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

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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

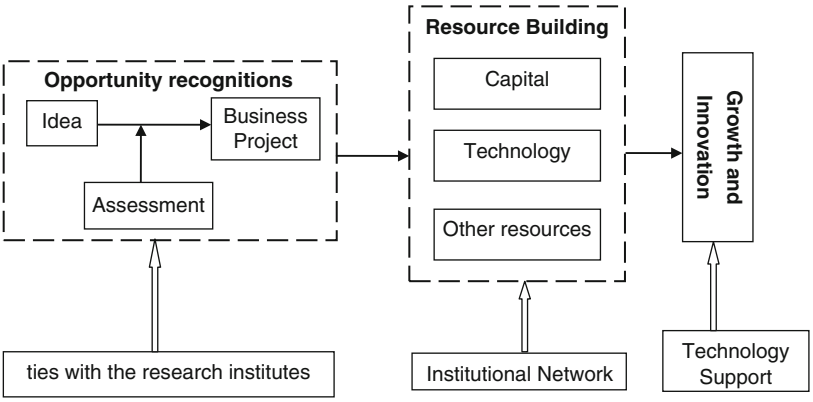

Fig. 4.1 The concept framework of data interpretation

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.

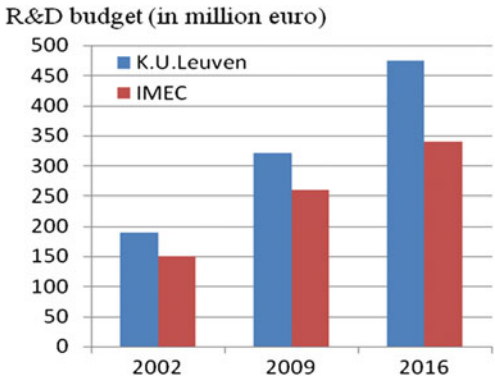

Fig. 4.2 R&D budget. *Source*: http://www2.imec.be/be_en/about-imec.html

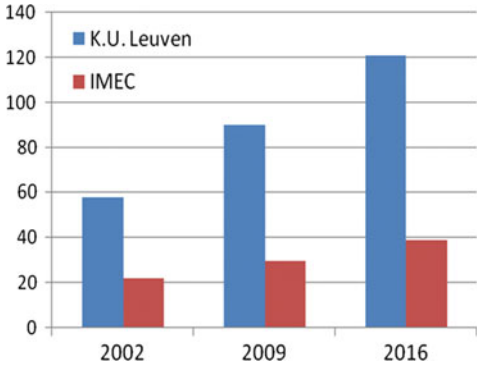

Fig. 4.3 Number of spin-off companies

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.

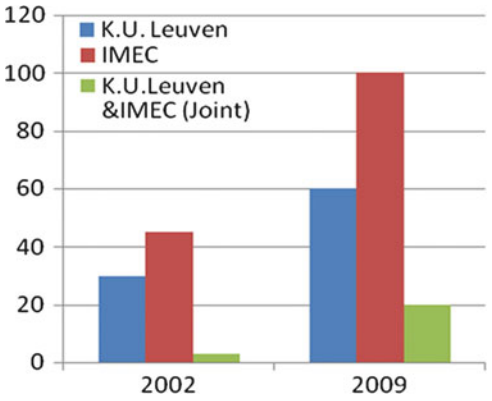

Fig. 4.4 Number of patent applications

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.

