.010)
Not previously employed	−0.049***	−0.070***	−0.019*
	(0.011)	(0.012)	(0.012)
Research only	−0.033***	0.013	−0.025**
	(0.012)	(0.012)	(0.012)
Teaching only	−0.008	−0.021	−0.022
	(0.027)	(0.028)	(0.027)
Both research and teaching[a]			
Institutional characteristics			
Weight given to research	0.021**	0.062***	0.013
	(0.011)	(0.011)	(0.011)
Weight given to commercialisation	0.076***	0.012	−0.040***
	(0.015)	(0.015)	(0.015)
In-house licensing capability	0.013	0.021	−0.008
	(0.021)	(0.022)	(0.021)
Proportion of business reps.	−0.014	0.082**	−0.029
	(0.036)	(0.037)	(0.036)
Proportion of public sector reps.	−0.015	0.034	0.051**
	(0.023)	(0.023)	(0.023)
Proportion of third sector reps.	−0.033	0.075	−0.063
	(0.057)	(0.058)	(0.057)
External licensing capability	0.029	0.032	0.004
	(0.026)	(0.026)	(0.025)
No licensing undertaken[a]			
Contracting system	−0.030***	0.008	−0.021*
	(0.011)	(0.012)	(0.011)
Staff indemnity insurance	0.009	−0.056**	−0.065***
	(0.023)	(0.024)	(0.024)
Commercialisation company	0.003	0.144***	0.116***
	(0.040)	(0.038)	(0.040)
Commercialisation department	−0.010	0.144***	0.098**
	(0.038)	(0.038)	(0.038)
Both company and department	−0.014	0.155***	0.107***
	(0.039)	(0.039)	(0.039)
No commercialisation facilities[a]			
Spatial characteristics			
Population density (ln)	0.006	−0.004	0.005
	(0.005)	(0.005)	(0.005)

(continued)

Table 10.3 (continued)

	Private sector	Public sector	Third sector
Distance to London (ln)	−0.014*	−0.024***	−0.003
	(0.008)	(0.009)	(0.008)
London	−0.021	−0.101***	0.006
	(0.037)	(0.038)	(0.038)
South-east	−0.001	0.015	0.032
	(0.021)	(0.021)	(0.021)
South-west	0.017	0.086***	0.066***
	(0.023)	(0.023)	(0.023)
East of England	0.033*	0.029	−0.009
	(0.024)	(0.024)	(0.023)
East midlands[a]			
West midlands	−0.017	0.027	−0.011
	(0.022)	(0.022)	(0.022)
North-east	0.009	0.045*	0.070***
	(0.024)	(0.024)	(0.024)
North-west	0.019	0.030	0.029
	(0.020)	(0.020)	(0.020)
Yorkshire and the Humber	0.038*	0.075***	0.015
	(0.020)	(0.020)	(0.020)
Wales	0.041*	0.072***	0.052**
	(0.025)	(0.024)	(0.025)
Scotland	0.012	0.075***	0.025
	(0.022)	(0.021)	(0.022)
Northern Ireland	0.052*	0.085***	0.090***
	(0.031)	(0.030)	(0.031)
Observations	20,514	20,379	20,369
Likelihood ratio	4,196.23***	4,010.58***	3,320.49***
Pseudo R^2	0.15	0.14	0.12

Note: Standard errors in parentheses
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$
[a]Reference category

by our results. Having owned a small company is associated with higher rates of interaction across all sectors, especially with the private sector, while having been employed in the public or third sectors has a positive effect on activities with those sectors, but a negative effect on interactions with the private sector. Not having been employed outside academia is negative for all types of interaction. In terms of roles within the higher education institution, being on a research-only contract has a negative effect on both private and third sector activities.

Moving on to the institutional factors, we find that these have, in general, less of an effect on academic interactions. A higher weight given by the institution to research is associated with more private and public sector interactions, while a

greater weight to commercialisation activities has a positive effect on private sector activities and a negative effect on third sector activities. However, having a dedicated commercialisation department or company is positive for public and third sector activities, but has no effect on private sector activities. Requiring all staff to use in-house contracting and indemnity insurance systems is negative for all types of activities.

These results are interesting in a sense that they indicate that for academics interacting with the public and third sectors it is still very important to receive positive signals from their institution about availability of commercialisation facilities, which may be considered useful for a wider set of interactions, and as long as there is no compulsory procedure involved. At the same time those who interact with the private sector may not find these facilities important. Similarly, the inclusion of private sector representatives in the institutional governing body sends a positive signal to those working with the public sector and has no effect on private sector interactions. For those who are interacting with the third sector, it is the presence of public sector representatives which sends a positive signal, probably reflecting the increasing interconnection between the two sectors.

As far as spatial factors are concerned, we find a very limited effect on academic interactions across all sectors. Population density has no effect at all, whereas distance to London, as a rough measure of closeness to partners and networks, is negative for all types of activities, although only statistically significant for private and public sector activities.

6 Conclusion and Discussion

The academic and policy literatures have increasingly acknowledged that university engagement with the economy extends well beyond the private sector and includes the public and third (or not-for-profit) sectors. This observation, however, is not adequately reflected in most of the literature on university–industry interactions which focuses on issues related to the translation of university research for use in the private sector. As a consequence, little is known about the extent and factors driving academic interactions with public and third sector organisations, and there is a risk that government and institutional policies may underestimate the importance of these activities and, therefore, underprovide support mechanisms for academic interactions which are not immediately driven by profit considerations.

In this chapter we challenge the narrow interpretation of an interface between the university and external organisations by exploring the extent and determinants of academic interactions with all sectors, including private, public and not-for-profit organisations. We find that the involvement of academics with private firms is substantial but less widespread than that with public and third sector organisations. This confirms our hypothesis that the contribution of the university to the economy and innovation processes should be conceptualised in a wider context of private, public and social innovation.

When it comes to the factors driving academic interactions, our results not only support many of the findings from the previous studies on university-business links but also reveal a number of interesting and surprising conclusions. These are mainly related to the impact of individual and institutional factors on public and third sector activities.

We find that individual characteristics are more important than institutional characteristics in explaining academic interactions. In particular, we find that the subject area is an important determinant. It is notable that a great deal of activity with not-for-profit organisations is carried out by academics from the health sciences. The results for gender are also very telling indicating that female academics are much more likely to be involved with the public and third sectors, as compared to interactions with private businesses.

Involvement in multiple roles within academia also leads to interesting findings. Being involved in research only has a negative effect on private and third sector activities. This implies that traditional university roles that combine both teaching and research, as opposed to the current trend of teaching- or research-only appointments, would be more beneficial for third stream activities and hence for the university's role in private and social innovation.

Institutional factors are less important than individual factors, but a few stand out. We find that a greater weight given by the institution to commercialisation can be detrimental to interactions with the public and third sectors, while the provision of dedicated facilities has a positive effect, as long as these are not made compulsory for all types of activities. This would suggest that universities should focus on providing facilities to simplify the process of interactions with outside organisations, without making the use of these facilities compulsory, and adopt a more flexible approach to its definition of knowledge transfer, to encourage interactions beyond the private sector.

Our results suggest that more institutional support could be provided to academics willing to engage with private, public and third sector organisations. Moreover, policymakers and university administrators should be concerned that the presence of commercialisation facilities does not necessarily translate into greater involvement of academics with private firms. Although the results do indicate that TTOs have started acknowledging the importance of public and third sector activities by signalling that their knowledge transfer facilities can be available to academic interactions with no immediate financial reward, but of a significant public and social benefit, still much needs to be done by the university to help academics to engage with public and social innovation.

Finally, we find only a limited scope for spatial characteristics such as population density and distance to London. Being located in a busy area, with many opportunities for networking and informal kinds of interaction, does not appear to significantly affect the probability of academic interaction with any of the sectors. Distance to London has a negative effect on private and public sector activities, indicating that closeness to the capital has a positive effect on interaction with these sectors.

Variable Included in the Analysis

Table 10.4 Description of the variables used in the analysis

Variable	Data source	Description
Dependent variables		
Private sector	CBR Survey of Academics (2009)	Whether the respondent has been engaged with private sector companies
Public sector	CBR Survey of Academics (2009)	Whether the respondent has been engaged with public sector organisations
Third sector	CBR Survey of Academics (2009)	Whether the respondent has been engaged with charitable or voluntary organisations
Individual characteristics		
Age: under 30[a] Age: 30–39 Age: 40–49 Age: 50 and over	CBR Survey of Academics (2009)	Whether the respondent belongs to the age band
Position: professor Position: reader, senior staff Position: lecturer Position: researcher Position: assistant staff[a]	CBR Survey of Academics (2009)	Whether the respondent holds a given position in the institution. Senior staff includes senior research and teaching staff; assistant staff includes research and teaching assistants
Female	CBR Survey of Academics (2009)	Whether the respondent is female
Manager	CBR Survey of Academics (2009)	Whether the respondent has management responsibility within the institution
Basic research[a] User-inspired research Applied research Other type of research	CBR Survey of Academics (2009)	Main type of research conducted by the respondent (Stokes 1997). Basic research has no application or use in view; user-inspired research is inspired by considerations of use; and applied research is directed towards an individual, group or societal need or use
Research only Teaching only Both research and teaching[a]	CBR Survey of Academics (2009)	Whether the respondent is involved in research, teaching or both research and teaching. Respondents not involved in any teaching or research were excluded from the analysis
Employed in small company Owned small company Employed in large company Employed in public sector Employed in third sector Not previously employed	CBR Survey of Academics (2009)	Whether the respondent has previously been employed in the private, public or third sector or has owned a small company

(continued)

Table 10.4 (continued)

Variable	Data source	Description
Subject: health sciences[a]	CBR Survey of Academics (2009)	Main subject area, as defined by the respondent
Subject: biological sciences		
Subject: English and physical sciences		
Subject: social sciences		
Subject: business and media		
Subject: humanities		
Subject: creative arts		
Subject: education		
Institutional characteristics		
Weight given to research	CBR Survey of Academics (2009)	Average value of the respondents' perception of the importance (on a 1–5 scale) given by their institution to research and commercialisation activities, respectively
Weight given to commercialisation		
Proportion of staff using TTO	CBR Survey of Academics (2009)	Percentage of respondents within each institution who have used the technology transfer office, knowledge transfer office or similar services, within the past 3 years
In-house licensing capability	HE-BCI Survey (2007)	Whether the institution has an in-house licensing capability for its intellectual property, uses an external agency or does not undertake action on licensing
External licensing capability		
No licensing undertaken[a]		
Contracting system	HE-BCI Survey (2007)	Whether the institution has a dedicated unit that provides a contracting system for all staff business and community interaction activities and whether it provides staff indemnity insurance
Staff indemnity insurance		
No commercialisation facilities[a]	HE-BCI Survey (2007)	Whether the institution has a commercialisation company or department to manage consulting links and other external interactions
Commercialisation company		
Commercialisation department		
Both company and department		
Proportion of business reps.	HE-BCI Survey (2007)	The proportion of business, public sector and third sector representatives on the institution's governing body
Proportion of public sector reps.		
Proportion of third sector reps.		

(continued)

Table 10.4 (continued)

Variable	Data source	Description
Spatial characteristics		
Population density	ONS (2005)	The resident population density (population per hectare) in the local authority district or unitary authority where the respondent's institution is located. The population estimate is based on the 2001 census, but has been adjusted for migration
Distance to London	Own calculations based on institution postcodes	Distance from the institution to the centre of London (in km)
London South-east South-west East of England East Midlands[a] West Midlands North-east North-west Yorkshire and the Humber Wales Scotland Northern Ireland	CBR Survey of Academics (2009)	Whether the respondent's institution is located in a given Government Office Region (GOR)

Note: CBR Survey of Academics (2009) refers to the "Cambridge Centre for Business Research Survey of Knowledge Exchange Activity by United Kingdom Academics, 2005–2009", available from the UK Data Archive, archive no. SN 6462 (Hughes et al. 2010a)
[a]Used as reference category in the regression analysis

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Chapter 11
The Role of Academic Spin-Off Founders' Motivation in the Hungarian Biotechnology Sector

Katalin Erdős and Attila Varga

1 Introduction

Increasing attention towards the role of universities in regional development has resulted in a large number of publications over the past quarter of a century. A sizeable body of literature shows a specific focus on academic entrepreneurship. Entrepreneurial activities in academia may take the forms of externally funded research, earning of supplemental income, trade secret generation (Louis et al. 1989), contract research, sales and testing, external teaching, patenting, licensing or spin-off firm formation (Klofsten and Jones-Evans 2000). Some of these activities have long been present in the scientific domain. However, there seems to be a recent turn in academic entrepreneurship as specific tasks related to science-directed commercialization in forms of patenting, licensing and spin-off firm formation have become significant elements of scientists' everyday activities (Gulbrandsen and Slipersaeter 2007). Etzkowitz (1983) argues that entrepreneurial universities created by the second academic revolution are the result of a natural evolutionary process of these institutions as a response to declining resources, increasing competition and requirements set by the knowledge economy (Etzkowitz et al. 2000; Goldstein 2009).

Biotechnology has its roots at university research that has generated a significant number of licences since the enactment of the Bayh-Dole Act (Powell and Owen-Smith 1998; Mowery et al. 2004). Many discoveries that form the basis of biotechnology originate at universities, like the recombinant DNA technique of Stanley Cohen and Herbert Boyer (Powell and Owen-Smith 1998; Zucker et al. 1998) and the cell fusion technology of George Köhler and Cesar Milstein (Owen-Smith et al. 2002). A special feature of biotechnology is the difficult, if not impossible separation

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of basic and applied research. Powell and Owen-Smith (1998) argue that the relatively clear division of labour between university and industry where the former is responsible for basic research and the latter for applied research does not hold in biotechnology. At the same time even the reward structures of the two spheres start to be blurred.

The evolution and early development of biotechnology have been greatly influenced by star scientists who kept their affiliations with their universities while establishing a spin-off company. Location of scientists—usually around great universities—and their intellectual human capital determined the growth and location of the biotechnology industry (Zucker et al. 1998). Many authors argue that biotechnology tends to cluster around large universities and research institutions (Owen-Smith et al. 2002; Zucker et al. 1998) partly due to the role of tacit knowledge and spillovers (Cooke 2001; Lawton Smith and Bagchi-Sen 2008) embodied in leading scientists of their field (Zucker et al. 1998, 2002). The cooperation of universities, start-ups and large pharmaceutical companies seems to be the best structure for commercializing new medical treatments (Powell and Owen-Smith 1998). Considering also the very high survival rate of spin-off companies compared to that of other new firms (O'Shea et al. 2004), the role played by them in the evolution of biotech clusters is even more evident.[1] Biotechnology is a field that has a clear potential to enhance the economic development of a region (OECD 2004; Owen-Smith et al. 2002). Besides the famous American success stories, like the Boston or San Diego area (Powell and Owen-Smith 1998), there are some European biotech regions, for example, Cambridge, where almost all high-technology companies are somehow related to Cambridge University (Wicksteed 1985). The 114 spin-off companies of the Oxfordshire region employed 9,000 people and realized a nearly one billion pound turnover in 2002 (Lawton Smith and Glasson 2005).

