



Universitat Autònoma de Barcelona

Documents de Treball

**TECHNOLOGICAL TRAMPOLINES FOR
NEW VENTURE CREATION IN CATALONIA:
THE CASE OF UNIVERSITY OF GIRONA**

**Andrea Bikfalvi, Christian Serarols, David Urbano,
Yancy Vaillant**

Document de Treball núm. 07/1

Departament d'Economia de l'Empresa

© Andrea Bikfalvi, Christian Serarols, David Urbano, Yancy Vaillant

Coordinador / Coordinator *Documents de treball*:

David Urbano

<http://selene.uab.es/dep-economia-empresa/recerca/Documents.htm>

e-mail: david.urbano@uab.es

Telèfon / Phone: +34 93 5814298

Fax: +34 93 5812555

Edita / Publisher:

Departament d'Economia de l'Empresa

<http://selene.uab.es/dep-economia-empresa/>

Universitat Autònoma de Barcelona

Facultat de Ciències Econòmiques i Empresariales

Edifici B

08193 Bellaterra (Cerdanyola del Vallès), Spain

Tel. 93 5811209

Fax 93 5812555

**TECHNOLOGICAL TRAMPOLINES FOR
NEW VENTURE CREATION IN CATALONIA:
THE CASE OF UNIVERSITY OF GIRONA**

**Andrea Bikfalvi, Christian Serarols, David Urbano,
Yancy Vaillant**

Document de Treball núm. 07/1

La sèrie *Documents de treball d'economia de l'empresa* presenta els avanços i resultats d'investigacions en curs que han estat presentades i discutides en aquest departament; això no obstant, les opinions són responsabilitat dels autors. El document no pot ser reproduït total ni parcialment sense el consentiment de l'autor/a o autors/res. Dirigir els comentaris i suggerències directament a l'autor/a o autors/res, a la direcció que apareix a la pàgina següent.

A Working Paper in the *Documents de treball d'economia de l'empresa* series is intended as a mean whereby a faculty researcher's thoughts and findings may be communicated to interested readers for their comments. Nevertheless, the ideas put forwards are responsibility of the author. Accordingly a Working Paper should not be quoted nor the data referred to without the written consent of the author. Please, direct your comments and suggestions to the author, which address shows up in the next page.

Technological Trampolines for new venture creation in Catalonia: the case of University of Girona

Andrea Bikfalvi (*Universitat de Girona, Spain*), **Christian Serarols, David Urbano, Yancy Vaillant** (*Universitat Autònoma de Barcelona, Spain*)

Summary

Recent trends in technology transfer show an intensification of spin-off creation as a modality of university research commercialisation, complementary to the conventional ones, contract research and licensing. In this paper we analyse the evolution, objectives, resources and activities of a specialised unit –Technological Trampoline (TT) - in charge of new venture creation at the University of Girona (Catalonia-Spain). Based on two theoretical frameworks, Resource-based-view and Institutional Theory, we adopt a multi-dimensional approach to study the strategy of spinning-off new ventures at the University of Girona in terms of resources and activities, how this process is organised and if the outputs fit with this UdG's objectives and the local environment. Our main contribution is an in-depth analysis of the spin-off creation unit with special emphasis on its variety of resources and activities. The results have a series of implications and recommendations at both university and TT level.

Keywords: *Spin-off, technology transfer, entrepreneurship, commercialisation of research.*

1. Introduction

University-based scientific inventions that translate into spin-off companies represent a potentially important and increasingly utilised option to create wealth from the commercialisation of research (Carayannis, 1998; Clarysse et al.; 2005; Lockett et al., 2005; Siegel et al., 2003; Vohora et al., 2004). The conventional route to transfer knowledge from university to market has been generally through two means: 1) licensing the rights to use technological discoveries controlled by university owned patents (Intellectual Property-IP) and 2) contract research. In recent years, university spin-off companies have become an increasingly popular way of exploiting potentially valuable research and knowledge; however, understanding this phenomenon remains limited. There are some factors that justify the necessity to explore these entrepreneurial processes and the spin-off companies (Wright et al., 2004a and 2004b).

First, a growing policy debate has led governments to increase pressure for technology transfer in the form of spin-offs companies to generate wealth for both, universities and the regional economy. University spin-offs are not only seen as contributors to a regions' economic development but also as sources of employment (Perez and Martínez, 2003), as mediators between basic and applied research (Autio, 1997) or as change agents of the economic landscape moving towards a knowledge-based economy.

Second, difficulties in transferring or licensing new scientific discoveries for which markets are undetermined, yet to emerge or nonexistent has led to find new ways of exploiting this knowledge. Moreover, instead of licensing to established firms, a spin-off offers incentives of a greater share of the wealth created eventually being returned to

the original academic institutions and academic inventors (Wright et al. 2004b).

Finally, there are different typologies of spin-offs emerging from public research institutions (PRIs) depending on several factors such as their relation to the parent organisation, type of technology transferred, and resources available in the PRI, etc. Therefore, traditional pioneering studies of new technology-based ventures have identified several typologies like: start-ups, spin-ins, research-based spin-offs, new high technology ventures, and joint-venture spin-offs among others (Hindle and Yenken, 2004; Mustar et al., 2006; Parhankangas and Arenius, 2003). The Lambert Review and other commentators have observed that there is a distinction between the founding of spin-offs per se and the creation of spin-offs that create significant wealth (Lambert, 2003; Clarysse et al., 2005). Recognition of this point draws attention upon the need of understanding more about the processes, resources and capabilities required for developing spin-off companies and how this may be different depending on the typology of spin-off company (Wright et al., 2004a).

This research is motivated by the need to learn more about university start-up companies and particularly those created on the basis of technology developed in universities (Parhankangas and Arenius, 2003; Roberts and Malone, 1996; Steffensen et al., 2000). In this research we adopt a multi-dimensional approach to study the strategy of the University of Girona in terms of resources and activities, how the process of spinning-off ventures is organised and if the outputs fit with this PRI's objectives and the local environment. This paper attempts to answer the following questions:

- What is the regional environment for spin-offs emerging from PRI in Girona?
- How does the actual model of technology transfer employed by the TT of the University of Girona work and how has it evolved since its foundation?
- What are the internal resources for supporting spin-off creation at the University of Girona?

2. Conceptual framework

First, we make a brief note on the definition of spin-offs due to the complexity and multiple facets of this phenomenon. We adopt the definition of university spin-off provided by Pirnay et al. (2003:356) and supported by the majority of the scholars:

“new firms created to exploit commercially some knowledge, technology or research results developed within a university”

However, we expand this definition taking Nicolau and Birley's (2003:340) definition that stresses that the founding member(s) may include the inventor academic(s) who may or may not be currently affiliated with the academic institution. We divided these spin-offs in two categories: start-ups¹ and spin-offs².

¹ Companies set up by former or present university staff and/or former students drawing on their experience acquired during their time at the university, but which have no formal IP licensing or similar relationships to the university (Hindle and Yencken, 2004)

2.1. Resource-based view

The resource-based theory has emerged as one of the most influential frameworks in strategic management research (Barney et al., 2001). Hence, we use the resource-based and the resource-dependence theory as a starting point for our inquiry.

The choice of these theoretical perspectives may be justified in the following way. The resource-based approach is particularly helpful in shedding light on the factors contributing to the nature and outcome of a spin-off arrangement (Parhankangas and Arenius, 2003:465). Especially, this theory seeks to explain the outcome of the resource sharing relationship (learning and competence development) in terms of similarity and complementarity of resource bases of the PRI and the spin-off.

Like the resource-based approach, the resource-dependence view maintains that organisational survival and performance depends on the organisation's ability to acquire and maintain resources (Aldrich, 1979; Pfeffer and Salanick, 1978; Thompson, 1967). Since the organisations are rarely self-sufficient, they enter into relationships with other organisations in order to obtain critical resources (Parhankangas and Arenius, 2003). The resource-dependence theory is mainly concerned with the acquisition of resources from outside of an organisation, for example via PRI in the case of spin-offs.

In table 1, we review the main studies related to the process of spinning-off ventures within PRI that have applied resource-based view and resource-based dependence view. Among these studies, the authors emphasise different aspects such as: organisational, social, financial, physical, technological and human resources (Brush et al., 2001).

Table 1: Areas covered in the resource-based view applied to spin-offs

Paper	Organisa-tional	Human	Physical	Finantial	Technolo-gical	Networ-king
Autio (1997)					X	X
Autio and Lumme (1998)					X	
Carayanis et al. (1998)		X	X	X	X	
Clarysse and Moray (2004)	X	X			X	
Clarysse et al. (2005)	X	X	X	X	X	X
Druilhe and Garnsey (2004)		X		X	X	X
Fontes (2001)		X		X	X	
Franklin et al. (2001)	X	X		X		
Heirman and Clarysse (2004)		X		X	X	
Hindle and Yencken (2004)	X	X		X	X	
Lindelof and Lofsten (2004)						X
Lockett and Wright (2005)	X				X	
Mustar et al. (2006)	X	X	X	X	X	X
Nicolaou and Birley (2003)	X					X
Parhankangas and Arenius (2003)	X				X	
Perez and Martinez (2003)	X				X	X
Pirnay et al. (2003)	X	X			X	
Shane and Stuart (2002)		X		X	X	X
Vohora et al. (2004)		X		X	X	X

² The rest of the companies different from "start-ups"

Walter et al. (2005)		X				X
Westhead and Storey (1995)		X	X			X
Wright et al. (2004a) – Literature review	X	X	X	X	X	X
Wright et al. (2004b)	X	X	X	X	X	X
TOTAL	12	16	6	12	18	13

The category “technological resources” refers to the firm-specific products and technology. The category “human resources” refers to attributes of the founding team, the management team and the personnel of the company. The category “networking”, also known as social resources, refers to the network or the social capital of the company. The “financial resources” refers usually to the amount and type of financing of the firm, which can be divided into two groups: external and internal. The category “physical resources” refers to assets such as firm’s plant, equipment and placement (Grant, 1991). Finally, the category “organisational”, also named link, refers to the internal structures, processes, and relationships in the spin-off but it also includes its link with the Technology Transfer Office (TTO) and its support structure, which is also related to the institutional framework. This last type of resources is complex, knowledge-based and defined as the systems, the routines and the relationships embedded in the company (Brush et al., 2001). Some scholars also call these resources dynamic capabilities (Amit and Shoemaker, 1993; Teece et al., 1997; Eisenhardt and Martin, 2000). In fact, these dynamic capabilities are organisational and strategic routines by which firms achieve new resource configurations (Eisenhardt and Martin, 2000).