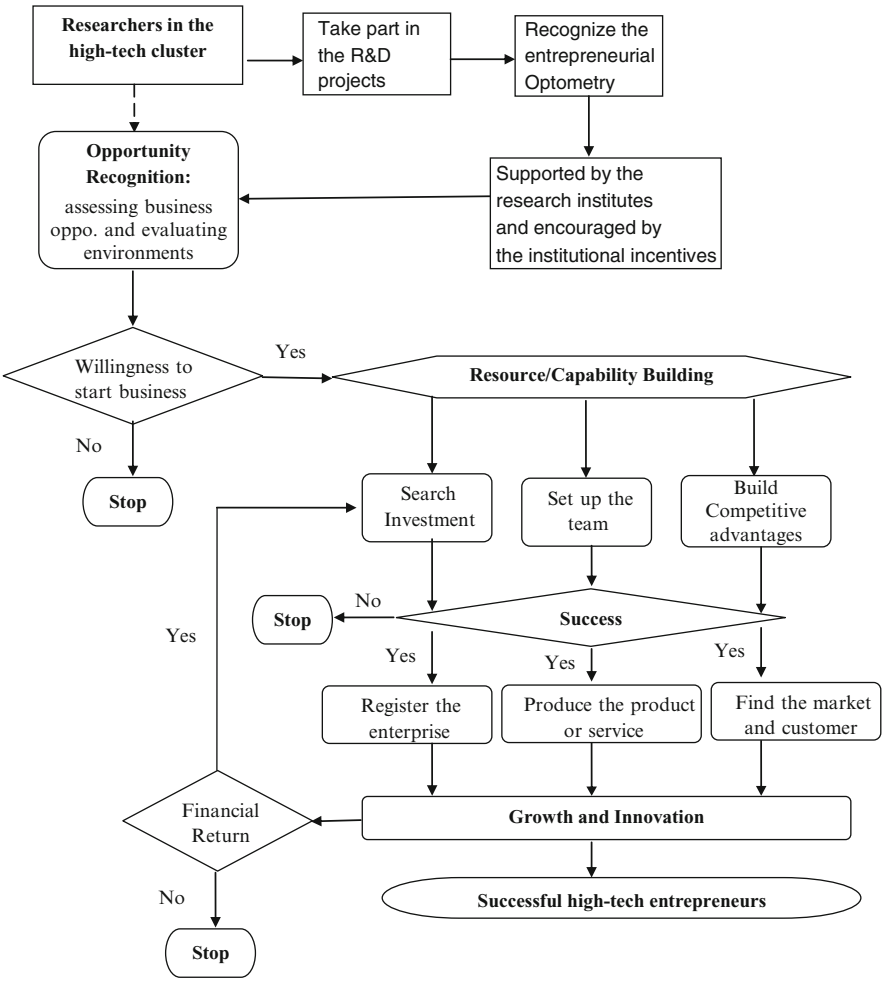

Fig. 4.5 The flowchart of high-tech entrepreneurial process in Leuven

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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References

Athreye S (2000) Agglomeration and growth: a study of the Cambridge hi-tech cluster. Open discussion papers in Economics 29, Faculty of Social Sciences, Department of Economics, The Open University

Becattini G (1979) Dal Settore Industriale al Distretto Industriale. Alcune considerazioni sull'unità di indagine in economia industriale. Rev Econ Polit Ind 1:7–14

Bhave MP (1994) A process model of entrepreneurial venture creation. J Bus Venturing 9(3):223–242

Brush CG, Patricia G, Myra MH, Harold SH (2001) From initial idea to unique advantage: the entrepreneurial challenge of constructing a resource base. Acad Manag Executive 15(1):64–80