There are significant differences among regions regarding their potential for developing biotechnology clusters. Varga (2000) argues that American metropolitan areas with large concentration of high-tech activities create more innovation from the same level of university research expenditures than small metropolitan areas. Trippl and Tödtling (2007) underline that spontaneous emergence of high-technology clusters based on local knowledge is only likely in regions that are historically high-technology centres. The development of biotechnology clusters in latecomer regions is a less understood phenomenon that definitely should consider distant knowledge sources and policy aspects as well. Trippl and Tödtling (2007) labelled areas with some weaknesses or shortcomings in their regional innovation systems as "RIS with weak potentials for high technology industries". These weaknesses may be rooted in the lack of some crucial factors, such as VC or spin-off support structure, low social capital or avoidance of risk taking, or the lack of experience in bringing

[1] Though Aldridge and Audretsch (2011) found that the average annual 426 spin-offs coming from US universities between 1998 and 2004 according to AUTM data is a very poor result compared to the funds provided.

inventions to the market. They argued that these shortcomings inhibit the spontaneous take-off of a cluster, even against the available scientific excellence. This view is supported by Bajmócy (2005) who argued that in less developed regions community intervention may be needed to utilize the knowledge potential of universities.

However academic entrepreneurs can significantly contribute to the development of biotechnology clusters even in regions with weak potential for high-tech industries (Trippl and Tödtling 2007). It is because development of biotechnology clusters in areas with weak RIS is to a large extent tied to distant knowledge links that can provide access to locally missing expertise and resources. A special feature of academic spin-offs compared to other new technology-based firms lies in the specificity of the academic entrepreneur who brings not only his/her human capital but also his/her social capital that can be about utmost importance for the firm (Murray 2004). Though networks of a researcher outside the academia are usually limited (Vohora et al. 2004) Murray (2004) argues that their social capital consists of two very valuable elements. One of them is the local laboratory network including contacts to current and previous students and advisors. The other one is the cosmopolitan network of scientists established through their scientific career with colleagues and co-authors. Both in the spin-off process and in the development of the company social capital of a scientist serves as the base of the company's growing scientific network. It ensures international embedding of the firm signalling to members of the scientist's network that the company is worth to cooperate with.

Empirical evidence suggests that motivations behind university spin-off formation are different from those of other high-tech start-ups. Etzkowitz (1983) and Franzoni and Lissoni (2009) underline the importance of academic motivations behind scientists' entrepreneurship. Lacatera (2009) argues that university scientists usually select projects for commercialization with higher expected revenues than industrial spin-off founders. This underpins their economic importance and the need to reveal the underlying motivations to create appropriate policies fostering spin-off-based regional economic development in less developed regions. This paper focuses on Hungarian biotechnology university spin-offs and the motivations behind their creation. By doing so it fills a gap in the literature, since to the best of our knowledge, there are no recent publications investigating the presence or absence of entrepreneurial scientists motivated by academic goals. By conducting interviews with Hungarian biotechnology spin-off founders, we collected data that enabled not only the identification but also the classification of academic entrepreneurs that was previously not done in Central Eastern Europe.

2 Academic Motivations in Spin-Off Firm Formation

Even though there seems to be some risks associated with the involvement of university scientists in the spin-off process, their importance is unquestionable in the case of biotechnology. Though knowledge commercialization requires specialized business knowledge and personality traits which academic researchers

often lack (Shane 2002; Roberts and Peters 1981), scientists' importance is still relevant in the commercialization process. It is partly because the starting point of any university technology transfer process is the disclosure made by scientists (Owen-Smith and Powell 2001). Another reason is that academic inventions are usually in such an embryonic stage that product development requires active participation by the inventors (Thursby and Thursby 2003).

Without scientists being motivated to take part in the commercialization process it is highly unlikely that the university is able to identify potentially marketable inventions. Thus the question arises: why do scientists want to be involved in any kind of entrepreneurial activities? Why should a researcher feel motivated to join or establish a company? These questions are extremely relevant considering that scientists have traditionally been identified by the norms of the Mertonian world of science. According to this world the pure aim of research is advancement of science by placing discoveries in the public domain to reap the acknowledgement of peer scientists (Merton 1988). Many researchers still believe that deep involvement in commercialization activities would corrupt science (Bok 2003; Slaughter and Leslie 1997) and erode scientific norms. Others argue that it is questionable whether patenting, licensing and spin-offs at universities are compatible with the notion of open science (Goldstein 2009; Gulbrandsen and Slipersaeter 2007; Luger and Goldstein 1997). Based on a large-scale survey Goldstein (2007) shows that most of the scientists in the USA do not support far-reaching integration of science and business; instead they prefer the land-grant-type university system that treats science as public good and not as commodity.

However, there are clear indications of a gradual change in the values of academic science. Etzkowitz (1998) argues that a normative shift has taken place in academia where university researchers do not necessarily consider ivory tower as the only way of making science anymore. Renault (2006) emphasizes the importance of norms and attitudes by arguing that academics' belief about the appropriate role of universities in technology commercialization is the most important predictor of their related behaviour though she also highlights the role of revenue sharing. In a similar vein, Lacatera (2009) argues that scientists hope for both scientific and monetary rewards from knowledge utilization. Among the motives the desire for profit is also observed in Etzkowitz (1998), but his emphasis is more on "academic" motivations in commercialization. Franzoni and Lissoni (2009) support the importance of academic motives insisting that successful entrepreneurial activities may increase the reputation of scientists and enhance their scientific and non-academic networks perhaps creating additional income for research purposes. Nonmonetary incentives behind spin-off establishment are observed by Bains (2005) as well who is a multiple spin-off founder and academic entrepreneur himself, arguing that taking part in venture-funded start-up is monetarily the worst option for an "average" academic.

Even if scientists decide to participate in the commercialization process, there is a large variation in their level of involvement, which is explained by the origin and intensity of motivation to a large extent. Etzkowitz (1998) evidences that some of the researchers do not participate at all, others only fill in a disclosure form and leave everything else on the TTO ("hands-off"-type scientists) while another group

of scientists is familiar with the business environment as well and willing to take part in the negotiation of selling the patent ("knowledgeable participants"). Deepest involvement is observed by "seamless web"- type researchers who take part in the strategic knowledge setting of the company as well.

Shinn and Lamy (2006) classify academic entrepreneurs according to the following aspects: the share of science- and business-related motivations, their coordination and by the synergy and tension between science and business. "Academic" entrepreneurs strategically coordinate the two activities, but lay the emphasis on the scientific value of the firm that creates resources and broadens their audience. "Pioneer" entrepreneurs rather focus on business activities and related applied research tasks that result in limited synergies between the firm and the university. "Janus" entrepreneurs separate academic and business activities and sequentially give priority to one or the other field. Meyer (2003) identifies a group of scientists that do not necessarily aim fast growth of their enterprise and stay at the university after spinning off a company. He terms them "entrepreneurial academics".

Lam (2011) goes a step further by investigating the relationship between personal value orientation of scientists towards commercialization and their motivations. She categorizes peer recognition and the related career advancement together with broadened research resources and increased salary as extrinsic motivation, whereas intrinsic motivation is related to the successful solution of a research question. She finds that "traditional" scientists are usually extrinsically motivated and commercialization is only a tool to increase their scientific reputation. "Entrepreneurial" scientists are the other opposite. They strongly identify themselves with commercial norms and enjoy participation and personal financial gain is about importance for them. Between the extremes, there are the "hybrids" with a mix of intrinsic and extrinsic motivations, strongly protecting scientific norms but also satisfying their intellectual curiosity and doing good for the society.

University scientists who are interested in entrepreneurial activities usually have some common professional characteristics as well. Professional characteristics are described in the literature by publication and citation records, position in the university hierarchy, the existence of available role models, business education and business experience. Publication is a common way of knowledge transfer (Agrawal and Henderson 2002; Landry et al. 2006) and case studies demonstrate that, as a result of the "publish or perish" mentality, academic innovators usually aim to perfect academic research and publish their work towards the scientific community (Gökpete-Hulten and Mahagaonkar 2010; Vohora et al. 2004). Publication records are important predictors in the sense that more successful researchers tend to be more active in establishing spin-offs (Di Gregorio and Shane 2003). Publication record is also a general measure of scientific quality that correlates with the probability of patenting (Renault 2006) that may actually result in establishing a firm. However, Landry et al. (2006) found no connection between the number of publications and spin-off creation. Agrawal and Henderson (2002) argue that not patents but their importance measured by citations is a good predictor of publication activity. On the other hand Lowe and Gonzalez-Brambila (2007) found that faculty entrepreneurs are usually star scientists, who are more productive in terms of publications and citations as well.

Position of individual researchers in the university hierarchy had a modest effect on patenting activity with somewhat deeper involvement of full professors. However to some extent tenured faculty had lower patenting rates than non-tenured faculty (Morgan et al. 2001). This is in line with previous findings that entrepreneurship can be an alternative job option for scientists with temporary employment contracts (Helm and Mauroner 2007).

Etzkowitz (1998, 2003) argue that the availability of role models increases the likelihood that a faculty member forms a company if the opportunity arises. Also business education would be beneficial to increase the performance of spin-off companies due to the already mentioned low entrepreneurial skills (Shane 2002).

However, not only formal business education but also business experience and industrial cooperation can be very useful in the spin-off process by supporting the identification of opportunities (Bodas Freitas and Verspagen 2009) and also later on in the development of the company as this view is strengthened by Helm and Mauroner (2007) where a positive relationship between growth of the spin-off and start-up experience was found. D'Este and Patel (2007) argue that researchers who participated in collaborative research are more likely to interact with industry and they do it through various channels.

Incentives for entrepreneurial involvement may depend upon the academic and business environment as well. Grants and support programs aiming at increasing technology transfer seem to be a good device to facilitate knowledge flows (Vohora et al. 2004), but there are some risks that should be kept in mind. Koschatzky and Hemer (2009) found that direct grants for start-ups can result in companies that operate in non-commercial environment. Meyer (2003) also found that after several years of spin-off, support may not result in self-sustained companies. Easily available financial assistance may result in the establishment of excessive infrastructural and personal capacities.

There is a common belief that the Bayh-Dole Act opened the door for American universities to be engaged in entrepreneurial activities especially in the field of licensing. However not all of the universities took a chance on this as many of them did not increase significantly their activities while others implemented strategies to influence the behaviour of faculty and to set up TTO to fully exploit the opportunity (Goldstein 2009). Thus there are significant differences in the entrepreneurial policy of universities. Renault (2006) highlighted the importance of incentives (like revenue share), but Klofsten and Jones-Evans (2000) argued that university pressure can exert even a negative effect on firm establishment. On the contrary, acceptance of equity for licences can increase the number of start-ups (Thursby and Thursby 2003). Feldman et al. (2002) found by analysing the technology transfer strategy of American research universities that universities with greater technology transfer experience tend to have more and more equity instead of licensing, even though the return in this case is slower and riskier. A possible reason for taking the risk can be explained by the advantages resulting from alignment of the interests of the university and the firm.

After the Bayh-Dole Act of 1980 that obliged universities to make an effort to commercialize their IP, the number of university technology transfer offices in the

United States boosted (Etzkowitz et al. 2000; Phan and Siegel 2006). These organizations are aimed to facilitate knowledge transfer, and their experience and expertise have an even greater importance if university–industry relations are weaker (Colyvas et al. 2002). Since most of the technology transfer offices lack the necessary resources and competences to search for inventions with commercial potential, the technology transfer process starts with "volunteer" disclosure of the faculty, which is in turn influenced by their perception about the quality of the TTO (Owen-Smith and Powell 2001). Also the organization and financing of the technology transfer office can play a role, since self-sustaining TTOs tend to prefer licensing due to the immediate income.

All of the above-mentioned factors may influence entrepreneurial attitude and action of university scientist and thus are important aspects in our investigation of Hungarian biotechnology spin-off founders.

3 Motivations Behind Founding Academic Spin-Offs in the Hungarian Biotechnology Sector

In this section we investigate the motivations of Hungarian biotechnology spin-off founders and the effects of these motivations on the growth potential and international competitiveness of the sector. Hungary has long pharmaceutical traditions. Governmental support programmes of biotechnology were launched already in the 1980s, resulting in a total support of some HUF 4.5 billion between 1986 and 1990 (PCA 2004). The first biotechnology companies were established in the second half of the 1980s (Ernst & Young 2006) and by the time of the political system change in 1990 some 800 researchers were familiar with the latest techniques in biotechnology (Frigyesi in PCA 2004). However, the change in the political system was followed by the period of R&D budget cuts, fierce international competition and privatization that severely hit the biotechnology sector as well (Frigyesi in PCA 2004).

University–industry relationships in the years of the socialism were characterized by Triple-Helix I where the state encompassed both spheres and directed their relationship (Etzkowitz and Leydesdorff 2000). Consequently, interactions were typically led by state intentions where universities responded to industrial needs, usually with a troubleshooting like service (Balázs 1996). Even today there is a significant knowledge base at universities not only in Budapest but also in some large cities outside the Central-Hungarian region, for example, Debrecen, Pécs and Szeged (Erdős and Varga 2012). However, the contribution of these cities to the development of the biotechnology sector is largely hindered by the traditional division of labour between universities and other public research organizations (Owen-Smith et al. 2002). The biotechnology cluster around Szeged is a good example in this regard as it is largely based on the Biological Research Centre of the Hungarian Academy of Sciences and on the Bay Zoltán Institute for Biotechnology and not primarily on university departments (Lengyel 2009).

Though the (earlier forbidden) entrepreneurial activities of researchers in the public service became supported after the political system changed, many of the founders were rather necessity entrepreneurs in the 1990s (Balázs 1996). Inzelt (2002) also argues that, due to the heritage of some peculiar unsolved institutional and IP problems, many spin-off companies in the 1990s could rather be characterized as scientific "backyard farms" with questionable economic development contributions. Entrepreneurial culture and risk-taking attitudes were indeed low (Szerb and Márkus 2007) paired with the lack of the availability of venture capital that is still typical in Hungary (as in most of Europe). Thus practical utilization of university inventions was rare before the system change (Frigyesi in PCA 2004), and it is still very immature. The first technology transfer offices were established only around 2004.

The detailed description above clearly highlights that Hungarian regions may be characterized by "RIS with weak potential for developing high technology clusters" (Trippl and Tödtling 2007). This is an important contextual feature, since as emphasized in the previous chapter, academic entrepreneurs may significantly contribute to the development of high-tech clusters in these regions. However, exactly the unfavourable conditions mentioned above like the low entrepreneurial culture or the lack of experience in entrepreneurial activities among researchers and universities alike may impede the evolution of a solid spin-off base.

3.1 Empirical Research Setup

The source of empirical results in this paper is interviews with Hungarian biotechnology spin-off founders in 2008. All of them took part in spin-off establishments and held a CEO, CSO or equivalent position in the firm. Identification of the entrepreneurs was not easy, since no unique database for academic spin-offs exists in Hungary. We used data available on websites of the Hungarian Biotechnology Association and the Hungarian Spin-off and Start-Up Association or on university technology transfer offices. We tried to match the names found in these sources with names of faculty members of universities located nearby the company headquarters.[2]

The compiled list was sent to business consultants and researchers interested in biotechnology to get confirmation about its properness and further suggestions for interviewees if it is possible. At the end we had a list including 22 names of which 18 persons agreed to be interviewed during the research period. The involved companies are likely to cover the vast majority of Hungarian biotechnology spin-offs, since the whole broadly interpreted domestic sector counted some 150 companies in 2008, the narrow definition identified around 55 firms (Convincive Consulting-HBA 2008).