Drawing on the previous categories of resources, table 2 summarises the key elements (variables) of each category when studying the PRI.

Table 2: Key elements and grouping in the resource-based view applied to spin-offs

Categories	Public Research Institution
Technological	Technological focus vs. non-technological Conditions of knowledge transfer from PRI Quality and legitimacy of R&D Mode of transfer (formal IP vs. informal)
Human	Size of the TTO’s team Team quality (Background; Experienced professionals “in-house”; Commercialization competences) Team variety (Public vs. private oriented; variety of backgrounds and professional experience; vble to evaluate business plans)
Networking/social	Contacts with industry and finance Contacts with surrogate entrepreneurs and other human resources Science parks and other R&D infrastructures Type of relationship with the spin-off
Financial	Capital (internal vs. external) Strategy of funding Availability of VC (associated VC fund) Level of investment
Physical resources	Space (offices) Laboratories and other equipment
Organisational (link and nature)	Organised vs. spontaneous support Processes of direct and indirect assistance (commercial, managerial and

	product development) Paths dependencies (PRI's history)
--	--

2.2. Institutional theory

Recent work on the heterogeneity of research-based spin-offs (Mustar et al., 2006) describes the institutional perspective of them as the relationship and the embeddedness with their parent organisation, which has its own culture, incentive system, rules and procedures. In order to be more specific, the institutional theory (North, 1990 and 2005) puts together the above concepts and defines institutions as “the rules of the game in a society, or more formally, institutions are the constraints that shape human interaction” (North, 1990:3).

Institutions include any form of constraint that human beings devise to shape human interaction. Institutions can be either formal - such as political rules, economic rules and contracts - or informal - such as codes of conduct, attitudes, values, norms of behaviour, and conventions, or the culture of a determined society. North attempts to explain how institutions and institutional context affect economic and social development.

In this sense, but applying this theory in the field of entrepreneurship, according to Urbano (2006), formal factors include all the institutions and support schemes referring to new ventures, namely government policies, the demand and offer of support mechanisms, the evaluation of new venture creation supporting programmes and their impact, as well as all economic and non-economic support mechanisms oriented to assist new entrepreneurs. The informal institutional factors embrace the society's attitudes towards venture creation, e.g. culture as a barrier or favouring factor, entrepreneurial spirit, the recognition of the entrepreneurial function, the social status of the entrepreneur and the fear to failure.

In table 3, we review the main studies related to the process of spinning-off ventures within PRI that have applied institutional theory.

Table 3: Studies on formal and informal institutional factors applied to spin-offs

Paper	Formal	Informal
Autio (1997)	X	X
Autio and Yli-Renko (1998)	X	X
Bozaman and Boardman (2004)	X	
Carayanis et al. (1998)	X	
Chiesa and Piccaluga (2000)	X	X
Clarysse et al. (2005)	X	X
Chrisman, Hynes and Fraser (1995)	X	
Di Gregorio and Shane (2003)	X	X
Debackere and Veugelers (2005)	X	
Degroof and Roberts (2004)	X	
Ferguson and Olofsson (2004)		X
Fontes (2001; 2005)	X	
Franklin et al. (2001)	X	X
Gibb (2005)	X	
Harmon et al. (1997)		X
Heirman and Clarysse (2004)	X	
Henrekson and Rosenberg (2001)	X	

Hindle and Yencken (2004)	X	
Jacob et al. (2003)	X	
Jones Evans et al. (1999)	X	X
Kennye and Goe (2004)		X
Krücken (2003)	X	X
Lindelof and Lofsten (2004)	X	X
Link and Scott (2005)	X	
Mustar and Larédo (2002)	X	
Mok (2005)		X
Nicolaou and Birley (2003)	X	X
Olofsson (2004)	X	
Siegel et al. (2003)	X	X
Steffensen et al. (2000)	X	
Upstill and Symington (2002)	X	X
Wright et al (2004a)	X	X

The institutional perspective puts an especial emphasis on the support structures including incentives and TTO's quality, as well as on environmental related matters like local norms of reward systems and IP policies. All these elements constitute the structure that needs to be embedded in a supportive context. This context is related to the institutional and policy environment, the culture and the history that has unfolded within the academic institution (Debackere and Veugelers, 2005). In this context, funding sources of universities, the dynamism of public research system, the autonomy of universities and regional development are among the most important factors which have played and still play a principal role in favouring the exploitation of research results at universities (Chiesa and Piccaluga, 2000). On the contrary, some obstacles such as negative impact on basic research and incompatibility between university mission and administrative and bureaucratic reasons hamper the process.

Additionally, several scholars have also proposed suggestions to improve policies that promote entrepreneurship based on empirical studies. For example, Chrisman et al. (1995), Bozaman and Boardman (2004) and Fergusson and Olofsson (2004) offer specific measures such as policies linking government and industry to university; measures to improve the role of research centres; and the study of scientific parks, respectively.

Although culture appears as one of the institutional factors, and its particular influence on the spin-off creation process goes beyond the objectives of the present work, it attempts to measure at which point "entrepreneurial culture" characterises local universities.

Other academics such as Jacob et al. (2003) describe a reflection of successful entrepreneurial transformation in the case of Chalmers University of Technology in Sweden. The researchers concluded that universities, in order to be able to meet the demands of the society, have to be assisted by facilitating institutions. These institutions included technology bridge foundations, university holding companies or the Swedish Agency for innovation systems.

All these previous experiences should be the starting point to analyse our local institutional framework, although we understand that they function in a well-defined historical, geographical, social and economical context. In table 4 we identify the main formal and informal institutional factors used when studying regions and PRIs, concretely, universities.

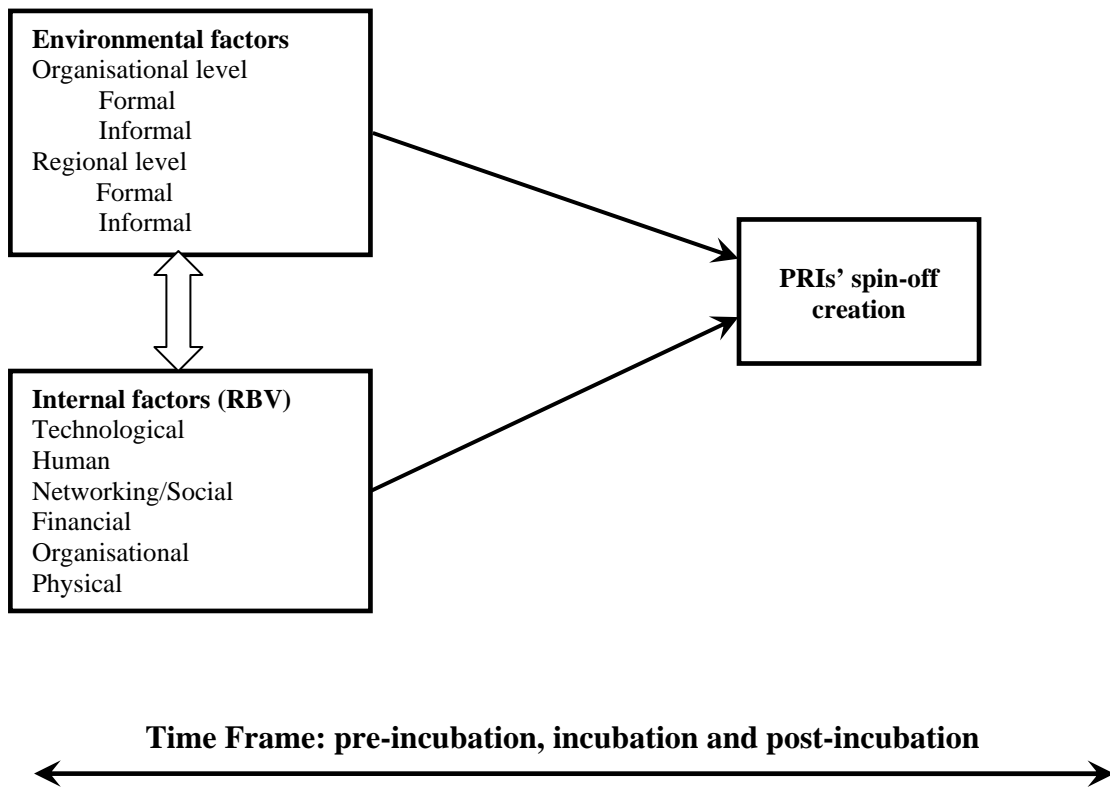
Table 4: Key elements and grouping in the institutional perspective applied to spin-offs

	Region	Public Research Institution
Formal	Institutions and infrastructure <ul style="list-style-type: none"> • Regional development agency • Technology and Innovation promotion organisms • Government’s regional representatives 	Technology Transfer Office Technological Trampoline Science Park Business Incubators
	Legislation <ul style="list-style-type: none"> • Territorial Autonomy Act • Catalan University Law 	Spin-off creation and promotion rules IP regulation
	Programmes Financial mechanisms (banks, business angel network) Grants for entrepreneurs Incentives for becoming an entrepreneur Contests and prizes	Programmes Spin-off investment fund
	Entrepreneurial region <ul style="list-style-type: none"> • Innovative firms • Industry – university collaborations • R&D budget • National and regional innovation system • FDIs and multinational companies established 	Entrepreneurial university <ul style="list-style-type: none"> • Number of spin-off companies • Number of subjects, courses and postgraduate programs relative to entrepreneurship • Availability of training for teachers willing to become entrepreneurs • TTO’s information diffusion activities
Informal	Role models – gazelle companies Culture	Spin-offs as role models Organizational structure University community’s perception on teachers/researchers’ entrepreneurial activity Teachers/researchers’ awareness about the functions and support a TTO can offer when creating a spin-off The pressure of “publish or perish” Students attitude on starting a business Employment conditions and opportunities

2.3. Model building

Considering the previous arguments, we have built a model that combines the theoretical frameworks reviewed to give answer to our research questions.