Bygrave WD (1994) The portable MBA in entrepreneurship. Wiley, New York
Creswell JW (1998) Qualitative inquiry and research design: choosing among five traditions. Sage, Thousand Oaks
Di Minin A, Lazzeroni M, Piccaluga A (2003) HTSFs in peripheral, knowledge intensive areas: an in-depth analysis in Pisa. In: The eleventh annual HTSF conference, Manchester
Dosi G, Malerba F (1996) Organization and strategy in the evolution of the enterprise. MacMillan, London
Eisenhardt KM (1989) Building theories from case study research. The Acad Manag Rev 14(4):532–550
Eisenhardt KM (1991) Better stories and better constructs: the case for rigor and comparative logic. The Acad Manag Rev 16(3):620–627
Elfring T, Hulsink W (2003) Networks in entrepreneurship: the case of high-technology firms. Small Bus Econ 21(4):409–422
Evans DS, Leighton LS (1989) Some empirical aspects of entrepreneurship. The Am Econ Rev 79(3):519–535
Feldman M (1994) Knowledge complementarity and innovation. Small Bus Econ 6(3):363–372
Feldman MP (2001) The entrepreneurial event revisited: an examination of new firm formation in the regional context. Ind Corporate Change 10:861–891
Giacon P (2010) The rising new generation of high-tech entrepreneurs: an exploratory study. Working paper. http://proceedings.utwente.nl/84/1/Giacon.pdf, accessed on 06-May 2012
Glaser B, Strauss A (1967) The discovery of grounded theory: strategies of qualitative research. Wiedenfeld and Nicholson, London
Graham S, Merges P, Samuelson P, Sichelman T (2009) High technology entrepreneurs and the patent system: results of the 2008 Berkeley Patent Survey. Berkeley Technol Law J 24 (4):255–327
Hamilton BH (2000) Does entrepreneurship pay? An empirical analysis of the returns to self-employment. The J Political Econ 108(3):604–631
Lissoni (2001), Knowledge spillovers and local innovation systems: a critical survey. In: Industrial and corporate change. Oxford University Press, Oxford
Mccormick D (1999) African enterprise clusters and industrialization: theory and reality. World Dev 27(9):1531–1551
Miles MB, Huberman AM (1994) Data management and analysis methods. In: Denzin N, Lincoln Y (eds) Handbook of qualitative research. Sage, Thousand Oaks, pp 428–444
Moskowitz TJ, Vissing-Jørgensen A (2002) The returns to entrepreneurial investment: a private equity premium puzzle? Am Econ Rev 92(4):745–778
Mytelka L (1991) Crisis, technological change and the strategic alliance. In: Mytelka L (ed) Strategic partnerships and the world economy. Pinter Publishers, London
Mytelka L, Farinelli F (2000) Local clusters, innovation systems and sustained competitiveness. UNU/INTECH Discussion Papers. http://xcsc.xoc.uam.mx/apymes/webftp/documentos/biblioteca/local%20clusters.pdf on 2012.04.05. ISSN: 1564-8370
Owen-Smith J, Powell WW (2004) Knowledge networks as channels and conduits: the effects of spillovers in the Boston biotechnology community. Organ Sci 15(1):5–21
Porter ME (1998) Clusters and the new economies of competition. Harvard Bus Rev 6:77–90
Robert EB (1991) Entrepreneurs in high technology: lessons from MIT and beyond. Oxford University Press, New York
Rosenblatt, Sheaffer (2001) Brain drain in declining organizations: toward a research agenda. J Organ Behav 22(4):409–424
Roth K, Kostova T (2003) Organizational coping with institutional upheaval in transition economies. J World Bus 38(4):314–330
Saxenian A (1996) Regional advantage: culture and competition in Silicon Valley and route 128. Harvard Business School Press, Boston
Shane S, Venkatraman S (2000) The promise of entrepreneurship as a field of research. Acad Manag Rev 25:217–226

Smith HL, Glasson J, Chadwick A (2005) The geography of talent: entrepreneurship and local economic development in Oxfordshire. Entrepreneurship Reg Dev 17(6):449–478
Strauss A, Corbin J (1990) Basics of qualitative research: grounded theory procedures and techniques. Sage, Newbury Park
Timmons JA (1999) New venture creation, 5th edn. Irwin McGraw hill, London, pp 236–251
UKSPA (1996) The United Kingdom science park association annual report 1996. The United Kingdom Science Park Association, Birmingham
United Nations Conference on Trade and Development (UNCTAD) (1998) Promoting and sustaining SMEs: clusters and networks for development. Paper presented at the Meeting on Clustering and Networking for SME Development, Geneva, 2–4 September 1998
Walcott SM (2003) Chinese science and technology industrial parks. Antony Rowe Ltd., Wiltshire
Yin RK (2003) Case study research: design and methods. Sage, Thousand Oaks