[2] Zucker et al. (1998) found that biotechnology spin-offs tend to cluster around parent universities.

The interviews were semi-structured with an average duration of 30–90 min. Voice records have been transcribed and sent back to the interviewees for checking and confirmation. The interview questions were centred around the motivation of the researchers and the different factors that helped or hindered them in the achievements of their authentic aims. Influencing factors in focus are based on the literature described in the previous chapter. Thus they are related to the professional characteristics of the academics, to the university's entrepreneurial policy and practice and to the local and broader entrepreneurial environment. Five firms were located in the Central-Hungarian region, five in Pécs, five in Debrecen and three in Szeged.[3]

The companies in our sample are related to red biotechnology and medical devices[4] which is a good reflection of the overall sectoral distribution, since more than 90 % of the Hungarian biotech firms belong to red biotech (Convincive Consulting-HBA 2008). Specialization of sample companies shows a large variety: three of them develop and market medical devices (related to surgery, gastrotonometrics and allergology), one is active in the field of medical biology, biotechnological research and bioinformatical software development, one in genomics, three develop diagnostic devices, molecules, one of them is active in the field of toxicology, two of them are related to food industry, six to pharmaceuticals and cancer therapy and one company is involved in gamete and embryo manipulation. The firms were established between 1992 and 2008. Majority of the companies in Pécs were founded in the first half of the 1990s, whereas the firms in Debrecen were maximum 3 years old, but some of them started in the year of the investigation. Nearly half of the companies had less than three employees, but five of them employed more than ten people.

3.2 A Typology of Hungarian Academic Spin-Off Founders

Based on the interviews and the aspects of investigation detailed in Chap. 2 we identified four different groups of researchers (Erdős and Varga 2012). The eight

[3] To the best of our knowledge there is no information on the spatial distribution of biotechnology spin-offs. In our identified sample most of the companies were located in the Central Hungarian region, but some of the researchers could not be interviewed due to international travels or other reasons. Considering the spatial location of biotechnology companies about 60% of them are located in Budapest, 20% in Debrecen, 10% in Szeged and the remaining in Pécs, Kaposvár, Veszprém and Gödöllő (Convincive Consulting-HBA 2008). This suggests that in our study spin-off companies on the countryside might be slightly over-represented showing a somewhat more even distribution than the overall sector. This might be related to the fact that most of the researchers keep also their university affiliations and establish their firms at their current location (Zucker et al. 1998), even against the disadvantageous entrepreneurial context compared to Budapest and its surroundings.

[4] Red biotechnology is related to medical applications and health care. We interpreted the term biotechnology broadly following its definition in the Hungarian biotechnology strategy, including also medical devices (medtech).

classical academic entrepreneurs believe that academic entrepreneurial activities are beneficial for their scientific achievement and do not conflict with traditional scientific norms. They harmonize academic and business life and try to reinforce the mutually beneficial areas. Academics in this category tender together with their university and hire PhD students in order to retain talented graduates in the region. Their internal motivation is rooted in the joy and happiness about successfully turning inventions into products. Sometimes they also consider the establishment of a company, a "living organism" as one of them labelled it, as a challenge. In many aspects they are similar to Lam's (2011) "entrepreneurial scientist". In some cases the decision of spin-off establishment is a consequence of the lack of companies willing or able to do it.

The achievement of their goals is supported by their experiences accumulated abroad where many of them have met successful academic entrepreneurs. They visited research excellence centres (like the Karolinska Institute in Sweden or the University of Wisconsin in Madison, University of California in San Francisco and, the perhaps most well-known biotechnology company, Genentech) and during their stay they established connections to leading experts in their fields. These relationships were maintained even after returning home. Deep embedding into international networks helped them later on in the development of their enterprise.

In some cases their cosmopolitan network grew simultaneously with the enterprise, as the connections were established through conferences and publications resulting in joint research later on. Colleagues at home universities are supportive; sometimes they are even co-founders. In one of the cases a researcher in this group became a role model in his university. Two of them are or were in high positions at their universities' technology transfer offices. This shows their strong belief and commitment towards the entrepreneurial turn at universities. This attitude is very important considering that many universities do not have experiences in university–industry technology transfer. Thus the presence of someone who is familiar with both spheres is a source of a good opportunity to reconcile the objectives of the actors.

The companies in this category became stable self-sustaining or even well profitable. In some cases their target market segment represents an enormous potential though they are still before market entry. Financial reward clearly plays a role but usually only as an indicator of success in business life something like publications in the scientific world. Money earned through the company is important to prove that the researcher is able to show an outstanding performance also outside the walls of the ivory tower. There is no doubt about their success within the university, as many of them are at the highest level of the university hierarchy and are well acknowledged by their peers.

However, academic success is not always satisfactory for the business world as reluctance to cooperate with scientists as businessmen is often experienced. This scepticism can be somewhat moderated if the scientist has some kind of business experience or even business education. Many successful academic entrepreneurs in our sample possessed project management experience accumulated within the science funding system. However at a certain stage of company development many of these scientists decided to hire professional management to run the company.

They felt that the firm would take too much of their time otherwise that would be harmful for their scientific performance. This clearly shows that though classical academic entrepreneurs feel committed to both areas academic career is always a priority. It also shows that the extrinsic motivation for peer acknowledgement and achievement in the university hierarchy is also a crucial incentive for entrepreneurial participation. Nevertheless, they also do care about the advancement of the biotechnological sector as a whole. Some of them filled or fill in positions in the Hungarian Biotechnology Association that aims the enhancement of the sector.

The second group of researchers is labelled *unbalanced academic entrepreneurs*. They have somewhat different motivations than the "classical" academic entrepreneurs. The majority of them restricted their activity within the company from the beginning on of the product development process (specifically on the related research and testing) and give an absolute priority to their academic work. These scientists are intrinsically motivated but not by the challenge of creating and developing a business organization. They are only interested in developing their idea and bringing the product to the market. This can be either rooted in the fact that these entrepreneurs did not mention any role model, which suggests that they are perhaps not aware of the scientific and business potential hiding in the opportunity. It is also possible that their attitude is related to the type of activity. These companies are operating in the medical device sector, so for an academic entrepreneur, the main objective is to develop a device that can cure patients or at least increase their quality of life. However, some extrinsic motivation in the form of peer recognition is also present. In this sense they seem to be close to the "hybrid" scientists by Lam (2011).

None of them in this category is a solo entrepreneur. One is cooperating with a surrogate entrepreneur, the other established the company with a colleague, while the third one decided to work with an already existing company located in the area. They are not involved in the everyday management of the firm. One of them even believes that it is natural that after a certain stage of development they lose control above the invention since it is the task of the industry to develop a market-ready product.

Their local laboratory network seems to play a more important role than their cosmopolitan network. University colleagues help them with feedbacks about the product in clinical tests and they are sometimes even co-authors suggesting that there is some prestige advantage on the university's side which in turn supports entrepreneurial engagement of its faculty.

There is a fourth researcher in this group who prefers business life over academia. He has international experiences though he has not seen successful academic entrepreneurs, but only successful scientists making business. He left the university to establish his own company, whereby his international business contacts helped him with advice and with a starting loan as well. He is strongly intrinsically motivated by the challenge and enjoyment of doing business on a scientific knowledge base, whereas extrinsic aspects do not seem to play a role. Even though he is not a university scientist, he cooperates with universities and also affiliates young PhD candidates. Thus in all four cases of "unbalanced" entrepreneurs the integration of university and business remains limited and there is a strong focus on one or the other activity.

We call the third group of academic spin-off founders as *impeded entrepreneurs*. Two of the three scientists in this category have international experiences enabling them to see successful academic entrepreneurs. They do not only understand the beneficial side of being an academic entrepreneur but are also highly motivated to become one of this type of scientists. Their motivation, skills and relationships would enable them to succeed, but some unfavourable conditions in the university or the business environment make it impossible. They are two highly acknowledged, internationally experienced researchers with breakthrough ideas, but in one case lack of financing while in the other availability of an IP blocks the development process.

The third case is a very interesting one that deserves a deeper analysis. This researcher has a good publication record though he does not have international experience. He has not seen any role models; nevertheless he had the motivation to become a successful academic entrepreneur. He established the company with a surrogate entrepreneur; consequently the management of the firm did not take too much of his time from research and teaching duties. This is also reflected by the acknowledgement received from his students. This scientist had a good working relationship with his colleagues, so there was no sign of any unintended side effects of the entrepreneurial activity. However, he permanently faced negative discrimination at the appointment procedures. The likeliest reason for this was his departmental head's disappointment about his unsuccessful company and jealousy about the success of this colleague. At the end this permanent latent tension led to the exit of the academic entrepreneur. The other two scientists in this group who remained at the university also feel stacked in the lower-middle level of the university hierarchy even though their scientific performance would enable a higher ranking.

This third example highlights an interesting situation. For this case we would assume that everything is provided to build a mutually beneficial relationship between industry and the academia at the most important hierarchical level regarding entrepreneurial activities, the university department (Renault 2006): the department head is an entrepreneur and the relationship with immediate colleagues is satisfactory. However, resulting from the destructive atmosphere, integration of the firm into the local laboratory network remains limited hindering the development of mutually beneficial relationships. This situation provides a negative role model for the colleagues and potentially destroys the seeds of an entrepreneurial culture.

The fourth group of academic entrepreneurs consists of three *externally motivated entrepreneurs*, who seem to be considerably different from the previous scientists. Two of them are at the beginning of their scientific career. They seem to be extrinsically motivated in the sense that one of them was explicitly asked by the TTO to carry out a specific research led to the novelty and to develop the invention in frame of a spin-off company. The co-founder was a colleague and later on an additional local industrial partner became also involved. The second researcher in this group is extrinsically motivated in the sense that he is responding to the expectations of the university by managing a 100 % university-owned company. This position does not seem to be the perfect ground for unfolding own research

ideas and reaping the acknowledgement for the development of a product from an own invention. The third researcher in this group established the company with his colleague in order to get access to research funds, since the scarcity of resources and their low stand in the university hierarchy do not make them very likely to win research grants. Thus in this case the company was a means for seeking for alternative resources to do research.

None of these externally motivated researchers have seen a successful academic entrepreneur before, though the one who has been abroad visited a state university but entrepreneurial activities were not typical there. It seems that their entrepreneurial intention is led by their university management. As young scientists they clearly tried to meet the requirements of their institution to enhance their own academic career. The local laboratory network plays here a very important role as colleagues at the university are also co-founders or co-workers even in the company. In some cases the borders between the two worlds seem to be demolished. However, due to rare international experiences, their cosmopolitan network does not seem to play any role, which also means that international embedding of their companies is very low, sometimes even non-existing. This can cause a hindrance in the firms' development limiting their growth potential and the related ability to create wealth. On the other side, it can happen that their current entrepreneurial involvement will help them establish business networks and develop entrepreneurial skills. If this experience is combined with an international fellowship later on it will enable them to become really successful entrepreneurs. The important lesson from this case is that the university should not put too much pressure on the researcher but provide sufficient help to come up with missing skills needed for entrepreneurial success through connecting scientists with business people. Otherwise an initial failure might result in a general disappointment and the negative example might keep back other scientists from the same department.

4 Summary

The ability of regions to develop high-technology industries and increase their competitiveness even at international scale seems to be a vital element of regions' wealth. Biotechnology is an industry employing highly skilled workers significantly contributing to the development of an area. In some regions it evolves naturally, but in others there are weaknesses in the regional innovation systems that inhibit this process. Hungary typically belongs to this second category having roots and traditions in biotechnology but lacking entrepreneurial culture and venture capital. Sometimes institutional routines also hinder the unfolding of the excellent knowledge base. Based on international experiences, academic spin-offs play a multiple role in the development of biotechnology clusters of this type of regions. The academic founder's human and social capital is likely to increase the survival rate and success of the firm. The willingness of an academic to engage in entrepreneurial

activities is a key momentum in the transfer of knowledge to the regional economy. To shed some additional lights on this issue we studied the motivations of Hungarian academic spin-off founders.

Based on interviews with Hungarian biotechnology spin-off founders we identified four categories of scientists according to their motivations and the outcome of their original intentions. The "classical" academic entrepreneurs have primarily intrinsic motivations; they find enjoyment in the development of their invention and the creation of a company. Their experiences and related cosmopolitan networks enable international embedding of the company and increase its competitiveness. Their role goes beyond this, since they might serve as role models for their colleagues helping so the integration of entrepreneurialism into the organizational culture of their parent institutions. Their successful companies and personal contributions carried out in frame of the Hungarian Biotechnology Association strengthen the position of the whole sector. This is a mutually beneficial relationship, since their success in the business world can support the realization of their extrinsic motivation that is their achievements in academia. The "classical" academic entrepreneurs identified here show many similar features to Lam's (2011) "entrepreneurial" scientists; however, profit motivation got a much smaller emphasis; usually it was an implicit success indicator. It might be that the still Mertonian institutional norms in Hungary are also responsible for this result.

"Unbalanced" academic entrepreneurs give an absolute priority to either academia or business but not both. While in case of the ones preferring academia the intrinsic motivations are the desire to develop their invention and do good for their patients, in case of the businessman interviewed, it is the challenge and enjoyment of creating a business. The primarily academic-oriented "unbalanced" scientists are also extrinsically motivated by peer recognition. They also needed the opportunity opened by the support schemes to enhance university–industry cooperation and spin-off establishment.

"Impeded" academic entrepreneurs are very similar to "classical" academic entrepreneurs. Perhaps they are even more intrinsically motivated in the sense that they follow their original aims even against unfavourable conditions, sometimes on the expense of external rewards. Unfortunately their full potential remains unexploited, or even worse, the discrimination they face might keep back other scientists from being involved in entrepreneurial activities.

The strong intrinsic motivation of the "classical" and "impeded" scientists is also shown by the fact that many of these companies were established long before entrepreneurial incentives started to be integrated into academic culture.

The "externally motivated" academic entrepreneurs seem to be similar to Lam's (2011) "traditional" scientists. They strongly identify themselves with scientific norms, but they also realize the need for taking part in entrepreneurial activities to make progress in academia. They work in an environment where entrepreneurial involvement seems to be a requirement, not an additional value added in the promotion process. However, this is sometimes a pressure, not an option, which results in a questionable synergistic output especially considering the usually

missing cosmopolitan network and the related potential of international embedding of the firm. To avoid overwhelming pressure exerted by the TTO it would be worth to analyse alternative funding models to the currently dominant project finance.

In summary we assume that the most valuable contribution to the sector's advancement is offered by the "classical" academic entrepreneurs. The advantage of "unbalanced" entrepreneurs is primarily realized through the practical utilization of inventions, whereas "impeded" academic entrepreneurs could create mutual benefits for both university and industry providing better circumstances. "Externally" motivated academic entrepreneurs realize the full potential only if the external impetus meets their internal need, which is not always the case. The age of the companies does not seem to play a role in the classification, since the different entrepreneurial groups include companies with diverse years of establishment.

One of the policy findings of this paper is that intrinsic motivations of scientists to participate in the entrepreneurial process underpinned by the support of universities and extrinsic motivations can significantly contribute to the development of biotechnology clusters, whereas pressure on scientists either to participate or not to participate can limit their contribution. Scientists focusing only on academia play a modest but stable role in the sense that integration of science and business is unfortunately limited, but they might bring useful inventions to the market.