Figure 1: Model of spin-off creation in PRIs



3. Research design

First, a qualitative approach was used to identify the strategy of the UdG's Technological Trampoline in terms of resources and activities and how the process of spinning-off ventures is organised. In this stage, several methods of data collection were used to address these issues, enabling to cross-check results.

In performing this study we followed procedures commonly recommended for conducting case study research (Eisenhardt, 1989; Yin, 1989). Data collection was performed at different levels and using a mix of techniques, avoiding common method bias. Our multi-dimensional dynamic approach involves two main different levels of analysis: the local environment at the PRI and the PRI with particular emphasis on the Technological Trampoline and a secondary one, the spin-offs that emerged from the TT since its foundation in 2001.

Next, we examined the organisation of incubation spin-off services from the perspective of the parent institute. This entailed looking at two interrelated levels: the internal activities geared towards spinning-off companies and the context in which resources are employed. At this stage, in order to track, analyse and identify resources, activities and changes over the time a history approach was necessary. Herein, the tracing of historic PRI documents (e.g. plans, contracts, etc.) was central and complemented with extensive interviews about the PRI's history and current operations.

Thus, we carried out semi-structured interviews with the former and the current head of the TT and the two present business development assistants.

Afterwards, we interviewed representatives of the spin-offs that emerged from the TT at UdG, focusing on the start-ups history and resource acquisition. Since the foundation of UdG's TT, ten companies have been created and we focused on understanding better the dynamics of venture formation and development as it is embedded in this particular PRI.

These in-depth face-to-face interviews ranged from two to three hours in length and were recorded and then transcribed. All these interviews were held on site at the UdG and at the businesses from May to September 2006. Triangulation was aided by the collection of archival data (Yin, 1989). To avoid confirmatory biases, one of the authors kept a distance from the field observations and focused on conceptualisation and analysis of the interpretations developed by other researchers (Vohora et al., 2004). Responses from the interviews and other data were developed in a case study database, which included the use of tables to record data (Miles and Huberman, 1994). These tables ensured that the data collection was focused on the research questions and verified the same information was being collected for all cases. Cross-case analysis, pattern matching and other content analysis techniques (Eisenhardt, 1989; Yin, 1989) were used.

4. Results and discussion

4.1. The role of the region for spin-off creation at PRI

4.1.1. Regional environment: Catalonia

The main distinctive characteristic of the regional R&D system of Catalonia is its level of resources, above the Spanish average, but still far from other scientific regions/countries of excellence (CIDEM, 2006). The population with university studies in Catalonia is slightly higher than in Spain, UE-15, East Midland and Lombardy. Employment in medium-high and high-tech manufacturing puts the region in the second best position just after Lombardy. Furthermore, in 2003, Catalonia spent 1.38% of its GDP in R&D activities and it had 6.42 researchers per every 1,000 inhabitants.

In Catalonia, the business sector represents the backbone of its innovation system with 67% of the total expenses, the other triple-helix poles, like administrative bodies and government, provide them adequate environment and tools, while universities and public centres are a valuable source of external knowledge (CIDEM, 2006).

Similarly to Sweden (Jacob et al., 2003), in Catalonia, universities are largely public and state-owned. After the "third mission" was defined and outlined along the commercialization of research, some legal solutions and efficient institutions (Henrekson and Rosenberg, 2001) were supposed to facilitate the process and act as a bridge between academia and businesses. In Catalonia these are basically three.

First, the Centre for Innovation and Business Development (CIDEM), established twenty years ago by the regional government, was created with the aim of improving the competitiveness of the Catalan industrial sector mainly dominated by SMEs. CIDEM initially focused its efforts on enhancing the quality of the Catalan industry and strengthening its presence on international markets. At present, CIDEM is concentrating its efforts in innovation, the backbone of its industrial policy. Their actions are carried out within six programs, one of which emphasises actions related to new venture creation support. In this last programme, the specific activities include: a) advice and assessment for technology-based entrepreneurs; b) concept capital³; c) genesis capital⁴ and d) several financial resources like Invertec⁵, Invernova⁶, Private Investors Network, non-refundable grants and other incentives to create a company like loans below market prices (CIDEM, 2006).

Second, the Ministry of Education and Science (MCYT), launched a nation-wide Innovation Plan for 2004-2007 including among other measures: the call for support of new technology-based firms' creation through incubators and venture capital, improved coordination between public and private sector (with specific measures targeting scientific and technological parks), additional support to TTO's and other technology centres. Furthermore, the Ministry's Torres Quevedo Programme provides subsidies for enterprises and other organisations, like scientific parks, that employ researchers and PhD students.

Third, the Centre for the Development of Industrial Technology (CDTI) is a national public organisation whose main objective is to assist Spanish companies to increase their technological competences. Among its activities, we highlight: a) the promotion of technology transfer and technological cooperation between enterprises and b) support in the development of new technology-based firms, through the Neotec initiative. The Neotec actions go from financial aid, training services or expert advice, up to the design of specific actions to facilitate the interaction between entrepreneurs and investors.

All the above-mentioned institutions and their support are part of the public system. However, there are private actors that also promote mechanisms and programmes that complement the public ones. The main ones are foundations (Fidem, CP'AC, MITA, CEDEL) that focus on specific targets such as women entrepreneurship, young people, unemployed managers and ethnic entrepreneurship, respectively. Furthermore, informal factors are also relevant for the creation of spin-offs, specifically referred to the Catalan

³ Concept Capital is a participative loan, up to €100,000, for new technology-based companies spinning-off from PRI with at most 2 years of existence.

⁴ Genesis Capital is a grant provided to new technology-based entrepreneurs used to evaluate the feasibility of the project within its first year of operation

⁵ Invertec is a company that makes short-term capital investments in technology-based companies at the seed phase of the project

⁶ Risk Capital Fund to invest in innovative technology-based companies at an early-stage

culture and the values and attitudes towards entrepreneurship. In our case, although the family tradition and the prestige of the entrepreneur are surprisingly not determinant factors in the new firm decision process, role models and success experiences are very important for the optimum climate to entrepreneurship in Catalonia. Additionally, not enough incentives for research, too much bureaucracy and non-entrepreneurial mentality of the university system are perceived as the main barriers to entrepreneurship.

4.1.2. Local environment: Girona and its university

During its historical industrial evolution the province of Girona is characterised by certain dynamism, meaning a progressive and continuous growth. It has been complemented with high capacity of structural transformation—passing from industry to services-, with the sustained help of the local agents characterised by entrepreneurial spirit (Girona Chamber of Commerce, 2006).

All these elements contribute to the province’s position in the regional and national context. The latest economic yearbook (La Caixa, 2005) ranks Spanish autonomous communities and provinces by their income per capita using 10 intervals of earnings. In this configuration, the region of Catalonia and the province of Girona are clearly surpassing Spain, the latter being among the best ranked provinces.

Hosted by the city of Girona, with a population of over 100,000 and situated a hundred kilometres northern Barcelona, the University of Girona was founded in 1991 in accordance with the Establishment Act approved by the Parliament of Catalonia. At present, the university has 15,000 students and almost one thousand academics specialised in different fields as human sciences, social sciences, architecture, life sciences and engineering among others (University of Girona, 2006a). Table 5 shows the main figures of the UdG.

Table 5: General information of the UdG

Indicators		Indicators	
Faculties	18	Spin-offs	11
Departments	20	Scientific and Technological park	Yes
Research groups	100	Electronic bulletin on research	Yes (monthly)
Research institutes	8	Bachelor degrees	21
Other institutions	19	Bachelor degrees with entrepreneurship subjects	1
Academics	970	Master degrees	25
▪ Full professors	6.8%	Master degrees with entrepreneurship subjects	2
▪ Associate professors	25.5%	PhD programmes (own + interuniversity)	6 + 11
▪ Assistant professors	12.4%	Postgraduate and PhD students	2,417
▪ Full-time teaching assistants	7.8%	Contract research (M€) in 2003	3.02
▪ Part-time teaching assistants	43.4%	External research funds (M€) in 2004	9.57
▪ Miscellaneous other ranks	4.0%	Internal research budget (M€) in 2004	1.21

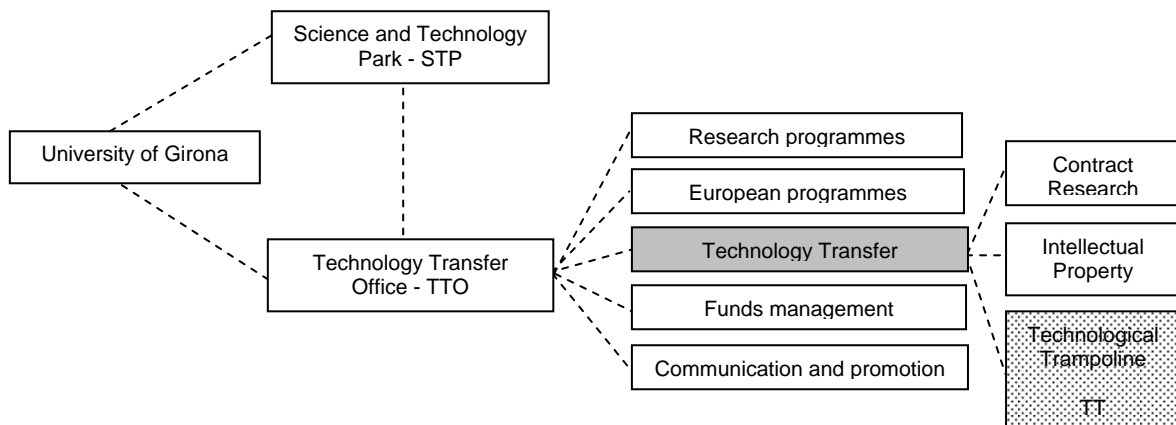
The UdG shows a continuous and sustained growth of R&D contracts, the most used

technology transfer mechanism among academic researchers. For example, in 1993 there were 20 R&D contracts that represented €390,000 and in 2004 there were 164 contracts with the business sector representing €3,020,000 (Technology Transfer Office, 2005).

The UdG applies for a specialised and decentralised model of technology transfer. Located in the main campus, together with science and engineering faculties, the Technology Transfer Office (TTO) provides administrative and supporting services relative to the different transfer modalities. Their functions are divided in two main areas a) specific activities of managing research incentives such as information, promotion, application and registration of European, national and regional research funds; b) technology transfer and knowledge management, acting as a bridge between industry and academia, promoting knowledge exchange basically through three mechanisms: R&D contracts; intellectual property, licensing and patenting; and spin-off creation.

Figure 2 describes its main units: 1) research programmes; 2) European programmes; 3) technology transfer unit including the Technological Trampoline (TT); 4) funds management; and 5) research communication, promotion and diffusion.

Figure 2: Main units of UdG's science-based and technology transfer activity



The Technological Trampoline (TT) is a public independent entity integrated in the TTO and responsible for promoting technology and knowledge exchange basically through spin-off creation. Although the TT is linked to the TTO in terms of office spaces and other physical resources, its functioning and budget are independent from both the University and the TTO.

Since 2002, the UdG jointly with the Ministry of Science and Technology and the regional government are promoting a Scientific and Technological park to foster technology transfer between the academics and the business sector. Currently, this park is still under construction and situated 1.5 km from the campus. It has approximately 50,000 square metres available from which 8,000 square metres are been built. From

those, 3,600 square metres will be reserved to locate ventures spun-off from university.

4.2. The role and activities of the TT

4.2.1. Strategy, objectives and evolution

The TT from University of Girona has a clear technological focus. According to both the former and the current head of the TT, it follows the recommendations from CIDEM to select the projects that would be given support:

- A differentiating/unique technology
- Global market-oriented
- Venture capital-oriented

Table 6: Criteria to select projects

Criteria to select projects	Mean
To which degree the selected projects can receive venture capital? (1=none, 2=low, 3=medium, 4=high, 5=always)	3,75
To which degree the selected projects have a differentiating technology susceptible to be patented? (1=none, 2=low, 3=medium, 4=high, 5=always)	4,13
To which degree the selected projects are product-oriented? (1=product; 5=service)	1,5
In what markets do they operate? (1=local, 2=regional, 3=national, 4=European, 5=international)	4,13
Time to breakeven (1 < 1 year, 2= 1-2 years, 3= 2-3 years; 4= 3-4 years; 5 > 4 years)	3,67*
Time to venture capital	2,67*

* 3 responses

According to the former director of the TT, time to breakeven and time to venture capital were not criteria to select projects because they did not have the expertise to evaluate them. Still, the TT network in Catalonia has no expertise in evaluating these criteria. Furthermore, these criteria can not be applicable to some projects that need a long time to develop their technology/products. For example, the TT is supporting a biotechnology spin-off which the average time to develop a new product is 10-15 years.

Since June 2001, the TT has evaluated approximately 101 projects from which 29 have received support. From those, 12 have received public funding (1.7 M€ in total) even though they have not been legally constituted as a firm. Only 10 spin-offs have been legally constituted, which makes a ratio of 1 every 10 projects evaluated. The half of these spin-offs have received venture capital (2.6 M€ in total) and only two owned one or more patents. They are mainly situated in the incubation stage of development and none of them has reached the breakeven.

The historical evolution of the TT in Girona has gone through 4 main stages: 1999-2001 concept, 2002-2003 creation, 2004-2005 consolidation and since 2006 growth.

4.2.2. Activities and services provided by the TT

The TT uses different instruments to promote its activities and attract new spin-off projects: a) one or two workshops per year with over 100 people audience where they explain what a spin-off is and promote the services provided by the TT; b) the organisation of two contests of new ideas in the region; c) a stand in an industrial fair yearly organised in the engineering faculty; d) 10 seminars per year on IP protection,

entrepreneurship and management oriented towards the fulfilment of the entrepreneurs' formation needs; e) informal meetings with the best quality research groups at university (110 research groups from which 24 provide 80% of the total contract research income); and f) their website.

In the following table, we indicate the services provided by the TT, number of users, if it was offered during its first year of operation, the average importance of this activity according to TT's personnel and the valuation of this activity in comparison to other TT from the network.

Table 7: Activities and services offered by the TT

Activities and services	Initially offered	Users*	Importance**	Valuation***
Seminars and workshops oriented to explain what entrepreneurship is and its process	No	400	3	1.5
Postgraduate course in technological entrepreneurship	No	20	3.5	1.75
Office spaces and other services (fax, meeting rooms, etc.)	No	6	4	1.5
Presence of TT's personnel in the spin-off	Yes	20	5	2.75
Evaluation of the spin-off's projects	Yes	101	4.5	2.5
Assistance in the business model definition	Yes	29	4.75	4
Assistance in writing the business plan	Yes	29	3.75	4.5
Assistance and management of IP rights	Yes	10	4.25	2.5
Information and assistance in applying for public funds	Yes	12	4.75	4
Search for external capital (seed, business angels, vc, etc.)	Yes	5	4.25	3.25
Workforce selection for the spin-off	No	5	2.75	2.25

* Since the TT was founded in 2001 till December 2005

** 1=non-important, 2=scarcely important, 3=average, 4=important, 5=very important

*** 1=below average, 2=average, 3=slightly above average, 4=above average, 5=highly above average

Interestingly, the services that the TT's personnel consider more important to support the process of venture creation are: 1) the presence of TT's personnel in the spin-off in its early stage of development; 2) the assistance in the definition of the business model; 3) information and assistance in applying for public funds and 4) evaluation of the spin-offs proposals.

It is also noticeable that the activities and services that were not offered in the beginning of the TT but are presently offered are not considered very important for its workforce (education, training and office space). Additionally, there are some services provided in a non-systematic way and sometimes by external individuals such as: legal, administrative, labour and tax consulting services and search for partnerships and suppliers. Furthermore, the TT considers extremely important to assist the spin-offs putting their products/services in the market and the marketing of such products. However, when the same question was asked to the spin-offs founders, almost all of them considered that it was impossible that any TT knew every market so they considered this service not very important.

Currently, the process of supporting spin-off creation has three main stages:

Diagnosis/evaluation phase, where the business idea is evaluated and classified as spin-off (exploit research results and knowledge obtained by these researchers while working at university) or start-up. During this phase the TT decides whether the initiative is feasible, according to both internal (UdG) and external (CIDEM) requirements.

Pre-incubation phase, where the project can benefit from all the services provided by the TT. A project manager is assigned to the project and with external advisors they constitute a pseudo board of directors that simulates the real functioning of a board. Once the business plan is written, the TT presents a report to the research vice-chancellor at UdG where they recommend whether or not to support the project and the specific conditions of the agreement with the promoters.

Incubation phase, where the promoters have to sign an agreement with the UdG for the shares and call options they would hand out to the TT for the services provided. In this stage the project receives continuous support from the TT, especially in the consolidation of the entrepreneurial team, marketing and sales and new sources of funding. This incubation phase lasts approximately three years, depending on the project and a post-incubation phase is expected.

4.3. Resources and process of spinning-off new ventures

4.3.1. Human resources

In the beginning, there was only one full-time and a part-time worker in the TT unit. Currently, the team is composed by three members, familiar with existing government grant programmes, in a very horizontal non-hierarchical organisation. Each member takes a project from the beginning till the post-incubation phase, providing all the support and resources required. The team is assisted by the TTO's team (17 people) in terms of contract research, IP and research programmes. This multidisciplinary team has links to the financial world to be able to evaluate the business plans (a ratio of 48:1 researchers to TTO officers but a ratio of 323:1 researchers per spin-off creation officers).

Surprisingly, none of the members of the team has technological background although one of the main criteria to select projects is their differentiating/unique technology. All of them have a master's degree in economics and they also have background in entrepreneurship. The team is very young, with an average age of 32, ranging from 26 to 38 years old. Their experience in the business world in areas like manufacturing, sales or R&D is quite limited, they have mainly worked in financial departments.