To exploit the full potential of academic entrepreneurship international mobility programmes would be useful for young scientists to help them accumulate experiences abroad and build strong connections in centres of scientific excellence. These relationships could later serve the base of their cosmopolitan network after returning home. A complement of this initiative would be the creation of predictable academic career pathways as a further motivation for young scientists to come home and strengthen the Hungarian scientific base. This does not seem to be an unrealistic suggestion as empirical evidence suggests that the aim of young postdocs who leave their country temporary is the enhancement of their domestic career (Musselin 2004).

The results above reflect the situation at universities. An interesting future extension would be the analysis of the motivations, attitudes and outcomes among researchers employed at public research organizations like, e.g., the Hungarian Academy of Sciences. Further investigations are needed to identify the major obstacles that keep nonuniversity researchers with intrinsic motivations back from being involved in entrepreneurial activities.

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Chapter 12
Hirschman Mobility, Governance and Loyalty in Europe's Top Research Universities

Edward M. Bergman

The emergence of Europe's knowledge economy has been slower than expected, if one takes the USA as a baseline, particularly in terms of anticipated knowledge productivity and related economic growth. But knowledge diffusion has also expanded more slowly than hoped. Many factors have been advanced as responsible, ranging from the incomplete integration of existing and new EU member economies to the ongoing reorganisation of traditional regimes of higher education throughout Europe.

This paper examines closely the factors underlying the intentions of highly skilled university academics to move from one post to another. While US universities have competed fiercely with each other for the best qualified students and faculty, many EU universities have only recently considered such actions and may in fact lack the policy flexibility to compete effectively. The focus on academic mobility is usually seen from a broader EU perspective that expresses concern for the range of intangible assets relied upon by firms, industries and regions to support their continued growth and development. This concern has grown in importance as globalisation steadily shifts the base of many economies away from production of routine, standardised goods and services to more knowledge-intensive output. Moreover, the precariously dated knowledge base that *recent* EU members now rely heavily upon is precisely the one they must swiftly replace if their transitions to modernity are to be realised. Since knowledge is seen as the prime prerequisite for upgrading of all EU member economies, universities and their faculties can be seen as principal agents in its generation and territorial diffusion. Much of the early emphasis was focused on establishing knowledge links between EU universities and the market (see Bergman 2010 for a review of recent evidence), but mobile

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academics and other scientists are now seen as equally important to the diffusion of knowledge.

In response to the growing importance of the knowledge economy in European life, the European Commission has pursued development of the European Research Area (ERA) since 2000. Launched first as part of the Lisbon process to accelerate knowledge transfers, the ERA was also intended to repatriate or help reduce further losses of Europe's academics to the USA, particularly its "star scientists" and those who may be more commercially inclined. Beyond the usual brain-loss issues, the ERA was also envisioned as a means of accelerating brain circulation of its "knowledge spillover agents"[1] within the EU and of improving its overall research capacity, consistent with knowledge economy requirements. The success of the ERA could be realised by accelerating the training of more scientists and creating an "internal market" for research that might retain potential outwardly mobile EU academics or attract expatriates home. At the same time, internal market efforts were to be further enhanced by improving coordination among national research and education systems, which account for the bulk of research undertaken in Europe. The EU also directed its attention to revision or enactment of better S&T policies concerning education, mobility and research that would enhance the prospects for an effective ERA (EC 2007, p. 17). Together, these actions are expected to stimulate greater mobility among scientists, while at the same time inducing a virtuous circle of competition for research services that would result from efforts to improve research opportunities and funding at universities and research centres throughout Europe.

A major review and relaunch of ERA began in 2007 with a comprehensive study and accompanying Green Paper. A concluding annex to the study lays out the original 2000 objectives, actions underway, and barriers encountered in bringing the ERA about. Building on the findings and further insights, the European Research Area Board issued its first report in 2009, which laid a broad basis for what it terms the "New Renaissance" for European research. Under its "United ERA" goal is the board's expectation that academic mobility will triple by 2030, essentially introducing the 5th freedom of knowledge mobility among member and affiliated states. The movement of knowledge is derived from the associated mobility of scientists (Ackers 2005), which is deemed necessary to develop and diffuse the knowledge economy throughout the ERA.

International mobility ("nomadism") has always been a feature of scientific fields, although the EU would prefer that such mobility occurs with greater frequency *within* the union's ERA to help stimulate reforms and share knowledge among member states. The factors responsible for present levels of mobility in single countries have been investigated in numerous studies during the past two decades and we have learned much recently (Crespi et al. 2005; Constant and

[1] Recent papers have explored the specific role of mobile "star scientists" concerning the spread of knowledge in Europe to firms and regions (Maier et al. 2007; Trippl and Maier 2010; Schiller and Diez 2010).

Dágosto 2008; Kahn and Ginther 2008; de Grip et al. 2009; Kim et al. 2006; Adams and Clemmons 2008), but until now there has been no comprehensive study of academics from representative disciplines that now conduct the majority of research in Europe's top universities. This chapter intends to help fill that gap.

1 Mobility of Academics and Scientists: The Framework

Although academic mobility has long been a topic of investigation in the USA, Europe's academics and scientific workers have received considerable scrutiny only recently in a series of studies, motivated heavily by concerns discussed above and thanks to the increasing availability of secondary data that permit such inquiries.

Academic mobility has typically been considered a specialised cohort within the field of migration studies, the leading studies of which rely upon the economic factors that underlay mobility, using common utility frameworks that imply an ex ante evaluation of relative costs and benefits (Borjas 1994). As de Grip et al. (2009) observe, economic self-improvement is a significant consideration in any career-related move, which leads to models that predict utility-based mobility in light of a variety of individual characteristics, particularly those related to human capital and demographic-life cycle characteristics. Economic conditions in the potential host country might also be expected to "pull" potential migrants (Harris and Todaro 1970) from their home country posts, particularly if wage growth could also be expected as future returns to mobility (Cheswick 1978).

But purely economic rationales are difficult to attribute to academics and scientists as their sole or even primary value. The love of science, inquiry or collegiality could easily trump pure economic returns in certain decisions to move. Indeed, it can be argued persuasively that academics have already demonstrated a strong *extra*-market orientation by the very fact of having pursued a more socially oriented career that is widely known to yield returns inferior to those available in private industry for equivalent levels of skill and training.

The special case of mobility of *academics within the ERA* adds a further dimension: the comparative advantage offered by potential EU host countries and universities on a wide array of salary plus other relevant scientific conditions remains quite unstable as improvements underway concerning academic freedom, research facilities, employment conditions, contract obligations (e.g., administration or teaching), university governance and the like at the home institution could alter mobility choices considerably. Indeed, potentially mobile academics may be involved in bringing such improvements about or at the very least consider themselves to have a voice in the beneficial development of their home institution. Accordingly, these possibilities also deserve attention in efforts to understand academic mobility in contemporary Europe.

We therefore propose to adopt the general framework proposed first by Hirschman (1970) in which the participant of an imperfect institution decides either to (a) remain loyal to it, (b) attempt to change it from within by exercising voice in

governance, (c) or decide to exit. This framework has been used many times to study employment and career-related issues, often prompted by labour-management disputes, but increasingly with an eye toward mobility of skilled employees (Withey and Cooper 1989; Graham and Keeley 1992; Jablin 1992; Luchak 2003; Solimano 2008; Pfister 2006; Mir et al. 2007; Hoffmann 2008). Unlike many articles that adopt this framework to explore logical consequences of Hirschman's seminal insights, we intend to model the exit mobility decision of European academics as the function of several specific human capital, demographic and institutional factors that arise within universities and specifically including other "Hirschman" variables that measure voice in governance and evidence of loyalty. We fully expect these Hirschman variables to be significant and negative, since we hypothesise both are substitutes for exit.

This paper relies upon a recent survey that collected the data necessary to introduce these Hirschman and other variables, which will be described in the following section. It will be followed by a discussion of the set of variables selected from a broader literature of academic and scientist mobility and their use in the modelling exercises. A logit model is estimated that accounts for the likelihood of prospective exit, given satisfactory conditions might be gained in the new location. Those who indicate a willingness to be mobile also specify the possible continental destinations, selecting as well the most important conditions to be met, which are summarised first descriptively and then analysed further by use of a multinomial logit model. The multinomial model estimates the relative likelihood of preferring mutually exclusive destination combinations: only European destinations (ERA loyalty), only non-European destinations (ERA exit) or indifferent to combined EU-other continent combinations (mixed choice as the reference case).[2] This paper concludes with a discussion of findings and implications for research and policy.

2 Data

The data used in this paper result from a large web survey of European academics in the first half of 2009. The survey was designed to collect information about the academic and institutional characteristics of university professors and researchers holding posts in one of the top 500 research universities located in Europe, as listed in the Shanghai Jiao Tong University (2009) rankings. This ranking was used as a familiar metric because it focuses heavily on the "hard" sciences and their role in the knowledge economy. Restricting ourselves to selecting only from the top 500 worldwide universities, our sampling frame resulted to 201 European universities.

The universities included in the survey are found in 19 countries, 201 of which are Shanghai ranked, with 14 additional, lower-ranked universities added from Austria and Switzerland to help understand possible differences between the

[2] See Appendix I.

Shanghai-ranked and unranked groups within countries. Within the overall university sampling frame, we further stratified the sample of academics by discipline, choosing 6 from each university's web page[3] that overlapped the groups studied by Goldstein (2010): Physics, Biological Sciences, Chemical Engineering, Computer Science, Economics and History. Three respondents were drawn from each disciplinary unit present in all sampled universities' web pages, where the director or chair was included when identification was possible, plus two (or three) other randomly selected respondents. This yielded a total of 9,393 invitations to participate in the survey, which were sent as an e-mailed letter of invitation that introduced the survey's purpose and supplied a unique log-in code to secure the file from uninvited or multiple respondents. Excluding all invalid e-mail addresses and respondents who replied to say that they refused to participate, our survey included a final number of 8,826 valid contacts. Respondents could choose to answer survey questions in any of the five most widely used European languages: English, French, German, Italian and Spanish. Of those valid contacts, 1,798 filled out the full questionnaire, yielding a 20 % response rate. Response rates to other surveys of mobility among European academics range as low as 12–16 %, and indeed the UK and Spanish respondents fell within that bracket, although Polish and Italian academics responded at twice these rates (30–33 %). Response rates differed little across disciplines[4] (2–3 % points around the mean).

A few respondent characteristics are offered here to give an overall impression, while further discussion of specific characteristics will be provided in later sections concerning the definition of variables. Males dominate these academic fields (82 %), as do those teaching in PhD granting departments (92 %) and those on permanent contracts (69 %). The median tenure of current posts is 9 years; 1996 is the median year ("degree vintage") in which the terminal degree was granted. Concerning traditional academic duties, 10 % had *no* peer-reviewed publications in the preceding 2 years (26 % had 10 or more); 10 % taught *no* courses in the same period, while 10 % taught 10 or more classes. The so-called Third Mission of social engagement by universities can be found in the 61 % who engaged in uncompensated forms of public service (e.g., public lectures or advice) and by the 30 % who have attempted to commercialise some academic skill, finding or discovery in the market.

[3] French universities presented a serious technical problem: their web pages do not list their academic faculty members and researchers by discipline nor do their web pages supply e-mail addresses necessary to conduct a web survey. As an alternative, we searched the ISI Web of Science to locate and then select academics at a given French university who had previously published in journals of a given discipline. Author data provided on the publications listed in the Web of Science sometimes included e-mail addresses or further information that permitted additional online search to obtain usable e-mail addresses. A subsequent survey of Finnish commercialisation efforts followed a similar procedure (Tahvanainen and Nikulainen 2011).

[4] Chemical engineering was found to be sparsely distributed in the overall sample and among respondents (4 %), while Physics (28 %) and Biological Sciences (25 %) are profusely and diversely represented in nearly all Shanghai-ranked universities, sometimes in multiple academic units at the same university. On the other hand, academic units of Computer Science (18 %), Economics (13 %) and History (12 %) are more evenly distributed across universities and among our respondents.

About 70 % of respondents had at least 6 months of career mobility following receipt of their terminal degree and before taking their current post. With respect to endogamy, about 39 % in current posts received their terminal degree from the same university. A full 75 % indicate they would be willing to accept a new post in another European or world region, assuming certain conditions were met. Why and where such mobility is likely to occur is of course the subject of this article.

3 Mobility Model and Variables[5]

Consistent with our overall analytic framework, the dependent variable for mobility is labelled *Exit*, the first of several Hirschman-inspired variables that apply to academics. It results from a yes or no answer to the following question: "Would you accept a university post in a different region, assuming improved conditions?"[6] The question requests an ex ante comparison of an unspecified but improved future opportunity for university work elsewhere to accepting the status quo ante of the present post. This formulation permits respondents to indicate a general openness to mobility, conditioned only by the prospects of general improvements at a destination. Following Hirschman, one should logically expect the probability of answering yes to be inversely related to answers that indicate loyalty to or voice in the post. A standard logit regression model will be used to model responses in light of several relevant independent variables.

A rich selection of independent variables is provided by the survey, the first of which is *Voice:* a variable directly measured by Likert-scale responses to this question:

> In determining the policies and governance of your university concerning expanded public-private partnerships (e.g., "university-industry" links), please specify the influence exerted by *university academic staff*.

Several other questions in the survey deal with issues of commercialisation and respondents had already given it considerable attention, so this question offers a familiar policy area with which to measure the voice of academics. The formulation of this question was taken from a previous study of European university governance[7] that was based on the responses of university administrators, which also

[5] The complete set of dependent and independent variables can be found in Appendix II.

[6] We focus exclusively on *prospective inter-university mobility*, not ex post mobility or mobility to other research positions (public research centres, industry R&D, etc.), non-university administrative posts or to self-employed/entrepreneurial positions. Of the 1,708 academics who responded to this question, 75.4 % indicated potential mobility to another university.

[7] In this cited study (CHEPS 2006), university administrators were the principal respondents. In addition to the influence of university academic staff, answers to the same questions were also collected concerning the relative influence of Ministries of Higher Education, University Leadership, Business and Industry Leaders and Regional Authorities. More basic questions about university governance and autonomy, which many consider of greater importance, have been raised by Aghion, Dewatripont, Hoxby, Mas-Colell and Sapir (2009).

permits its use as an external and useful benchmark (CHEPS 2006). Academics in the present survey consider themselves to have (1) no influence (9 %), (2) some influence (45 %) or (3) much influence (31 %) on this policy, while in the CHEPS survey, administrators consider *the degrees of influence* exercised by academics, respectively, as (1) 8 %, (2) 64 % and (3) 20 %.[8] The imbalance of responses shows a higher-percentage academics consider themselves to have "much" influence, about 50 % more than university leaders would agree they do. The opposite assessment is even more dramatic: while university leaders (CHEPS) consider their influence to be (1) none (1 %), (2) some (22 %) and (3) much (72 %), academics reduce their assessment of the influence of their university leaders on this matter as (1) 1 %, (2) 39 % and (3) 35 %. Academics deflate administrator claims to much influence by 50 %. There is clearly some potential tension between university leaders and academic staff concerning their respective roles in university governance, which may also be expected to spill over into decisions concerning academic mobility. We intend to capture and test for the effects of this tension by also coding the academics' view of the importance of administrators (*ProvostVoice*) in setting university commercialisation policies. All else equal, stronger administrator voice in governance matters may increase the possibilities of academic mobility.