Unexpectedly, none of them have created a venture of their own before and none comes from the academic world. Their main competences are: the support in the development of the business plan, support in obtaining public funding, patent

management and other consultancy services. However, they lack competences in marketing and sales, a factor that the literature considers can influence the success of the supporting process. In order to overcome their lack of competences in certain areas, the TT has joined the public Catalan network of Technological Trampolines (XTT) created by CIDEM.

The TT has developed a methodology to self-evaluate projects that addresses to the TT looking for support. This methodology works for the majority of projects (80%) but for the rest of the projects the TT uses external advisors from venture capital firms.

4.3.2. Technological resources

Although the main criterion to select projects has been to have a differentiating technology susceptible to be patented, it has not always been strictly followed, especially in the beginning (see table 8). Only 3 of the 10 spin-offs created had a completely new technology, 2 of them employed existent technology and the rest presented different degrees of newness. In addition, two of these spin-offs hold six patents and other three have IP protections (know-how license and notary acts on software).

Table 8: Comparison between the theoretical technological selecting criteria and the evaluation of the technology of the spin-offs created

Technological criteria	Mean
<i>Theoretical selecting criteria</i>	
To which degree the selected projects have a differentiating technology susceptible to be patented? (1=none; 5=all of them)	4,13
To which degree the selected projects are product-oriented? (1=product; 5=service)	1,5
<i>Evaluation of the technology of the spin-offs created</i>	
To what extend the selected projects use existing knowledge to develop their first product? (1=all knowledge was new; 5=nearly all used knowledge/technology existed)	2,75
To what extend the selected projects synthesize existing knowledge to develop their first product? (1=no synthesis; 5=a lot of synthesis)	3
What was the scope of your know-how/ technology? (1=specific product; 5=platform technology with many applications)	3,03

The TT at University of Girona has no technological specialisation, assisting any kind of technology developed in this PRI. Interestingly, the majority of the projects came to the TT and were given support from the idea/opportunity recognition phase (50%) and 40% from the first prototype phase. Only one project was given support after the legal constitution of the firm, when it had already developed its products.

Regarding Intellectual Property protection, there are at least three acts, directives and by-laws (at the national, regional and local level) that regulate the process of transferring IP from universities to academics or ventures.

For example, the 20th article of the national IP act (Law 11/86) deals with the ownership of the IP rights of the inventions developed by researchers and academics at

universities as a result of their research activity. Concretely, this article establishes that the IP rights belong to university and that academics have the right to participate in the royalties obtained by the exploitation of such an invention by university or by the transfer of rights. Each university has the right to establish the conditions and amount of such participation in its by-laws. However, if the researcher's invention is a consequence of any kind of contract research with either public or private entities, this contract should specify which party would hold the property rights.

4.3.3. Financial and physical resources

The TT is exclusively funded by the CIDEM. Its current budget is €150,000 per year⁷ rising from €90,000 in 2002. The reason why the TT is exclusively funded by CIDEM is historical. Initially, neither the TTO nor the UdG had considered supporting spin-off creation as an activity for commercialising research. It was a new concept that needed a cultural change at University; the UdG was still in its “ivory tower” in 2001. CIDEM was the real promoter of this initiative among Catalan universities so it had to provide funding to overcome University's initial barriers. The TT forecast that in 2-3 years time they will be financially self-sufficient. Their incomes will come from the profits generated by the spin-offs they have participated and the public grants they apply for.

To assist in overcoming the lack of funding, the UdG participates in Invertec, SL, a seed capital fund promoted by the regional government and coordinated by CIDEM. The aim of this fund is the promotion of Catalan technology-based firms by participating in their equity. It invests up to €300,000 in those firms spun-off from PRI that have the support from Technological Trampolines. This fund tends to invest in earlier stages and lower amounts than a typical VC, it will hold equity in the company after separation with the percentage of equity taken varying but never comprising a majority. The UdG also participates in three business angels' networks.

Due to the difficulty that universities have to directly participate in the equity of the spin-offs, the UdG created a company, UdG Iniciatives, SL, to articulate its participation. At present, this instrument has already participated in five of the spin-offs created by the UdG and has options to participate in the rest. Its participation varies from 3 to 10% of the equity.

Apart from this, the UdG also offers office spaces below market prices (6 €/square metre) to spin-offs. In some exceptional cases, the UdG provides equipment and laboratory facilities. However, the most common arrangements for these facilities are via contract research with specific research groups or departments at university. In the mid-term, with the complete construction of the Scientific and Technological Park of

⁷ It does not include physical resources such as office space and equipment which are provided by the TTO for free.

the UdG, the TT will be able to offer more spaces and equipments.

4.3.4. Organisational and networking resources

The organisation and functioning of the TT is clearly marked by the CIDEM. This regional development agency monitors and evaluates the TT's activities. During the TT's five years of existence (2001-2006), CIDEM changed its evaluation criteria. At present, qualitative aspects complement the initial quantitative ones.

The TT offers a range of support activities and services, but to complete the internally lack of resources, they use their social network. This network includes firms, consultants and institutions specialised in technological development, commercial activities, venture capital and financial entities, management and business administration and R&D projects. Furthermore, the UdG also uses a sort of board of directors as the principal selecting mechanism for spin-offs projects. This board is constituted by business men, academics and the director of the TT. This board is complemented by external advisors (VC directors) when the evaluation is out of the scope of the TT's personnel. Links with local industry, specialised advisors and the VC community are important. Since the value added to equity investment will essentially come from second-round financing by VCs, the success of the spin-off service is quite dependent upon the "entrepreneurial context" of the region. However, the degree to which the government is willing to sponsor entrepreneurial initiatives is even more important in determining efficiency of the service.

4.3.5. The process of spinning-off new ventures

Opportunity search and awareness creation

Most opportunity recognition happens in an indirect way. Usually, since it is a small university, the TT's personnel periodically and informally meets with every quality research group director in order to inform of the spinning-offs possibilities of their research. Furthermore, the TT has also accepted many projects coming from outsiders, for example ex-students and end-of-contract researchers.

Overall, the trigger to spin-off is thus quite complex and staged in this case. It is especially oriented towards professors and researchers that can have a career at the UdG but many outsiders also benefit from their support. In certain cases, spin-offs present an alternative to employment at an established firm, especially for end-of-contract researchers.

Strategic choice how to commercialize R&D

The selection criteria are limited, and projects eligible for funding are at a very early stage in the spin-off funnel. However, the spin-off services not only give advice during the phase of project validation but also in later phases. Moreover, there are clear selection criteria though sometimes are left a part, especially in technology matters. Typically, researchers have to prepare a business plan to be selected by the spin-off

service. This results in an acceptance rate of about 29%, but a creation rate of 10%.

Intellectual property assessment and protection

Although the IP department is not the heart of the technology-transfer service via spin-off creation, proprietary technology is likely to be the key trigger to spin-off a company. However, this criterion has not always been followed and, in reality, it appears not to be the result of a strategy designed to create value from R&D strategy but of the entrepreneurial mission of the university. Nonetheless, only 20% of the companies owned a patent.

Incubation and business plan development

Incubation and business plan advice are key activities at UdG. The researchers are assisted in writing a preliminary business plan, which can be defended in front of a public or private seed capital fund. Incubation facilities also include space and sometimes access to equipment. However, the UdG is currently resource-deficient in physical resources until the Scientific and Technological Park is fully built. Support includes business advice and coaching among other activities. All this piece of advice and activities are regulated in a contract in exchange of a part of the equity of the spin-off.

Control over the process after the spin-off of the company

The amount of money available is limited and is usually only sufficient for a couple or three years. Most companies founded through this process are likely to seek complementary revenues through short-term contract research or consulting. In the UdG, 50% of the spin-off companies have already received seed capital financing but only 20% of the firms have received external capital via VC or business angels.

5. Conclusions and future research

Our main contribution is an in-depth analysis of the spin-off creation unit with special emphasis on its variety of resources and activities. In our attempt of giving a holistic view on the matter, we focused on both past and present characteristics. Moreover, we situated the TT in its immediate environment describing its links with the TTO and the PRI, broadening the analysis up to the regional level.

The findings highlight that the region of Catalonia is highly entrepreneurial in Spain, but still far from other European scientific regions of excellence like Baden-Württemberg or Ile-de-France (Clarysse et al., 2005). At the university level, the commercialisation of research happens similarly to the one described in Debackere and Veugelers (2005), but having different magnitudes. The regional environment clearly impacts on the resource acquisition process of the TT and its spin-offs. Concretely, the regional government is financially supporting this unit and at the same time is creating a network of advisors, business angels, IP specialists and other resources and capabilities to help in the success of such companies. Still, support mechanisms mainly come from

the regional level, rather than local (city council, chamber of commerce), national or international levels.

Similarly to Germany (Krücken, 2003), where either the regional government (Lander) or the National Ministry of Science and Research were the main driving forces of the TTOs' institutionalisation process, the motivation of creating a spin-off support unit at UdG was twofold. On the one hand, a general interest of a limited group of people to follow the international trend, including transfer-oriented professors and technology transfer officers. On the other hand, the regional government's initiative to help universities create the adequate structures to facilitate the commercialisation of research via spin-off creation. By that time, the university and its managers were still in the "ivory tower". This resulted into a laissez-faire university policy, where the TT followed its own path towards developing and diversifying its activities and finding resources in order to continuously assist and support researchers to carry out their ideas. Lately, the TT in Girona has already gone through a consolidation stage where an institutionalisation of the unit and routinisation of its services has been achieved.

The elements of the three typologies of incubation strategies in European research institutions (Clarysse et al., 2005) can be identified at the University of Girona. Nevertheless, the predominant typology at the UdG is the Supportive model. This model stems from the general idea of commercialising technology developed at the RI through other means than licensing or contract research. Hence, the spin-offs are an alternative option to create value from technology and their returns are based on economic profitability rather than financial gains for investors upon exit. Once the TT decides to commercialise technology through a spin-off, the team of researchers is intensively coached, including help with looking for money. However, in the beginning the TT had to create awareness, entrepreneurial culture and role models, thus the spin-offs created did not follow their selection criteria and initial objectives. Therefore, we still can observe a mixed model between Low Selective and Supportive. According to Clarysse et al. (2006:212) "...it is important for RIs to be very clear about their objectives and specify clearly the resources that are needed/activities performed to meet these objectives". The lack of clarity about the TT's objectives results in hybrid types that can be either resource or competence deficient. In fact, we have observed a hybrid model as a result of the continuous change in its objectives as a consequence of a learning-by-doing, try-and-error process and lack of sufficient competitive research.

As suggested before, another problem identified at the UdG is its shortage of competitive research, which hinders any support to technology transfer activity. In fact, the UdG is only capable of spinning-off one or two technological companies per year, the rest may not be based on a differentiating/unique technology. Thus, the main point at the UdG lies on whether the applied model and the resources employed are worth

used. In our opinion, it appears to be inappropriate to acquire the resources required to perform a Supportive model and then try to perform activities associated with a Low Selective model because their research outcomes are not sufficient.

Implication and recommendations

Our research suggests that the University of Girona should have a deeper pool of research with commercial potential. There is a need to first become a research university, with high quality of research (knowledge exploration and creation), and regional, national or international recognition. This can be stimulated through: 1) the recruitment, retaining, and development of star scientists; 2) partnership with leading industries in the region; 3) further investment and resources for research activities; and 4) a change in its incentive structure, especially for tenures.

Next, the process of cultural transformation aiming at converting the university into a more entrepreneurial should happen at different levels: teaching centres, including students and professors, administration and institution government. A major diffusion and a higher number of subjects on entrepreneurship and new venture creation are part of this transformation.

Third, although the TT followed a positive development path strongly guided by learning-by-doing that can be observed in both activities and resources, some recommendations are needed:

- A project selection methodology based on well-defined concepts and procedures is needed. Although the criteria and objectives regarding technology are very clear, the results are not completely successful. A clear methodology would automatically drive to resource savings and a better and more efficient allocation of them.
- Recruit more technology transfer officers with an appropriate private sector background and links with the local industrial districts in order to discover new opportunities, including experience of starting a business.
- At the university level, an incentive mechanism targeted at research groups and individual researchers should be designed by this embedded institution taking into account: academics profile, specific needs and regional industrial districts. Knowledge on existing practices in European research institutions having a more advanced entrepreneurial culture might be a starting point when designing incentive structures and schemes for local academics willing to start a business.
- Although the decentralised organisation gives the TTO freedom of actuation by establishing their goals, mission and objectives, there are no monitoring mechanisms of the impact of their activities in the local environment. Despite spin-off companies are commonly used as a performance indicator, they should be a tool and not an aim when creating regional welfare.

Fourth, our analysis shows a high variety of institutions aiming to support and promote innovation in both enterprises and universities in the region. A frequent, regular and devoted process of continuous information about the existence and activities of such institutions and their initiatives (with special emphasis on national and European context) concerning spin-off creation and promotion could be a solution in enhancing the number of science-based entrepreneurial ventures.

Finally, a number of limitations and areas for further research can be noted. First, examination of the broader technology-transfer strategies of the UdG and the research incentive structure was beyond the scope of this study. Further research should examine the rest of technology-transfer strategies and the balance of spin-offs versus other modes of technology transfer such as licensing and contract research. Second, our research does not deal with an in-depth analysis of the organisational or entrepreneurial culture within the PRI and the local environment. Third, the cultural transition of becoming entrepreneurial at both regional and university levels is a complex issue, and a more-detailed analysis based on historical, social and other criteria would make the analysis complete. Fourth, we do not show the results of the analysis aimed at characterising and analysing the success of the spin-offs created at this PRI. This is part of an undergoing research with the main objective of confronting both sides and show discrepancies if any in the model used by the TT and the expected results.

One main limitation and a primary future research field refers to the analysis and comparison of the resources, activities and success of the rest of PRI's incubation strategies in the same region (Catalan universities), then broadening the analysis to PRI's located in other regions within the Spain.

6. Acknowledgements

This paper is a part of a broader project devoted to study and encourage the creation of spin-offs, involving all PRIs in Catalonia and it is funded either by the Autonomous University of Barcelona. Financial support from the above institution, grant number EME 2005-41 is gratefully acknowledged.

7. References

- Aldrich, H. (1979) "Resource-dependence and inter-organisational relations". *Administrative Science Quarterly*, 7, pp. 419-454.
- Amit, R.; Shoemaker, P. (1993) "Strategic Assets and Organizational Rent". *Strategic Management Journal*, 14, (1), pp. 33 – 46.
- Autio, E., (1997) "New technology-based firms in innovation networks". *Research Policy*, 26, pp. 263-281.
- Autio, E.; Lumme, A., (1998) "Does the innovator role affect the perceived potential for growth? Analysis of four types of new, technology-based firms". *Technology Analysis & Strategic Management*, 10, pp. 41-54.
- Autio, E.; Yli-Renko, H. (1998) "New, technology-based firms in small open economies - an analysis based on the Finnish experience". *Research Policy*, 26, pp. 973–987.
- Barney, J.; Wright, M.; Ketchen, D. (2001) "The resource based view: 10 years after 1991". *Journal of Management*, 27 (6), pp. 625-642.
- Bozaman, B.; Boardman C. (2004) "The NSF Engineering Research Centers and the University

- Industry Research Revolution: A Brief History Featuring an Interview with Erich Bloch". *Journal of Technology Transfer*, 29 (3), pp. 265-375.
- Brush, C.G.; Greene, P.G.; Hart, M.M. (2001) "From initial idea to unique advantage: the entrepreneurial challenge of constructing a resource base". *Academy of Management Executive* 15 (1), pp. 64-78.
- Callan, B. (2001) "Generating spin-offs: evidence from across the OECD". *STI Review*, Vol. 26, pp. 13-56.
- Carayannis, E.G.; Rogers, E.M.; Kurihara, K.; Allbritton, M.M. (1998) "High technology spin-offs from government R&D laboratories and research universities". *Technovation*, 18 (1), pp. 1-11.
- Centre for Innovation and Business Development (CIDEM) (2006) "La situació de la innovació a Catalunya". First edition. Barcelona.
- Centre for Innovation and Business Development (CIDEM) (2006) "SUPPORT FOR ENTREPRENEURS - Financing and subsidies". Retrieved August 30, 2006 from <http://www.cidem.com/cidem/eng/suport/financing/index.jsp>.
- Clarysse, B.; Wright, M.; Lockett, A.; Van de Velde, A.; Vohora, A. (2005) "Spinning out new ventures: a typology of incubation strategies from European research institutions". *Journal of Business Venturing*, 20, 183-216.
- Clarysse, B.; Moray, N. (2004) "A process study of the entrepreneurial team formation: the case of a research-based spin-off". *Journal of Business Venturing*, 19, pp. 55-79.
- Chiesa, V.; Piccaluga, A. (2000) "Exploitation and diffusion of public research: the case of academic spin-off companies in Italy", *R&D Management*, 30, 4, 329-339.
- Chrisman, J.; Hynes, T.; Fraser, S. (1995) "Faculty Entrepreneurship and Economic development: The Case of the University of Calgary". *Journal of Business Venturing*, 10, pp. 267-281.
- Debackere, K.; Veugelers, R. (2005) "The role of academic technology transfer organisations in improving industry science links", *Research Policy*, 34, 321-342.
- Degroof, J.; Roberts E. (2004) "Overcoming Weak Entrepreneurial Infrastructures for Academic Spin-Off Ventures". *Journal of Technology Transfer* 29 (3) pp. 327-352.
- DiGregorio, D.; Shane, S. (2003) "Why do some universities generate more start-ups than others?". *Research Policy*, 32 (2), pp. 209-227.
- Druilhe, C., Garnsey, E. (2004) "Do academic spin-outs differ and does it matter?". *Journal of Technology Transfer*, 29 (3-4), pp. 269-285.
- Eisenhardt, K.M. (1989) "Building Theories from Case Study Research". *Academy of Management Review*, 14, pp. 488-511.
- Eisenhardt, K.M. and Martin, J.A. (2000) "Dynamic Capabilities: What are they?" *Strategic Management Journal*, 21, pp. 1105 - 1121.
- European Commission (2000) Commission Decision of 14 March 2000 listing the areas of Spain eligible under Objective 2 of the Structural Funds for the period 2000 to 2006 (2000/264/EC) Official Journal L 084 , 05/04/2000 P. 0026 - 0046.
- European Commission (2002) "Innovation tomorrow. Innovation policy and the regulatory framework: Making innovation an integral part of the broader structural agenda". Innovation papers, no 28. Luxembourg.
- Ferguson, R.; Olofsson, C. (2004) "Science parks and the development of NTBFs - location, survival and growth". *Journal of Technology Transfer*, 29 (1), pp. 5-17.
- Fontes, M. (2005) "The process of transformation of scientific and technological knowledge into economic value conducted by biotechnology spin-offs". *Technovation*, 25, pp. 339-347.
- Fontes, M., (2001) "Biotechnology entrepreneurs and technology transfer in an intermediate economy". *Technological Forecasting and Social Change*, 66 (1), pp. 59-74.
- Franklin, A., Wright, M., Lockett, A., (2001) "Academic and surrogate entrepreneurs in university spin-outs". *Journal of Technology Transfer*, 26 (1-2), pp. 127-141.