One may inquire directly about loyalty to an institution (Finkelstein 2012), who surveys a cross section of countries and finds precipitous declines for Anglo-phone universities (particularly the UK and Australia but also the USA), modest declines in selective Latin American and Asian universities, but growth in loyalty alone among German academics. Loyalty can also be measured indirectly in several ways to minimise the potential for strategic responses by relying on questions concerning routine academic activities that signal loyalty. Since remaining at or returning to one's alma mater captures a clear dimension of loyalty, *UniEndog* measures endogamy, which is determined by whether the respondent indicates the terminal degree was (or not) earned at the same university as the present post. Another obvious dimension of loyalty is measured by whether one holds an unlimited or time-limited *Contract* in the present post. A third is measured by the length of time (*Tenure*) spent in the present post, which could reflect aspects of both inertia and previous loyalty. A final dimension is the *Vintage* of one's terminal degree (and a rough proxy of respondent age); the older the degree and its depreciable basis, the less easily one may find or even be willing to entertain other opportunities, i.e., a form of involuntary loyalty. As expected, there is some collinearity among the alternatives.

Despite recent advances, mobility is conventionally thought to be more willingly undertaken by men than women, due to an enabling mix of elements that involve domestic circumstances, career orientation, relative gains from mobility and risk averseness (Kahn and Ginther 2008; Constant and Dágosto 2008). We therefore

[8] Respondents could also select "Not Relevant or Don't Know", which were recoded as missing values in this frequency distribution, representing the remaining percentages.

assume that *gender* (0/1 male) increases the probability of exit mobility. The academic practices of respondents could also affect mobility decisions, e.g., the systematic use of research funds to produce highly visible peer-reviewed scientific publications (*SciPub*). Working in an academic department in which PhD students are studying (*PhdProg*) may also reveal strong research interests and thereby promote mobility. The reasoning is generally the same: scientific prowess and focus are the internationally signalled *and* universally recognised qualities among other potential science-oriented destinations, thereby expanding mobility possibilities. Finally, following Constant and DÀgosto (2008) and Crespi et al. (2005), we expect academics with post-degree mobility (*PostDegMob*) more likely to be mobile in the future. To repeat, we hypothesise positive and significant signs for these variables.

Academic activities may also tend to anchor respondents in their current post if activities yield valued contacts with non-academics that could be difficult to replicate in another country. In such circumstances, academics might be less likely to exit their post for another. More specifically, the academic contacts made with collaborative industry colleagues (*CollabProj*), the clients from whom funds were received to prepare client or policy reports (*PolicyPub*) or the actions with external others necessary to commercialise one's academic discoveries and talents (*Commerce*) all measure tangible connections with local businesses and industry. In addition to the potential loss of networks valued for their own sake by an exit decision, there may be adverse pecuniary consequences as well.

Productivity in conventional academic terms may also have a bearing on willingness to exit. Highly published academics are usually visible to other universities eager to enhance their scholarly profiles and might therefore become the intended object of recruitment efforts. If so, the number of peer-reviewed publications (PeerRevPubs) claimed by respondents could be expected to increase their exit possibilities. Crespi et al. (2005) show the chances for mobility of European academics are higher for those with more peer-reviewed publications (*PeerRPubs*), as do Kahn and Ginther (2008) for the USA.[9] Very different reasoning is involved with instructional productivity, as high average number of classes taught (ClassLoad) is unlikely to attract attention of other universities; however, respondents with heavy class obligations may consider exit as a means of escaping the burden of teaching pressure. Academics may feel pushed from home institutions by an obligation to teach relatively heavy course loads and thereby hope to escape some of the burden (or even lack of appreciation) by relocation to another more

[9] Likert-scaled responses to publication totals provide a rough measure of academic productivity, an exploratory ordered-logit model (not shown here) of which indicates clearly that among sample respondents, previous mobility in other institutions or countries exerts a strong and positive influence on academic productivity, which corresponds to recent findings of Kim et al. (2006). The productivity benefits sought through various EC and other European measures to stimulate mobility therefore appear to be well founded, offering further support for efforts to understand better the factors that underlay academic mobility.

favourable institution.[10] Finally, academics who become actively engaged in their communities (*PubSvs*) as part of their university's "Third Mission" obligations are often in an excellent position to develop valued relationships not easily or casually broken. Indeed, they may ". . .have enhanced human capital and developed commercial and social networks that are highly effective. . ." (Markman et al. 2008). On the other hand, these academics are far more exposed to other sectors, organisations and ideas; consequently, they may be more willing to consider new possibilities, including a new post elsewhere. Our expectation is therefore uncertain for *PubSvs*; it could positively or negatively affect exit probabilities.

Factors that characterise academics are of considerable interest in this model, including those that characterise the respondent and the respondents' structural relation to the university. One group consists of control variables for the discipline to which a respondent belongs, including those that distinguish between the so-called "pure" and "applied" sciences or between them and the "social" sciences. The disciplines *Physics*, *Biology*, *ComputerSci*, *Chemical Engineering* and *Economics* will be compared with base case of *History*. The universities themselves may differ in ways that induce greater overall mobility, perhaps indirectly. European universities that offer specialised degree programs or enjoy great prestige—the academics of which are often highly recruited elsewhere—could be expected to experience generally greater mobility. There is no a priori for disciplinary differences in mobility among academics, although the institutionally and culturally specific social sciences might be somewhat less mobile than the physical sciences. The presence of specialised technology-oriented degree programs ("general tech" *Engineering*, "red tech" *Medicine* or "green tech" *Agriculture*) or membership in LERU (Leading European Research Universities) signifies some of the most popularly recruited categories.

A second group of control variables refer to the surrounding social and economic context faced by respondents. Economic distress in the immediate vicinity of one's university post may offer family-related grounds for mobility, particularly if one's spouse or children seek but cannot find paid employment. These conditions are proxied by average (*RegUE2007*) and long-term (*LTRegUE2007*) unemployment rates of the locality. More broadly, the country in which one's university is located indicates the national university system from which an academic might (or not) be interested in exiting, perhaps due to the relative national wealth and resources devoted to university systems, the knock-on effects of which could affect academic mobility decisions. Finally, the EU macro-region in which the country is located may introduce broader cultural, historical or language influences on an academic's exit decision. These are *EU-10Reg* (recent accession countries), *MediternReg* (EU countries on Mediterranean) and *MidContinentReg* (EU continental core) that are compared to *NordicReg* (Nordic countries) as the base variable.

[10] "In research universities, teaching load is also important. It's quasi-impossible to both do cutting-edge research and be an excellent teacher when the teaching load of a professor is close to 200 h per year", from interview "Innovative universities must attract top researchers" with Professor Jean-Claude Latombe, *EurActiv*, 9 April 2009; http://www.euractiv.com/en/science/latombe-innovative-universities-attract-top-researchers/article-181199.

4 Modelling Mobility Among European Academics

The model used here will attempt to explain the willingness to leave a present post, which is a dichotomous choice, calling for a standard logistic regression model. To gain a bit of clarity, we first parse the independent variables into groups that represent important conceptual ensembles for logit modelling, before considering their entry in an aggregate model. Panel 1 (Table 12.1) examines the Hirschman variables alone, which are of greatest theoretical interest.[11] They do not disappoint in either sign or significance. Two highly significant loyalty variables, Vintage and Tenure, show that long-loyal academics are much less likely to consider future exit from their university posts in search of another. The voice variables are also compelling and reinforcing: academics that consider their own voices important in governance issues are significantly more likely to remain, but those who think administrators have powerful voices—presumably at the cost of their own—are more likely to exit. The coefficients reflect the earlier contrasting depictions of influence from this and the CHEPS administrator survey.

The next group of variables tested in panel 2 cover a range of typical academic activities and relationships that might affect mobility decisions. Somewhat surprisingly, very little of what or how much academics actually do in their present posts appears to affect their future mobility. Those who were previously mobile are somewhat likelier to continue, but the other academic practice variables remain convincingly insignificant.

The five control variable groups (panels 3–7) have varying influence: one discipline only (Economics) shows significant negative effects, two specialised technical degree offerings at respondent universities have significantly positive effects (Agriculture, Engineering), local economic distress is significantly associated with greater mobility, while several national university system controls feature significantly higher mobility,[12] although EU10Reg respondents show reduced mobility.

The full model assembles all seven variable groups' results (panel 8). Strong support continues for the importance of "Hirschman effects" in academic mobility decisions. Loyalty variables also remain highly significant, while both academic voice and administrator voice variables gain significance. One must necessarily conclude that academics with stable career histories and shorter remaining career prospects are quite likely to be *immobile* in the future. At the same time, academics who claim to exercise voice to influence local university governance issues are also less likely to consider future mobility, due perhaps to the satisfactions expected from its exercise or from its expected fruits. Academics do react to threats posed by relative loss of governance, since academic exit probabilities rise significantly with increases in administrator voice. These are precisely the results one can expect if respondents behave as Hirschman hypothesised. The perceived loss of governance participation by academic respondents stimulates mobility in significant ways.

[11] Collinearity problems eliminated some Hirschman loyalty variables.

[12] Austrian, British, Dutch, French, German, Italian, Swedish and Swiss universities show positive effects.

Table 12.1 Variable group and aggregate mobility models

Logit models	Logistic regression															
	1		2		3		4		5		6		7		8	
Panel 1																
Tenure	−0.04	**0.00**													−0.03	**0.00**
Vintage	−0.02	**0.04**													−0.04	**0.00**
Voice	−0.30	**0.02**													−0.31	**0.03**
ProvostVoice	0.25	**0.07**													0.37	**0.01**
Panel 2																
Gender			0.20	0.16											0.49	**0.00**
PostDegMob			0.22	**0.09**											0.34	**0.03**
PeerRPubs			0.02	0.64											0.09	0.19
ClassLoad			−0.03	0.54											0.01	0.84
SciPubs			−0.09	0.55											−0.08	0.64
PolPubs			−0.09	0.43											0.06	0.67
Panel 3																
Physics					−0.18	0.36									−0.24	0.33
Economics					−0.44	**0.05**									−0.43	*0.11*
ComputerSci					−0.13	0.55									−0.33	0.21
Biology					−0.20	0.33									−0.26	0.28
ChemEngr					−0.04	0.91									0.25	0.55
Panel 4																
EngineergDeg							0.26	**0.03**							0.32	**0.05**
MedicalDeg							−0.02	0.89							0.43	**0.02**
AgriDeg							−0.48	**0.00**							−0.13	0.50
LERU							−0.07	0.67							−0.24	0.27
Panel 5																
RegUE2007									0.00	**0.02**					0.00	0.96
LTRegUE2007									0.10	**0.00**					−0.05	0.31

(continued)

Table 12.1 (continued)

Logit models	Logistic regression															
	1		2		3		4		5		6		7		8	
Panel 6																
The United Kingdom											1.23	**0.00**			0.84	**0.05**
Switzerland											1.64	**0.00**			1.36	**0.00**
Sweden											1.41	**0.00**			1.16	**0.03**
Spain											−0.01	0.98			11.69	0.99
Portugal											0.25	0.69			11.72	0.99
Poland											0.20	0.72			1.80	**0.07**
The Netherlands											1.48	**0.00**			1.04	**0.02**
Italy											0.85	**0.02**			12.19	0.99
Ireland											0.79	0.14			−0.18	0.78
Hungary											−0.34	0.52			0.66	0.49
Germany											1.94	**0.00**			1.59	**0.00**
Greece											0.25	0.69			11.92	0.99
France											1.56	**0.00**			13.24	0.99
Denmark											0.42	0.29			−0.23	0.63
Belgium											0.65	0.13			0.18	0.73
Czech Rep											1.08	0.15			1.37	0.21
Austria											1.15	**0.00**			1.39	**0.00**
Panel 7																
Mediter Reg													0.25	0.23	−11.82	0.99
EU10Reg													−0.53	**0.09**	−0.97	0.28
Mid Cont Reg													0.89	**0.00**	Omitted	
Panel 8																
Const./$P > \chi^2$	32.24	**0.03**	0.95	**0.00**	1.31	**0.0**	1.10		1.01	**0.00**	−0.10	**0.00**	0.53	**0.00**	70.75	**0.00**
Pseudo R^2/*obs*	0.070	*1617*	0.003	*1698*	0.002	*1706*	0.008	*1706*	0.006	*1706*	0.063	*1706*	0.029	*1706*	0.132	*1613*

As expected, respondents who were previously mobile or who are male are shown here as significantly more likely to exit their present posts. Respondents from universities that offer Medical or Engineering degrees also appear more likely to experience overall mobility, perhaps as a consequence of their highly recruited faculties exerting strong cross-discipline influence on the respondent disciplines taken as a whole: respondent disciplines alone show little effect (Economics is barely insignificant). The national controls change somewhat in this aggregate model, and EU macro-regions lose all direct effect.

5 Mobile Academics: Conditions and Destination Selectivity

The 75 % of total respondents who indicated an interest in mobility were identified and queried further about (1) conditions sought in an alternate destination and (2) which global destinations—Australia, Asia, Europe, North America and South America—were preferred. Any combination of destinations could be selected, with the total for any respondent ranging between 1 and 5 locations. Those selecting only one destination region appear to be highly selective, they are one-third of all who are mobile, and the ERA is preferred by most of those preferring a single destination. Another quarter selected only two potential destinations. In both cases, the respondents may be open only to clear improvements in their situations and they may also have good knowledge of options and circumstances at those destinations. On the contrary, those selecting four or five destinations are relatively indiscriminate and are open to many alternatives to their present post. Figure 12.1 summarises various combinations of numbers of destinations sought with the conditions sought in all destinations.

A typical profile of conditions most highly sought is clearly evident: better research opportunities, higher salaries and promotions are most frequently mentioned conditions (respondents could select the three most important from a list of 14 condition improvements), while less publishing pressure, better social benefits and more contacts with firms and other organisations are least frequently mentioned and presumably least important conditions. The most frequently mentioned conditions are wholly logical and well documented in the literature; moreover, these are among the conditions many national systems of higher education are now considering to staunch the loss of valued academics who might seriously be considering an exit option. Other options high on the EC's list of desiderata appear in our data to be far less important than once thought, particularly health and pension benefits, and language preference.

Despite the protestations of academics concerning rising publishing pressures in the new competitive environment of rankings and faculty recruitment wars, this is the *least important* consideration to anyone considering exit. A tolerance for higher publication expectations could indicate a latent capacity for more research output from university academics, given suitable incentives and policy adjustments within universities.

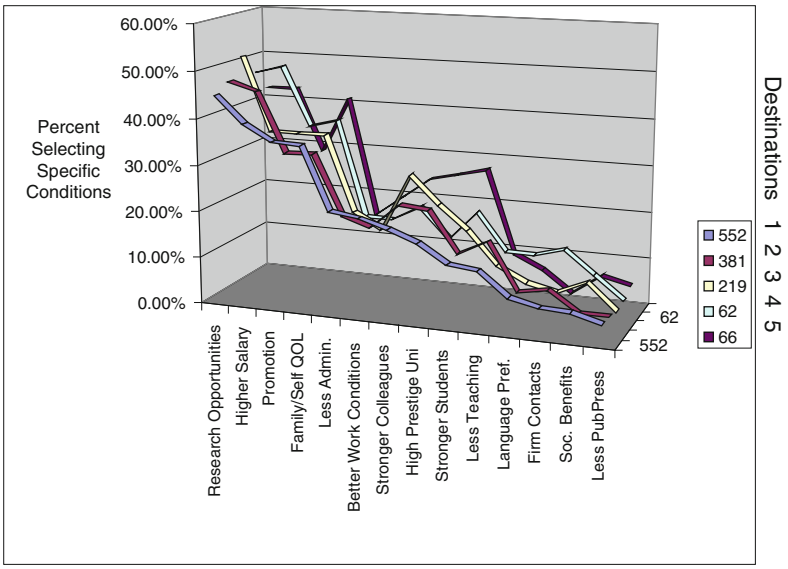


Fig. 12.1 Is the number of potential exit destinations related to destination conditions?