- Fundación COTEC para la innovación tecnológica (2004) “Libro Blanco 2004 - El Sistema Español de Innovación: Situación en 2004” (White Book 2004. Spanish Innovation System: Status in 2004).
- Generalitat de Catalunya (2006) “Statute of Autonomy of Catalonia”. Retrieved August 30, 2006 from <http://www.gencat.net/generalitat/eng/estatut/index.htm>
- Gibb, A. (2005) “Towards the Entrepreneurial University. Entrepreneurship Education as a lever for change”. Working paper.
- Girona Chamber of Commerce (2006) “Informe de conjuntura de l’economia gironina 2005”. Girona.
- Grant, R. (1991) “The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation”. *California Management Review*, 33, pp. 114 – 135.
- Grant, R. (1992) “Contemporary Strategy Analysis: Concepts, Techniques, Applications”. Basil Blackwell. Cambridge. Massachusetts.
- Gübeli, M.H.; Doloreux, D. (2005) “An empirical study of university spin-off development”. *European Journal of Innovation Management*, 8 (3), pp. 269-282.
- Harmon, B.; Ardichvili, A.; Cardozo, R.; Elder, T.; Leuthold, J.; Parshall, J.; Raghian M.; Smith, M. (1997) “Mapping the University Transfer Process”. *Journal of Business Venturing*, 12 (5), pp. 423-434.
- Heirman, A., Clarysse, B., (2004) “How and why do research-based start-ups differ at founding? A resource-based configurational perspective”. *Journal of Technology Transfer*, 29 (3-4), pp. 247-268.
- Henrekson, M.; Rosenberg, N. (2001) “Designing Efficient Institutions for Science-Based Entrepreneurship: Lesson from the US and Sweden”. *Journal of Technology Transfer*, 26, 207-231.
- Hindle, K; Yencken, J. (2004) “Public research commercialisation, entrepreneurship and new technology based firms: an integrated model”. *Technovation*, 24, pp. 793-803.
- Jacob, M.; Lundqvist, M.; Hellsmark, H. (2003) “Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology”, *Research Policy*, 32, 1555-1568.
- Jones-Evans, D.; Klofsten, M.; Andresson, E.; Pandya, D. (1999) “Creating a bridge between university and industry in small European countries: the role of the Industrial Liaison Office”. *R&D Management*, 29/1, pp. 47-56.
- Kennye, M.; Goe, R. (2004) “The role of social embeddedness in professorial entrepreneurship: a comparison of electrical engineering and computer science at UC Berkeley and Stanford”. *Research Policy*, 33 (5), 691-707.
- Krücken, G. (2003) “Mission impossible? Institutional barriers to the diffusion of the ‘third academic mission’ at German universities”. *International Journal of Technology Management*, 25 (1/2), pp. 18-33.
- Lambert, R. (2003) “Lambert Review of Business-University Collaboration”. London: HMSO.
- Lindelof, P., Lofsten, H., (2004) “Proximity as a resource base for competitive advantage: university-industry links for technology transfer”. *Journal of Technology Transfer*, 29 (3-4), pp. 311-326.
- Link, A.; Scott, J. (2005) “Opening the ivory tower’s door: An analysis of the determinants of the formation of U.S. university spin-off companies”. *Research Policy*, 34, pp. 1106-1112.
- Lockett, A.; Siegel, D.; Wright, M.; Ensley, M.D. (2005) “The creation of spin-offs at public research institutions: Managerial and policy implications”. *Research Policy*, 34, pp. 981-993.
- Lockett, A.; Wright, M. (2005) “Resources, capabilities, risk capital and the creation of university spin-out companies”. *Research Policy*, 34, pp. 1043-1057.
- Miles, M.; Huberman, M. (1994) “Qualitative Data Analysis, second edition”. Thousand Oaks, CA: Sage.
- Ministry of Universities, Research and Information Society – DURSI (2006) “Statistics”. Retrieved July 15, 2006 from www.gencat.net/dursi
- Mok, K. H. (2005) “Fostering entrepreneurship: Changing role of government and higher

- education governance in Hong Kong". *Research Policy*, 34, pp. 537-554.
- Moray, N.; Clarysse, B. (2005) "Institutional change and resource endowments to science-based entrepreneurial firms". *Research Policy*, 34, pp. 1010-1027.
- Mustar, P.; Larédo, P. (2002) "Innovation and research policy in France (1980–2000) or the disappearance of the Colbertist state". *Research Policy*, 31, pp. 55-72.
- Mustar, P.; Renault, M.; Colombo, M.G.; Piva, E.; Fontes, M.; Lockett, A.; Wright, M.; Clarysse, B.; Moray, N. (2006) "Conceptualising the heterogeneity of research-based spin-offs: A multi-dimensional taxonomy". *Research policy*, 35, pp. 289-308.
- Nicolaou, N., Birley, S., (2003) "Academic networks in a trichotomous categorisation of university spinouts". *Journal of Business Venturing*, 18 (3), pp. 333-359.
- North, D. (2005) "Understanding the process of economic change". Princeton: University Press.
- North, D. (1990) "Institutions, institutional change and economic performance". Cambridge: University Press.
- Parhankangas, A; Arenius, P. (2003) "From a corporate venture to an independent company: a base for a taxonomy for corporate spin-off firms". *Research Policy*, 32, pp. 463-481.
- Pérez, M; Martínez, A. (2003) "The development of university spin-offs: early dynamics of technology transfer and networking". *Technovation*, 23, pp. 823-831.
- Pfeffer, J., Salanick, G. (1978) "The External Control of Organisations: A Resource Dependence View". Harper & Row, New York.
- Pirnay, F.; Surlémond, B.; Nlemvo, F. (2003) "Toward a typology of university spin-offs". *Small Business Economics*, 21 (4), pp. 355-69.
- Roberts, E.B., Malone, D.E., (1996) "Policies and structures for spinning-off new companies from research and development organisations". *R&D Management*, 26 (1), pp. 17-48.
- Shane, S., Stuart, T., (2002) "Organisational endowments and the performance of university start-ups". *Management Science*, 48 (1), pp. 154-170.
- Shane, S. (2002) "University technology transfer to entrepreneurial companies". *Journal of Business Venturing* 17, 537–552.
- Siegel, D.S.; Waldman, D.; Link, A. (2003) "Assessing the impact of organisational practices on the relative productivity of university technology transfer offices: an exploratory study". *Research policy*, 32, pp. 27-48.
- Smilor, R.W., Gibson, D.V., Dietrich, G.B. (1990) "University spin-out companies: technology start-ups from Ut-Austin". *Journal of Business Venturing*, 5, pp. 63–76.
- Steffensen, M., Rogers, E.M., Speakman, K. (2000) "Spin-offs from research centers at a research university". *Journal of Business Venturing*, 15 (1), pp. 93–111.
- Technology Transfer Office (2005) "Annual report - 2005". Retrieved on September 4th, 2006 from <http://www.udg.es/vrrecerca-ct/mr03/index.htm>.
- Teece, D.J., Pisano, G. and Shuen, A. (1997) "Dynamic Capabilities and Strategic Management". *Strategic Management Journal*, 18 (7), pp. 509 – 533.
- Thompson, J. (1967) "Organisations in Action". McGraw-Hill, New York.
- Upstill, G.; Symington, D. (2002) "Technology transfer and the creation of companies: the CSIRO experience". *R&D Management*, 32 (3), pp. 233–239.
- Urbano, D. (2006) "New Business Creation in Catalonia: Support measures and attitudes towards entrepreneurship". Collection of studies (Col.lecció d'estudis) Centre for Innovation and Business Development - CIDEM, 2006.
- University of Girona (2006a) "Annual Activity Report, 2004-2005", Girona.
- University of Girona (2006b) "Strategic Research Plan, 2005-2008", Girona.
- Vohora, A.; Wright, M.; Lockett, A. (2004) "Critical junctures in the development of university high-tech spinout companies". *Research Policy*, 33, pp. 147-135.
- Walter A.; Auer, M.; Ritter, T. (2005) "The impact of network capabilities and entrepreneurial orientation on university spin-off performance". In press, *Journal of Business Venturing*.
- Westhead, P., Storey, D., (1995) "Links between higher education institutions and high technology firms". *Omega*, 23 (4), pp. 345-360.
- Wright, M., Birley, S., Mosey, S., (2004a). "Entrepreneurship and university technology transfer". *Journal of Technology Transfer*, 29 (3-4), pp. 235-246.
- Wright, M., Vohora, A., Lockett, A., (2004b) "The formation of high tech university spinout

companies: the role of joint ventures and venture capital investors”. *Journal of Technology Transfer*, 29 (3-4), pp. 287-310.

Yin, R.K. (1989) “Case study research-design and methods”. Newbury Park: Sage Publications.