These preferred conditions can be subdivided into two categories that increasingly autonomous universities might act upon through resource reallocation/generation (research opportunities, higher salaries, promotion, lessened teaching load) or altered governance (reduced administration, working conditions, stronger faculty and student colleagues, higher rank/prestige university, less publication pressure), plus the purely in situ category that offers intrinsic advantages of a country or region (family/self QOL, preferred language, contact with firms, social benefits).

6 European Research Area Mobility: Stay or Go?

The descriptive summary provided in the previous section offers good insight into the overall conditions sought by mobile academics and some indication of their selectivity, i.e., one or all possible destinations. Missing is an understanding of *which* destinations are important and why. We therefore code all possible destination combinations into three mutually exclusive categories,[13] which consequently permit the use of a multinomial logit model. Respondents who selected *only* an ERA destination ($n = 512$) are considered in Hirschman terms to be loyal to the European Research Area, even if not to their present university, as they might be willing to move from their home post but to stay within Europe. Expanding this

[13] Twenty-seven unique destination combinations were selected by respondents, which were reduced to three that permit our model to focus on the ERA. For details, see Appendix I.

group is an explicit goal of ERA measures. The second much smaller comparison group consists of those respondents whose selections *excluded* any ERA destination ($n = 54$), about half of whom prefer North America only. The third group consists of respondents who included Europe among one or more other of four possible destinations ($n = 837$) and are thereby apparently indifferent to an EU destination. This last group forms the large reference case from which the ERA-only or non-ERA groups can be shown to differ in their responses to the independent variables. It also includes a substantial number of possible North American and other destinations in various mixtures that resemble the palette of choices typically considered by "nomadic" scientists and academics who circulate widely and are actively recruited. We rely on multinomial logit regression to distinguish the relative effects of our independent variables on the three mutually exclusive destination options.

The technical interpretation of multinomial models can be a bit complicated, as the coefficients indicate *relatively* greater or lesser influence of the variables on alternative destination categories (ERA only or non-ERA) rather than choosing "ERA-indifferent" destinations, which serves as the reference case in our model. To aid interpretation, the results are expressed in "relative risk ratios" (rrr), whose values indicate whether either alternative has a relatively higher (>1) or lower (<1) probability of responding to a unit change of a given variable than the reference case (mixed destinations). A ratio of equal probabilities would be 1.0 (and insignificant); a ratio >1.0 (and significant) indicates relatively how much more likely the alternative (A or B) is affected by a unit change of a variable than the reference case, and the opposite interpretation applies for significant ratios <1.0. We therefore focus our interpretation on the values of those variables with significant probabilities (as per values of column P > |z| in bold) for each alternative in Table 12.2.

The results of the model are limited to the comparison of EU-only vs. base (mixed EU/other) destinations to better understand why mobile academics might remain within the ERA. Most of the variables included in this model are repeated from the mobility-decision model, plus conditions respondents thought necessary to consider mobility (Adminst, Benefits, Conditions, Family, Firms, Ppressure, Promotion, Colleagues, Language, Ropportunity, Prestige, TeachLess, Salary, Students).

Only a few control variables showed effects: chemical engineers and physicists were 2.4–1.6 times more likely to choose destinations within the ERA, as were respondents (1.4×) from universities that offer agriculture degree programs. None of the local, national or EU region control variables proved significant.

However, we see again the importance of governance issues in determining destination, although their coefficient significance has unsurprisingly waned: respondents with voice are about 30 % *more* likely—and respondents experiencing strong administrative voices are 22 % *less* likely—to select ERA-only destinations. Governance issues continue to influence academics' choice of remaining in the ERA or looking elsewhere. None of the academic practices appear to affect the destination choices of respondents.

The conditions respondents sought by relocating were powerful and meaningful. Relocating academics who seek more challenging colleagues, better prepared

Table 12.2 Mobility destination model (EU only[a] vs. reference base)

	Multinomial logistic regression		
Variable	rrr	*z*	$P > \|z\|$
Tenure	1.00	0.37	0.71
Vintage	1.01	0.77	0.44
Voice[b]	**1.32**	**1.96**	**0.05**
ProvostVoice[b]	**0.78**	**1.69**	**0.09**
Gender	1.01	0.06	0.95
PostDegMob	0.93	0.48	0.63
PeerRPubs	1.06	0.87	0.38
ClassLoad	1.02	0.37	0.71
SciPubs[c]	0.78	1.50	0.13
PolPubs	0.82	1.45	0.15
Physics	**1.66**	**2.05**	**0.04**
Economics	1.36	1.14	0.26
ComputerSci[c]	1.00	0.00	1.00
Biology	1.03	0.14	0.89
ChemEngr[b]	**2.44**	**2.25**	**0.02**
Engineering[c]	0.88	0.85	0.40
Medical	0.91	0.53	0.60
Agriculture[b]	**1.39**	**1.72**	**0.09**
Leru	0.94	0.26	0.79
Adminst	0.91	0.45	0.66
Benefits	0.66	1.36	0.18
Conditions	1.03	0.17	0.87
Family	0.88	0.73	0.47
Firms[b]	**0.62**	**1.68**	**0.09**
Ppressure	0.86	0.43	0.67
Promotion	0.88	0.64	0.52
Colleagues[b]	**0.59**	**2.58**	**0.01**
Language	0.77	0.96	0.34
Ropportunity[b]	**0.68**	**2.22**	**0.03**
Prestige[b]	**0.57**	**2.69**	**0.01**
TeachLess	**0.69**	**1.59**	0.11
Salary[b]	**0.63**	**2.55**	**0.01**
Students[b]	**0.62**	**2.15**	**0.03**
RegUE2007	1.00	1.32	0.19
LTRegUE2007[c]	0.97	0.63	0.53
The United Kingdom[c]	0.46	1.33	0.18
Switzerland	0.60	0.88	0.38
Sweden	0.60	0.78	0.44
Spain	1.87	0.84	0.40
Portugal	1.45	0.33	0.74
Poland	5.55	1.17	0.24
The Netherlands	1.00	0.01	0.99
Italy	1.22	0.32	0.75
Ireland	0.88	0.16	0.88
Hungary	5.99	1.22	0.22

(continued)

Table 12.2 (continued)

	Multinomial logistic regression		
Variable	rrr	*z*	$P > \|z\|$
Germany	1.10	0.17	0.87
Greece	0.88	0.11	0.91
France	0.68	0.61	0.54
Denmark	0.67	0.60	0.55
Belgium	1.58	0.68	0.50
Austria	1.03	0.05	0.96
Slovenia		Omitted	
Finland		Omitted	
Czech Rep	2.54	0.62	0.54
Mediter Reg		Omitted	
EU10Reg	0.39	0.67	0.50
Mid Cont Reg		Omitted	

$N = 1210$; LR $\chi^2(106) = 172$; Prob $> \chi^2 = 0$; Log likelihood $= -910.3414$; pseudo $R^2 = 0.09$

[a]The no-EU alternative proved generally insignificant, due to its small numbers, and is excluded from discussion

[b]Variable is significant in hierarchical group and total models

[c]Variable is significant only in hierarchical group model

students, improved salaries, better research opportunities, more prestigious university or improved chances to work with local firms are 32–43 % *less likely* to select ERA-only destinations,[14] instead favouring the reference case of mixed destinations. It bears noting that most of these conditions are offered by leading world universities and are rapidly coming under the decentralised policy control of European university administrations, while opportunities to work with local firms also depend heavily upon regional development and business leaders. In short, the respondents for whom improved conditions are important in deciding to relocate are considerably less likely to settle for an ERA-only destination.

7 Principal Findings

The voice and loyalty variables most closely associated with Hirschman's view of the exit option perform as expected and are generally the most significant and noteworthy. Two of the variables that affect the chances for an ERA-only destination can be traced to Hirschman. As we saw in the mobility-decision model, a strong voice by university leadership stimulated exit from universities, while it also reduces heavily the probability that mobile respondents will select an EU-only destination. On the other hand, respondents that claimed academic voice in university governance are more likely to remain in their university *or* within the ERA if they have considered mobility. Overall, university governance schemes are shown

[14] Reduced teaching loads were barely insignificant, which warrants mention.

here to have powerful and significant—perhaps under-appreciated—effects on the decision of academics to exit their university or the ERA.

At the same time, these powerful Hirschman effects wash away possible hypothesised effects on mobility decisions from differences in economic health of respondents' present university region, in research-based university rankings, in traditional mission performance (e.g., teaching or research) or discipline of respondent or in European region. It is the relation of a scholar to his or her institution that appears decisive in decisions to become mobile. Choice of possible destination (ERA or non-ERA) for mobile respondents pivots heavily on advantages[15] available at potential future locations and on two of the disciplines, but the national university effects vanish for these opposite outcomes.

8 Conclusions

Academic mobility between universities and with respect to European circulation follows closely the core ideas about exit from organisations that were advanced a half-century earlier by Hirschman. There is much to consider here for attentive EU policymakers, national ministries of higher education and university administrators, particularly if their intent is to retain Europe's academics within the ERA and to reap the benefits of knowledge flows within Europe.

Of great importance are the several conditions that reduce EU-only destination preferences, which are rather worrying because they confirm conventional wisdom, yet they offer clear opportunities for redress. These are conditions where improvement is possible and where obstacles to ERA success are clearly visible. Salaries in many university systems are often unrelated to accomplishment or lag behind alternative opportunities, particularly for specific academics and disciplines in the greatest demand around the world. The same is true for research opportunities, although some progress has taken place and may continue if funding for universities, R&D infrastructure and innovative projects gains further importance. We note also lessened preference for EU-only destinations among respondents who seek stronger colleagues and students or a post in more prestigious universities.

This issue challenges typical policies that promote simple mass education within universities. It also focuses attention on the importance to mobile academics of excellence in the academic enterprise, which in turn raises the question of better meritocratic selection of established academics and aspiring scholars. Highly

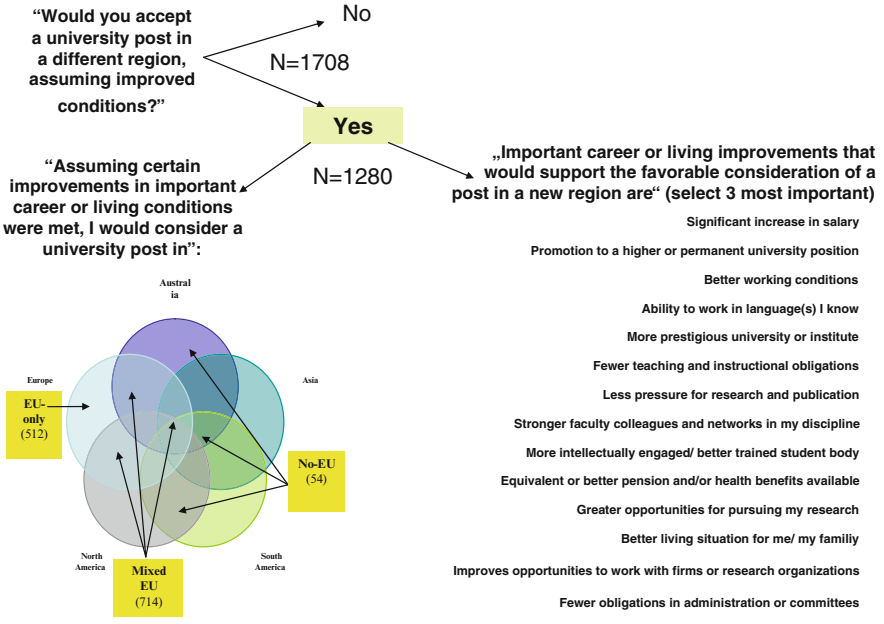
[15] We have also learned what is *relatively unimportant* in retaining academics within the ERA: (1) reduced administrative burdens, (2) better working conditions, (3) improved quality of life for family and (4) career promotion.

These are important conditions for *all* destinations, but differences among them do not appear to affect choice of destination alternatives. Destination choices are also unaffected by (1) language preferences, (2) improved social benefits and (3) less publication pressure, which are all far less important everywhere and might therefore be safely ignored while focusing policy attention on the more important conditions.

qualified scholars may come to recognise even more fully the leverage that potential mobility could have when matters of institutional governance come into play.

University administrators will want to review policies that give voice to academics, as well as those that instil loyalty, while also reconsidering opportunities for moderating or blending their own voices in the interests of retaining and attracting academic excellence. It is entirely possible that several additional policies will need to be revised somewhat to retain their best scholars, while providing an appealing destination to potentially mobile academics the same universities hope to attract. We now have a clearer sense of which conditions are most appealing to mobile academics at both the university and ERA levels and what could be done to take better advantage of intra-EU mobility.

Appendix I



25 combinations of place categories selected by respondents are generated from these codes:

1=EU

10=NA

100=AU

1000=AS

10000=SA

whose values are then reduced to the 3 EU-relative categories as per column headings and Venn diagram above.