Edicions / Issues:

- 95/1 *Productividad del trabajo, eficiencia e hipótesis de convergencia en la industria textil-confección europea*
Jordi López Sintas
- 95/2 *El tamaño de la empresa y la remuneración de los máximos directivos*
Pedro Ortín Ángel
- 95/3 *Multiple-Sourcing and Specific Investments*
Miguel A. García-Cestona
- 96/1 *La estructura interna de puestos y salarios en la jerarquía empresarial*
Pedro Ortín Ángel
- 96/2 *Efficient Privatization Under Incomplete Contracts*
Miguel A. García-Cestona
Vicente Salas-Fumás
- 96/3 *Institutional Imprinting, Global Cultural Models, and Patterns of Organizational Learning: Evidence from Firms in the Middle-Range Countries*
Mauro F. Guillén (The Wharton School, University of Pennsylvania)
- 96/4 *The relationship between firm size and innovation activity: a double decision approach*
Ester Martínez-Ros (Universitat Autònoma de Barcelona)
José M. Labeaga (UNED & Universitat Pompeu Fabra)
- 96/5 *An Approach to Asset-Liability Risk Control Through Asset-Liability Securities*
Joan Montllor i Serrats
María-Antonia Tarrazón Rodón
- 97/1 *Protección de los administradores ante el mercado de capitales: evidencia empírica en España*
Rafael Crespi i Cladera
- 97/2 *Determinants of Ownership Structure: A Panel Data Approach to the Spanish Case*
Rafael Crespi i Cladera
- 97/3 *The Spanish Law of Suspension of Payments: An Economic Analysis From Empirical Evidence*
Esteban van Hemmen Almazor
- 98/1 *Board Turnover and Firm Performance in Spanish Companies*
Carles Gispert i Pellicer
- 98/2 *Libre competencia frente a regulación en la distribución de medicamentos: teoría y evidencia empírica para el caso español*
Eva Jansson
- 98/3 *Firm's Current Performance and Innovative Behavior Are the Main Determinants of Salaries in Small-Medium Enterprises*
Jordi López Sintas y Ester Martínez Ros

- 98/4 *On The Determinants of Export Internalization: An Empirical Comparison Between Catalan and Spanish (Non-Catalan) Exporting Firms*
Alex Rialp i Criado
- 98/5 *Modelo de previsión y análisis del equilibrio financiero en la empresa*
Antonio Amorós Mestres
- 99/1 *Avaluació dinàmica de la productivitat dels hospitals i la seva descomposició en canvi tecnològic i canvi en eficiència tècnica*
Magda Solà
- 99/2 *Block Transfers: Implications for the Governance of Spanish Corporations*
Rafael Crespí, and Carles Gispert
- 99/3 *The Asymmetry of IBEX-35 Returns With TAR Models*
M.^a Dolores Márquez, César Villazón
- 99/4 *Sources and Implications of Asymmetric Competition: An Empirical Study*
Pilar López Belbeze
- 99/5 *El aprendizaje en los acuerdos de colaboración interempresarial*
Josep Rialp i Criado
- 00/1 *The Cost of Ownership in the Governance of Interfirm Collaborations*
Josep Rialp i Criado, i Vicente Salas Fumás
- 00/2 *Reasignación de recursos y resolución de contratos en el sistema concursal español*
Stefan van Hemmen Alamazor
- 00/3 *A Dynamic Analysis of Intrafirm Diffusion: The ATMs*
Lucio Fuentelsaz, Jaime Gómez, Yolanda Polo
- 00/4 *La Elección de los Socios: Razones para Cooperar con Centros de Investigación y con Proveedores y Clientes*
Cristina Bayona, Teresa García, Emilio Huerta
- 00/5 *Inefficient Banks or Inefficient Assets?*
Emili Tortosa-Ausina
- 01/1 *Collaboration Strategies and Technological Innovation: A Contractual Perspective of the Relationship Between Firms and Technological Centers*
Alex Rialp, Josep Rialp, Lluís Santamaria
- 01/2 *Modelo para la Identificación de Grupos Estratégicos Basado en el Análisis Envoltante de Datos: Aplicación al Sector Bancario Español*
Diego Prior, Jordi Surroca
- 01/3 *Seniority-Based Pay: Is It Used As a Motivation Device?*
Alberto Bayo-Moriones
- 01/4 *Calidad de Servicio en la Enseñanza Universitaria: Desarrollo y Validación de una Escala de Medida.*
Joan-Lluís Capelleras, José M.^a Veciana

- 01/5 *Enfoque estructural vs. recursos y capacidades: un estudio empírico de los factores clave de éxito de las agencias de viajes en España.*
Fabiola López-Marín, José M.^a Veciana
- 01/6 *Opción de Responsabilidad Limitada y Opción de Abandonar: Una Integración para el Análisis del Coste de Capita.*
Neus Orgaz
- 01/7 *Un Modelo de Predicción de la Insolvencia Empresarial Aplicado al Sector Textil y Confección de Barcelona (1994-1997).*
Antonio Somoza López
- 01/8 *La Gestión del Conocimiento en Pequeñas Empresas de Tecnología de la Información: Una Investigación Exploratoria.*
Laura E. Zapata Cantú
- 01/9 *Marco Institucional Formal de Creación de Empresas en Catalunya: Oferta y Demanda de Servicios de Apoyo*
David Urbano y José María Veciana.
- 02/1 *Access as a Motivational Device: Implications for Human Resource Management.*
Pablo Arocena, Mikel Villanueva
- 02/2 *Efficiency and Quality in Local Government. The Case of Spanish Local Authorities*
M.T. Balaguer, D. Prior, J.M. Vela
- 02/3 *Single Period Markowitz Portfolio Selection, Performance Gauging and Duality: A variation on Luenberger's Shortage Function*
Walter Briec, Kristiaan Kerstens, Jean Baptiste Lesourd
- 02/4 *Innovación tecnológica y resultado exportador: un análisis empírico aplicado al sector textil-confección español*
Rossano Eusebio, Àlex Rialp Criado
- 02/5 *Caracterización de las empresas que colaboran con centros tecnológicos*
Lluís Santamaria, Miguel Ángel García Cestona, Josep Rialp
- 02/6 *Restricción de crédito bancario en economías emergentes: el caso de la PYME en México*
Esteban van Hemmen Almazor
- 02/7 *La revelación de información obligatoria y voluntaria (activos intangibles) en las entidades de crédito. Factores determinantes.*
Gonzalo Rodríguez Pérez
- 02/8 *Measuring Sustained Superior Performance at the Firm Level*
Emili Grifell - Tatjé, Pilar Marquès - Gou
- 02/9 *Governance Mechanisms in Spanish Financial Intermediaries*
Rafel Crespi, Miguel A. García-Cestona, Vicente Salas
- 02/10 *Endeudamiento y ciclos políticos presupuestarios: el caso de los ayuntamientos catalanes*
Pedro Escudero Fernández, Diego Prior Jiménez

- 02/11 *The phenomenon of international new ventures, global start-ups, and born-globals: what do we know after a decade (1993-2002) of exhaustive scientific inquiry?*
Alex Rialp-Criado, Josep Rialp-Criado, Gary A. Knight
- 03/1 *A methodology to measure shareholder value orientation and shareholder value creation aimed at providing a research basis to investigate the link between both magnitudes*
Stephan Hecking
- 03/2 *Assessing the structural change of strategic mobility. Determinants under hypercompetitive environments*
José Ángel Zúñiga Vicente, José David Vicente Lorente
- 03/3 *Internal promotion versus external recruitment: evidence in industrial plants*
Alberto Bayo-Moriones, Pedro Ortín-Ángel
- 03/4 *El empresario digital como determinante del éxito de las empresas puramente digitales: un estudio empírico*
Christian Serarols, José M.^a Veciana
- 03/5 *La solvencia financiera del asegurador de vida y su relación con el coste de capital*
Jordi Celma Sanz
- 03/6 *Proceso del desarrollo exportador de las empresas industriales españolas que participan en un consorcio de exportación: un estudio de caso*
Piedad Cristina Martínez Carazo
- 03/7 *Utilidad de una Medida de la Eficiencia en la Generación de Ventas para la Predicción del Resultado*
María Cristina Abad Navarro
- 03/8 *Evaluación de fondos de inversión garantizados por medio de portfolio insurance*
Sílvia Bou Ysàs
- 03/9 *Aplicación del DEA en el Análisis de Beneficios en un Sistema Integrado Verticalmente Hacia Adelante*
Héctor Ruiz Soria
- 04/1 *Regulación de la Distribución Eléctrica en España: Análisis Económico de una Década, 1987-1997*
Leticia Blázquez Gómez; Emili Grifell-Tatjé
- 04/2 *The Barcelonnettes: an Example of Network-Entrepreneurs in XIX Century Mexico. An Explanation Based on a Theory of Bounded Rational Choice with Social Embeddedness.*
Gonzalo Castañeda
- 04/3 *Estructura de propiedad en las grandes sociedades anónimas por acciones. Evidencia empírica española en el contexto internacional*
Rabel Crespí; Eva Jansson
- 05/1 *IFRS Adoption in Europe: The Case of Germany.*
Soledad Moya, Jordi Perramon, Anselm Constans

- 05/2 *Efficiency and environmental regulation: a 'complex situation'*
Andrés J. Picazo-Tadeo, Diego Prior
- 05/3 *Financial Development, Labor and Market Regulations and Growth*
Raquel Fonseca, Natalia Utrero
- 06/1 *Entrepreneurship, Management Services and Economic Growth*
Vicente Salas Fumás, J. Javier Sánchez Asín
- 06/2 *Triple Bottom Line: A business metaphor for a social construct*
Darrel Brown, Jesse Dillard, R. Scott Marshall
- 06/3 *El Riesgo y las Estrategias en la Evaluación de los Fondos de Inversión de Renta Variable*
Sílvia Bou
- 06/4 *Corporate Governance in Banking: The Role of Board of Directors*
Pablo de Andrés Alonso, Eleuterio Vallelado González
- 06/5 *The Effect of Relationship Lending on Firm Performance*
Judith Montoriol Garriga
- 06/6 *Demand Elasticity and Market Power in the Spanish Electricity Market*
Aitor Ciarreta, María Paz Espinosa
- 06/7 *Testing the Entrepreneurial Intention Model on a Two-Country Sample*
Francisco Liñán, Yi-Wen Chen
- 07/1 *Technological trampolines for new venture creation in Catalonia: the case of the University of Girona*
Andrea Bikfalvi, Christian Serarols, David Urbano, Yancy Vaillant