Combinations	NO-EU	Mixed-EU	EU-ONLY	Total
1	0	0	512	512
10	26	0	0	26
11	0	312	0	312
100	6	0	0	6
101	0	35	0	35
110	7	0	0	7
111	0	165	0	165
1000	5	0	0	5
1001	0	12	0	12
1010	3	0	0	3
1011	0	25	0	25
1101	0	7	0	7
1110	2	0	0	2
1111	0	39	0	39
10000	3	0	0	3
10001	0	11	0	11
10010	1	0	0	1
10011	0	13	0	13
10101	0	5	0	5
10111	0	14	0	14
11001	0	1	0	1
11010	1	0	0	1
11011	0	7	0	7
11101	0	2	0	2
11111	0	66	0	66

Appendix II

Variable label	Definitions of dependent variables	Mean Std dev	Min. Max.	Observations
Model 1 mobile academics	Would consider accepting a post at another university	0.75 0.43	0 1	1,708
Model 2 mobility destinations	Destination *categories* of mobile academics: no EU = 1 (54), mixed EU = 2 (714), EU only (512) = 3	NA	NA	1,280

Variable label	Definitions of independent variables	Mean Std dev	Min. Max.	Observations
UniEndog	Present post at same university that granted terminal degree	0.38 0.49	0 1	1,716
Contract	Unlimited employment contract	0.69 0.46	0 1	1,716
Tenure	Number of years at present post	11.4 9.7	0 44	1,799
Vintage	Number of years since terminal degree received	35.0 10.7	0 51	1,689
Voice	Influence of academic staff on university governance	0.32 0.47	0 1	1,694
ProvostVoice	Influence of university administrators on university governance	0.74 0.44	0 1	1,692
ExternalVoice	Influence of industry leaders on university governance	0.60 0.49	0 1	1,684
ClassLoad	Class teaching load in the last 2 years[a]	2.86 1.16	1 5	1,798
Gender	Male	0.81 0.39	0 1	1,798
PeerRPubs	Output of peer-reviewed publications in the last 2 years[a]	3.44 1.27	1 5	1,798
PhdProg	Present post in academic department with PhD students	0.92 0.27	0 1	1,732
PostDegMob	At least 6 months experience elsewhere between degree and present post	0.70 0.46	0 1	1,724
PubSvs	Non-compensated service to external parties in previous 6 years	0.39 0.49	0 1	1710
SciPubs	Peer-reviewed publications generated from funded research	0.76 0.42	0 1	1,798
Commerce	Taken actions to commercialise academic findings or skills	0.30 0.46	0 1	1,730
NatEndog	Present post in same country as university granting terminal degree	0.74 0.44	0 1	1,716
Policy	Client or policy reports generated from funded research	0.34 0.47	0 1	1,798
CollabProj	Collaborative funded research with industry colleagues	0.46 0.50	0 1	1,798

(continued)

Variable label	Definitions of independent variables	Mean Std dev	Min. Max.	Observations
PeerRevKnow	Peer-reviewed publications best measure of university knowledge[b]	2.25 1.06	1 5	1,715
BasicThreat	Basic science threatened by university research commercialisation[b]	3.66 1.07	1 5	1,710
The United Kingdom	Respondent in a UK university	0.13 0.33	0 1	1,799
Switzerland	Respondent in a Swiss university	0.07 0.25	0 1	1,799
Sweden	Respondent in a Swedish university	0.03 0.16	0 1	1,799
Spain	Respondent in a Spanish university	0.03 0.18	0 1	1,799
Portugal	Respondent in a Portuguese university	0.01 0.09	0 1	1,799
Poland	Respondent in a Polish university	0.01 0.11	0 1	1,799
The Netherlands	Respondent in a Dutch university	0.09 0.29	0 1	1,799
Italy	Respondent in an Italian university	0.07 0.25	0 1	1,799
Ireland	Respondent in an Irish university	0.01 0.12	0 1	1,799
Hungary	Respondent in a Hungarian university	0.01 0.12	0 1	1,799
Greece	Respondent in a Greek university	0.01 0.09	0 1	1,799
Germany	Respondent in a German university	0.29 0.45	0 1	1,799
France	Respondent in a French university	0.08 0.26	0 1	1,799
Denmark	Respondent in a Danish university	0.04 0.19	0 1	1,799
Belgium	Respondent in a Belgian university	0.03 0.17	0 1	1,799
Austria	Respondent in an Austrian university	0.07 0.25	0 1	1,799
Colleagues	Work with stronger colleagues	0.21 0.40	0 1	1,379
Ropportunity	Better research opportunities	0.43 0.50	0 1	1,379
Students	Work with stronger students	0.14 0.35	0 1	1,379
Salary	Higher salary	0.38 0.49	0 1	1,379
PubPress	Less publishing pressure	0.03 0.18	0 1	1,379
TeachLess	Lower course load	0.12 0.33	0 1	1,379

(continued)

Variable label	Definitions of independent variables	Mean Std dev	Min. Max.	Observations
FirmOrg	Better contacts with firms, organisations	0.06 0.24	0 1	1,379
LessAdmin	Less administration/committees	0.18 0.39	0 1	1,379
Benefits	Better health/pension benefits	0.05 0.22	0 1	1,379
QOW	Quality of working conditions	0.18 0.38	O 1	1,379
FamilyQOL	Quality of life for self/family	0.33 0.47	0 1	1,379
Language	Ability to work in preferred language	0.07 0.25	0 1	1,379
Promotion	Promotion to a higher/permanent post	0.31 0.47	0 1	1,379
Prestige	More prestigious university	0.18 0.37	0 1	1,379

[a]1 = 0, 2 = 1–2, 3 = 3–5, 4 = 6–10, 5 = >10
[b]1 = totally agree; 5 = totally disagree

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Chapter 13
Action-Based Education in Academic Entrepreneurship: A New Role of the Student?

Lene Foss, Elin M. Oftedal, and Tatiana Iakovleva

1 Introduction

The scope of entrepreneurship programs offered by academia has expanded significantly in many areas around Europe, Asia, North America, Australia, and New Zealand (Gartner and Vesper 1994). With reference to the theory of planned behavior and the literature on entrepreneurship education, research has confirmed that students involved in entrepreneurship programs increase their competencies and strengthen their intention towards self-employment (Fayolle et al. 2006; Mwasalwiba 2010; Sanches 2010). In examining the literature, more economically oriented studies with ex ante and ex post survey responses find that students learn about their entrepreneurial aptitude through entrepreneurship education (von Graevenitz 2010). Based on previous research, Dutta et al. (2011) conclude that specialized entrepreneurship education has a significant positive impact on the likelihood of future venture creation. However, a diverse and broad-based educational experience seems to make a critical difference in terms of the entrepreneurs' personal income and net worth. Thus, the former facilitates venture creation, whereas the latter adds to entrepreneurial success. Further, it has been noted that academic entrepreneurship is regarded as an experience or outcome, rather than a clearly defined role (Jain et al. 2009). Interestingly, in research on entrepreneurial universities (83 studies in all) revealing organizational designs that encourage commercialization of university innovations, a focus on entrepreneurial education is not apparent. The term academic entrepreneurship has been treated as a task academics can perform, but not as a role in itself (Jain et al. 2009). Thus, we reveal a blank spot in previous literature on how the new action-based entrepreneurship programs offered

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by universities affect the role of students (Foss and Lozano 2012; Ollila and Williams-Middleton 2011; Rasmussen and Sørheim 2006).

In this paper we therefore ask: *How do action-based entrepreneurial programs aimed at commercializing RBIs affect the role of the entrepreneurial student?*

In answering this question we develop a model which expands prior research on academic entrepreneurship, entrepreneurial education, and role theory. In developing propositions we use quotes from students' experiences with an action-based entrepreneurial program aimed at commercializing RBIs[1] to support our arguments. Our main thesis is that the role of the entrepreneurial student is one that evolves and changes due to different institutional settings and individual skills and motivation.

This paper is structured as follows: we firstly give a brief description of the way entrepreneurial teaching has developed over the years, and then we review the literature on the role of entrepreneurs in academic entrepreneurship to establish the dimensions of the role of the student. We illustrate discussion with quotes from interviews. We develop three propositions followed by a model and conclude with a discussion on the limitations of the study and the implications for theory and policy.

2 Can Entrepreneurship Be Taught?

Entrepreneurship studies can be broadly divided into three categories—teaching *about*, *in,* and *for* entrepreneurship (Hytti and O'Gorman 2004; Kirby 2004). Teaching *about* entrepreneurship is aimed at giving students a general understanding of entrepreneurship as a phenomenon (Hytti and O'Gorman 2004). The objective is to educate different stakeholders, including policy makers, financers, and the general public on the role of entrepreneurs in the community. The training of individuals *in* entrepreneurship is aimed at making them more entrepreneurial in their work as well as increasing their innovativeness and creativity. Educating *for* entrepreneurship refers to the creation of an entrepreneur, the individual who decides to start his or her own business.

Educating *for* entrepreneurship is actually the most beneficial to society. There is a discussion in the literature on the most suitable teaching methods for educating students for entrepreneurship. Here "traditional" methods of teaching are not always the most suitable and appropriate. The benefits of action-based entrepreneurship education built upon a venture creation approach have been discussed in previous research, along with the challenges of facilitating such learning experiences (Kirby 2004; Ollila and Williams-Middleton 2011; Rasmussen and Sørheim 2006; Siegel

[1] This program is the Master of Science in Business Creation and Entrepreneurship at Tromsø University Business School in Norway. The two-year program which builds on a co-creation model with collaboration between the BCE program at the Business School, the inventors at the Tromsø University, and the Technology Transfer Office (TTO) started in 2008 and has produced several spin-offs where students are co-entrepreneurs. This paper uses quotes from the 25 interviews (with students, inventors, and TTO) reflecting collaborative challenges.

et al. 2003). For such learning to happen, it is necessary to stimulate entrepreneurial processes, providing students with the tools to start a business. Educators can use new venture creation to help students acquire a range of both business understanding and skills (Kirby 2004).

In a review of 103 peer-reviewed articles dealing with entrepreneurship education Béchard and Grégoire (2005) investigate the main elements in entrepreneurship teaching. The authors find the focus to be mainly on the social and economic role of entrepreneurship education for both individuals and society. Furthermore, there is apparent interest in systemizing entrepreneurship education, i.e., in how to develop a curriculum, as well as a focus on the content to be taught and how it should be presented to the students. Finally, there is an interest in how to meet students' individual needs by structuring the teaching activities. The three subjects not addressed included contributions from a social-cognitive approach, a psychological-cognitive approach, and a spiritual and ethical approach. Thus, Béchard and Grégoire (2005) conclude that research on entrepreneurship education generally fails to consider the reasons that motivate particular educational choices.

3 The Role of the Entrepreneurial Student in Academic Entrepreneurship

The academic entrepreneurship literature points to an essential conflict between the primary motivations of the university scientist on the one hand and the firm or entrepreneur on the other (Siegel et al. 2003). Recent research suggests that the relationship between these two actors may take different constellations (Jain et al. 2009; Spilling 2008) and that some scientists manifest disparate concerns and attitudes regarding research commercialization (Owen-Smith and Powell 2011). This illustrates the challenges of commercializing university-based research, as science and industry are based on different types of logic and knowledge; while science is reflective and future-oriented, industry is more action-oriented and needs short-term results.

Additionally, these conflicting motivations are continually reinforced by the demands of the different institutional environments of science and business. The role of the scientist may therefore be hard to combine with the role of the entrepreneur as cultural differences are many and extensive (Cunningham and Harney 2006). Thus, the relationship between institutions and roles in academic entrepreneurship needs to be explored.

In role theory, the concept of role ambiguity refers to the lack of specificity and predictability of a specific role (Beehr 1976; Kahn et al. 1964). Unclear role-related information may lead to role ambiguity. Moreover, role conflict results from two or more sets of incompatible demands involving work-related issues (Kahn et al. 1964; Katz and Kahn 1978). As such, the organizational and role context of their behavior is deemed to distinguish academic entrepreneurs from others who are engaged in entrepreneurial activity. We claim that this represents an understudied issue and that we need more knowledge of how and why role ambiguity develops.

Jain et al. (2009) identify a fundamental difference in the role of the academic and the role of the entrepreneur when it comes to norms, processes, and output. Whereas the norms of the academic are universalism, collectivism, disinterestedness, and skepticism; the norms of the entrepreneur are uniqueness, private property, passion, and optimism. The processes of the academic are characterized by experimentation, long-term perspective, and individualism, while the processes of the entrepreneur have a narrower focus, a short-term perspective, and are more team oriented. Finally, the output of the academic is measured in publication and peer recognition, while the output of the entrepreneur is measured in products and profits.

These role differences may raise the barriers for academics to commit to academic entrepreneurship. This argument is supported by other research (Owen-Smith and Powell 2011) and points to a possible division of labor where the scientist remains in his/her role as the inventor of ideas and other actors explore and develop the commercial potential of the idea. This role of co-entrepreneur may be assigned to a student. Students are academically educated and have a network within academia through other students and professors, but they are not rooted in academia in the way scientists are, and they have their eyes on business as their future work medium. In addition, students may have the quality of an entrepreneurial change agent as they are not yet deeply embedded within any specific institutional setting. The quote below illustrates this notion:

> These guys are relatively young people and I think the advantage has been that they are eager to expand their knowledge, not only in the entrepreneurship sector, but also in the technology sector. They asked a lot of relevant questions regarding the technology and they forced me to communicate in a way so that they really understood the technology idea, which I think is really important. When it comes to the other part, everything dealing with administration and the non-technology part, I am confident that they have contributed a lot. It's very difficult for me again to say exactly what sort of contribution they made other than saying that these are young enthusiastic people and I would think that they are more enthusiastic than older people so to speak, in the same position .....they ask a type of question that might not have come from a person who is supposed to be experienced.... They have nothing to lose in a way. They have everything to learn.... (Inventor)

However, when an entrepreneurial student takes on this role, there is a clear discrepancy in education, work experience, and age between a scientist in life sciences and a student of entrepreneurship. The role of co-entrepreneur is more active compared to the more passive student role. We believe that a more active student role enhances entrepreneurial intentions and capabilities and creates a stronger understanding of oneself as an entrepreneur. The quote below shows a student group with a clear understanding of their own role in the process.

> In our case I think we were the engine. Because the idea was for a long time only a plan to be commercialized, but they maybe didn't have the right force to push it. I think we were really crucial for the idea because we put our brains into it, we put our time in. It started with the students. (Student)

Based on the discussion above we assume that the role of the student entrepreneur revolves around three dimensions: co-entrepreneurship, entrepreneurial intentions and capabilities, and the understanding of oneself as entrepreneur. Each of these dimensions will be further discussed in relation to entrepreneurial education.

4 Action-Based Entrepreneurial Education: A New Context for Developing the Role of the Student

The dominant pattern of education has been based on an individualized mind-set, with the aim of modeling single individuals to become entrepreneurs (Laukkanen 2000). In short, the candidates receive knowledge and capabilities through a linear educational process, or what Gibb (1993) refers to as a didactic model. This approach is debated in the literature, as entrepreneurship has come to be seen as the concrete enactment of new ventures. According to Gibb (2002), this calls for an action-oriented approach.

As an alternative to the individual focus, Laukkanen (2000) conceptualizes the business generation model" as an educational strategy for entrepreneurship education. Its aim is to foster the necessary conditions for new ventures and for the strategic expansion of regional SMEs: the emergence and fusion of viable business concepts, entrepreneurial actors, resources, and a munificent environment. In an educational setting, students should meet and internalize a realistic business concept from the outset and should be operationally involved in real business contexts. In such a model there is room for including opportunities and contexts (Gartner 1985; Shane 2003), which emphasizes learning-by-doing (Fiet 2001). Action-based entrepreneurship education can be accomplished in many different ways, depending on both the operational context and the university's ambitions (i.e., whether their primary focus is on teaching or being actively engaged in the business generation process). The operational context is related to both internal university support and the entrepreneurial environment in the region. Rasmussen and Sørheim (2006) argue that, by broadening the perspective and actually including the formation of new ventures as a part of education, a better match with these conceptions can be achieved. In addition, new venture creation will be in line with the overall mission of the university by contributing to economic development. Such action-oriented or learning-by-doing processes often rely heavily on student involvement. In such a context, we seek to generate knowledge on the emerging role of the student as a co-entrepreneur of research-based innovations (RBIs).

Neck and Greene (2011) also suggest that teaching entrepreneurship does not imply a new pedagogy but basically a new method. The method is teachable and can be learned, but the outcome is not predictable, as it depends on and is influenced by the participants. Entrepreneurship as a method does not only give students understanding and knowledge but also requires that they put this knowledge into practice. The authors claim that learning the method is more important than learning specific content, due to the real-life changes the student will face after education.

Lackéus and Middleton Williams (2011) argue that the action-based method is essential for achieving important learning outcomes such as tacit learning, personal development, and self-awareness. One important benefit of this pedagogy is that it allows higher-level learning from highly emotional and critical incidents in the venture creation process, provided that action is also paired with opportunities for

reflection together with experienced mentors. In some instances, a real-life learning environment can provide for what Fayolle terms an emergency learning situation, especially when economic and personal stakes are high (Fayolle et al. 2006).

Bager (2010) demonstrates that the camp model (changing the learning situation by switching to another location and including students from other disciplines as well as business leaders and experts) gives other learning outcomes such as application of knowledge, faster learning, idea generation, problem-solving, self-efficacy, creativity, dealing with complexity and ambiguity, and training presentation skills. Timmons and Spinelli (2004, p. 66) argue that there is a limit to what can be taught in entrepreneurship education. They also add that the only way to learn is through personal experience. Institutions of higher learning, such as colleges and universities, have to put together a curriculum which provides for experiential learning and personal experiences. Botha et al. (2006) emphasize the fact that most programs pay great attention to the knowledge aspects but are weaker when it comes to teaching the skills and attitudinal aspects that are crucial to the success of any potential or start-up entrepreneur. In addition, he argues that lecturing as a teaching method needs to be changed because this approach often reveals more about the teacher than the subject being taught.

This literature review shows that while there are a variety of classifications of entrepreneurship education, these seem to be converging towards a single framework for entrepreneurship education. We conclude that the field develops towards the attitude-changing perspective on entrepreneurship. Most scholars conclude that there is a need for a more innovative design of modules of entrepreneurship education that will enable students to achieve their desired outcomes in learning either for, about, or in entrepreneurship. This leads us to the following proposition:

Proposition 1. *Action-based entrepreneurship education aimed at commercializing RBIs expands the role of students towards co-entrepreneurship.*

5 A Variety of Learning Methods as a Context for Developing a New Student Role

According to role theory, each social role is a set of rights, duties, expectations, norms, and behavior a person has to face and fulfill. Moreover, the environment accepts and prefers some type of behavior over the others (Mead 1934; Ajzen 1991). As a result, people often behave in a predictable way, and each individual's behavior is context specific, based on social position and other factors (Kahn et al. 1964). In relation to entrepreneurship education, it raises a much debated question of whether or not entrepreneurship can be taught and if so, what the appropriate methods are.

The underlying assumption is that, for learning to take place, experiences have to occur. Nonaka in his classical article of 1994 speaks about knowledge transformation cycles—from tacit to explicit. He describes this process as a spiral, arguing that

tacit knowledge goes through codification and becomes more explicit. Each individual possesses tacit knowledge, and it is possible to exchange this knowledge with others through shared experience or socialization. At the same time, some knowledge is explicit, and exchanging explicit knowledge between individuals, leading to new knowledge creation, is called combination. However, tacit and explicit knowledge are two parts of the same system. We thus need knowledge conversation that combines tacit and explicit knowledge. One process is to convert tacit knowledge into explicit knowledge, which is called externalization. Another way is to convert explicit knowledge back into tacit though learning, which is labeled internalization. Hence, the spiral of knowledge goes from socialization and combination towards externalization and then back to internalization. More recently, these ideas have been incorporated into entrepreneurship literature, with studies theorizing on the decision of individuals to become entrepreneurs as involving a transition in their role identity (Hoang and Gimeno 2005). Experiential learning is the process whereby knowledge is created through the transformation of experience (Kolb 1984, p. 41). Learning is often a subconscious, internal process (Marsick and Watkins 1990).

Politis (2005) further acknowledge that *entrepreneurial* learning is an experiential process in which knowledge develops through experiencing, reflecting, thinking, and acting. As such, students are thrown into the "unknown," since no one can guarantee the outcome. This type of learning corresponds to higher-level learning that appeals to a person's critical thinking, reflection challenging deeper personal values and interpretation, and develops tacit as well as explicit knowledge (Cope and Watts 2000).

It has been argued that going through acute situations where the individual has to make critical decisions fosters deep-rooted learning (Cope and Watts 2000). Letting the students go through the commercialization process simulates real entrepreneurial experience. Therefore, students are not only gaining academic knowledge but also developing tacit knowledge, something that is important for an entrepreneur (Rotefoss 2001). The quote below demonstrates a student's level of learning in an action-based entrepreneurial program.

> I knew some of the theoretical frameworks before, but not at a practical level which I learned in this program. I have learned how to use these theoretical skills and frameworks. ....I gained a lot of knowledge about commercializing the ideas from university and how this processes evolves. How this processes evolved from the scientist to the company . . . and the legal side of commercialization process. I didn't know much about universities and their role in this industry. ... That's what I think I gained the most, but also a bit of marketing and a how to write a business plan and also how to interact with investors because we also had some presentations with private investors and banks. How to be confident, what are the important things you have to present, what is not important and how to maybe act in front of them. All these things were new for me and I gained this knowledge during the program. (Student)

This quote supports our theoretical notion that the student learning is two-dimensional, where one element is tacit (i.e., commercialization) and the other explicit (i.e., academic). The two levels of learning that the students achieve during

the program alter their role within the innovation system. The student develops unique knowledge that both university faculty and industry may actively use. In the autonomous and independent student role which is created through practicing actual entrepreneurship, and not learning only along the "academic" axis, students become an important resource for the university in their commercialization activity. They learn to be outwardly focused and acquire network capability while balancing their academic efforts against the challenges of "real" life. As such, students are no longer apprentices but become active participants in the innovation system.

There is a balance between tacit and explicit knowledge, or between experience-gained and academically gained knowledge, that allows students to become active in the knowledge transfer process. Based on the above discussion, we argue that students in practical entrepreneurship programs learn in a more integrative way, as proposed below:

Proposition 2. *A combination of different teaching methods (tacit as well as explicit knowledge components) will shape the entrepreneurial intentions and capabilities of students.*

6 Cooperation and Interaction in Academic Entrepreneurship: Shaping the Role of the Student

Although the student has much in common with the scientist and the entrepreneur (see Table 13.1), the role as co-entrepreneur is still different from that of the scientist and that of the experienced entrepreneur. Tan and Ng (2006) point out that entrepreneurship education should be supported by three pillars: industry, academia, and public policy (government.) Funds should also be obtained to support these linkages. Commercializing RBIs involves many actors from different institutional affiliations, thus involving a higher degree of cooperation and interaction between various actors. As Rasmussen and Rice (2012) state, "The major channels for technology transfer are the transfer of people, especially graduate students, and research cooperation." Concluding their review of the academic entrepreneurship literature, Djokovic and Souitaris (2008) suggest that research on academic entrepreneurship needs to explore the interaction between networks and other potential determinants of spinout structure and performance, such as personal values and the behavior of academic entrepreneurs. Further research on the intermediaries of academic entrepreneurship, i.e., the technology transfer offices (TTOs), indicates that they are not always effective in commercializing knowledge (Gregoro and Shane 2003; Rothaermel et al. 2007; Muscio 2010; Siegel et al. 2003). Thus, in her literature review, Foss (2012) urges future research to grasp the complexity of actors, agency, motives, values, institutions, and culture involved in transforming scientific ideas to commercialized products. In conclusion, previous research points to the various roles of academic staff in commercializing RBIs (Owen-Smith and Powell 2011; Spilling 2008). Recent research indicates that the

Table 13.1 Differences between scientists and entrepreneurs

	Scientist	Entrepreneur
Norms	Universalism, collectivism, disinterestedness, skepticism	Uniqueness private property, passion, and optimism
Processes	Experimentation, long-term perspective, individualism	Narrow focus, short-term perspective, and team management
Outcome	Publication, peer recognition	Products and profits

Source: Jain et al. (2009)

interaction between actors in academic entrepreneurship has not been a research priority (Foss 2012). This gives us an opportunity to explore how increased interaction between students, scientists, and TTOs in action-based entrepreneurship programs affects the role of students. The following quote lends support to the idea that the cooperative elements between the various actors in the commercialization of RBIs seem to be a crucial research stream:

> We had a good relation with the inventor from the very beginning . . . We really had a good collaborative relationship and still have, even though not all of us are involved as much at the moment, but the inventor is always there if you need him to help you. So I can just say positive things about that relationship. . .We had good feedback from the university commercializing system (TTO). . .In our case, the TTO was really important. . .they have facilities, equipment of their own, so we have to rent and have a good, clear contract between the TTO and the company. That was really important, they were like the key stakeholder for this idea. (Student)

From identity theory we know that students learn "who they can be" by constructing stories of "who they want to be" (Rae and Carswell 2000, p. 151). Thus they work towards enacting their "storied identity." This implies that students should have role models who reinforce their entrepreneurial belief systems. Students have a different concept of self before they enter the entrepreneurship program and existing industry knowledge, prior knowledge of markets, and customer problems increase the likelihood of entrepreneurial recognition (Corbett 2005, p. 476). The student who participates in the commercialization process gains an understanding of "what they can be" and "who they want to be" in communication with other actors in the innovation structure. Thus, their "me" develops differently than their "I" (Mead 1934). First, in dialogue with the actors in the innovation system, students see their part differently and have the opportunity to develop their role accordingly. Second, the new self-concept may, in turn, contribute to the very context in which students find themselves, thus making the student an important resource within the innovation system. Therefore, their concept of self, as student and co-entrepreneurs, will evolve as they enter into, communicate with, and relate to the commercializing context. This is illustrated in the quote below:

> I think that the BCE program was a huge personal change. . .I am a completely different person from when I actually started the program and now. . .my confidence, my skills sets in general. I feel I know a little bit of everything. You know if the CEO of my company talks about some pretty deep financial stuff I know that I can sort of relate and know enough to feel comfortable and discuss it. Maybe not contribute so much always, but I can discuss it and I know what he is talking about and I know why it's important. So I have a completely different confidence level than I had previously. (Student)

This discussion leads us to our last proposition:

Proposition 3. *Cooperation and interaction with other actors in commercializing RBIs within an action-based entrepreneurship education affect the concept of self among students.*

7 Discussion

The argument in this paper is that we must improve our understanding of the relationship between action-based entrepreneurship education aimed at commercializing RBIs and the changing role of entrepreneurship students. We argue that the role of the entrepreneurial student is a crucial component in a knowledge-based economy where universities need to contribute to regional innovation by helping to commercialize research-based ideas. Thus, universities need to educate students on how to take ideas to the market, to collaborate with inventors and TTOs, and to develop skills and self-esteem that make them capable in terms of technology transfer and starting university spin-offs. Our contribution has been to theorize and illustrate, with real-life examples from students and inventors, an action-based entrepreneurial program and to develop a (theoretical) framework with propositions for future testing.

The propositions can be summarized in Fig. 13.1.

Our theoretical argument is coupled to how factors at the system level (action-based entrepreneurship programs), educational level (different teaching methods), and interactional level (cooperation and interaction) affect three aspects of the student role, which includes capabilities and intentions, the role of the student as co-entrepreneur, and the concept of self.

We propose that students in a practical entrepreneurship course may create a role for themselves that deviates from the classical student role because of different learning methods. Further, we claim that student entrepreneurs can bridge the gap between academia and industry. Finally, we argue that students who attend practical entrepreneurship programs evolve their role based on their interaction with diverse actors involved in the commercialization process, including scientists, TTOs, investors, and customers. Thus, the external context influences their concept of self.

8 Implications for Theory

Examining the role of the student in entrepreneurial education can provide insights into the causes and consequences of a more active and expanded role of the student within today's universities. More specifically, we outline a framework integrating research from various strands of literature: entrepreneurship education, academic

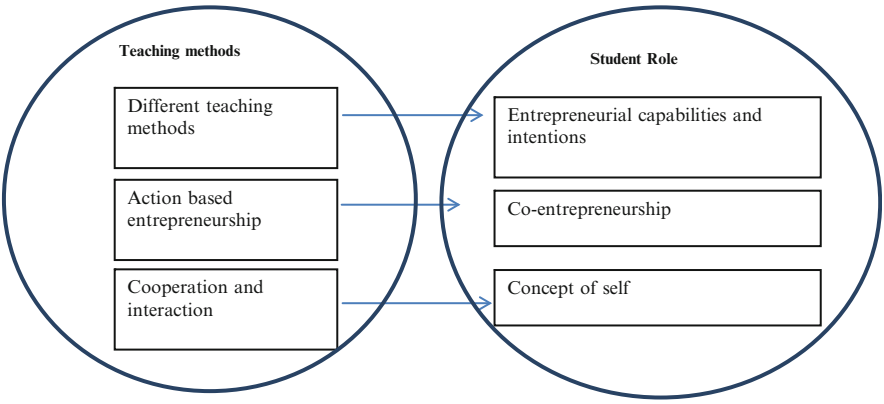

Fig. 13.1 The relationship between teaching methods and the student role

entrepreneurship, and role theory. Our model is parsimonious and should be seen as a first attempt to integrate previous research supported by anecdotal empirical quotes. Yet our view departs in several aspects from previous research, by taking an integrative approach to explanatory factors and by developing an explicit focus on the role of the entrepreneurial student in academic entrepreneurship.

9 Limitations and Implications for Future Research

This exploratory study is theoretical in nature and based on an inductive research paradigm. As such, it has its limitations. First, the case of the active learning form is used as illustration, which allowed us to draw preliminary results/conclusions and to shape propositions. It does not, however, allow for the testing of theory. Secondly, as in any qualitative study, conclusions do not allow for generalizations, although we argue that the position derived from this research could be tested using a more quantitative approach. In particular, our second proposition of how a combination of different teaching methods shapes students' intentions can be tested through a comparative and longitudinal survey conducted with two or more student groups—those involved in intensive action-based education versus those being taught by more traditional methods. Propositions one and three can be tested with more advanced qualitative methods than those applied in our research. A longitudinal multiple case study that accounts for multilevel modeling problems would enable future research to clearly define the role of students in RBI processes and their role in commercializing innovations.

We hope to motivate future research to make use of our ideas in this paper and to refine the propositions and our model according to a more fine-grained causal picture that allows a more precise operationalization of variables. The various

action-based entrepreneurial programs being taught (throughout the world) would make an interesting empirical background for developing theories of the role of the student in academic entrepreneurship.

Future research should examine the intermediate effects of other variables on education—commercialization relationships. One way of refining the model would be to differentiate the proposed effects by applying psychological variables as intermediate ones. Hence, the independent variables may be assumed to work differently, with regard to the personal characteristics of the individual.

We argue that there is a need for future research to address the question of how the co-creation of values happens during the educational process, how the self-perception of students is changing, and how the new role of students as co-entrepreneurs can impact educational programs, universities, and commercialization actors. We hope to motivate further work that links the role of students and commercialization outcomes. There is a need to take a closer look at students as groups, as many action-based entrepreneurial programs involve student *teams* as co-entrepreneurs. Thus, these relational dynamics and processes may affect the co-creation of values as well as the ways in which they impact the research-based innovation system.

10 Implications for Policy

In light of universities' new responsibilities in commercializing research-based ideas in order to generate innovation and regional development, the role of the entrepreneurial student is under scrutiny. From learning *about* entrepreneurship, students are now supposed to learn *how to become* an entrepreneur. In this chapter, we have used this change in context to discuss the challenges being faced by students in developing their role in a new institutional terrain, where they have to relate to inventors of RBIs, as well as the support system in terms of TTOs. In order to gain a deeper understanding of the role of the student in this context, it is necessary to generate knowledge of comprehensive practices. Thus, this paper discusses different aspects of the role of the student in the commercialization process.

We argue that the actions and development of students are the most important elements of learning, and that the focus in educational programs should be on stimulating this self-development, and on helping students to take on the role of real co-entrepreneurs. Recognizing the impact that students can have on the knowledge transfer in the form of commercialization of innovations is highly important to community development and should be appreciated by both policy makers and practitioners.

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