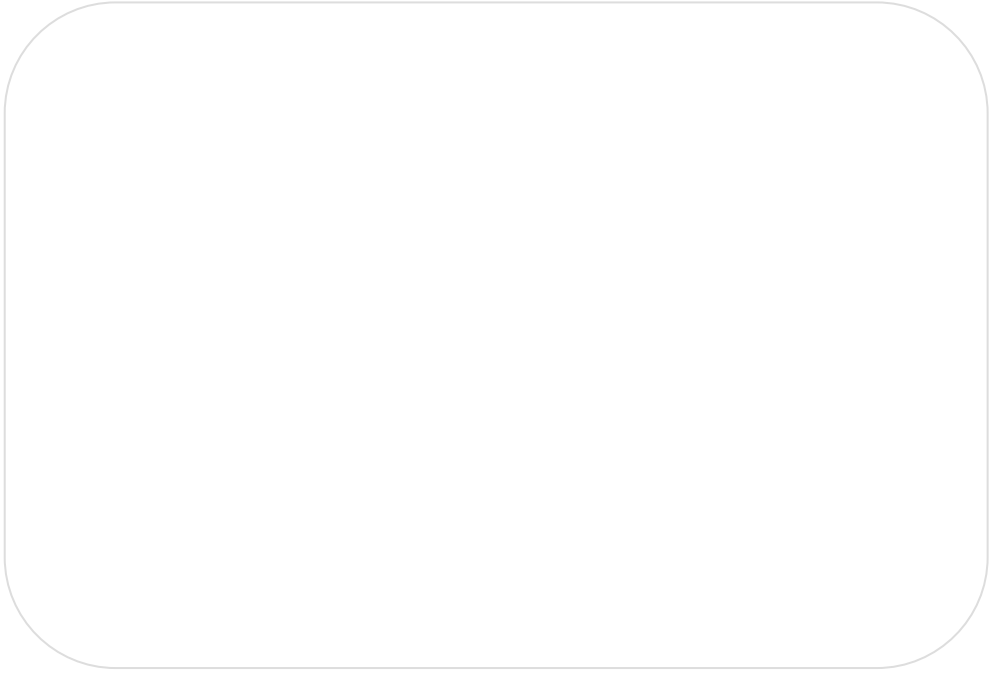




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**Surveying Technology-Based Small Firms:
A Perspective From Belgium**

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SURVEYING TECHNOLOGY-BASED SMALL FIRMS

A PERSPECTIVE FROM BELGIUM

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Abstract: This paper details a survey methodology on technology-based small firms (TBSF) in Belgium. The survey's objective is to better understand the factors underlying the creation and development of firms with high growth potentials. In this respect it focuses on the socio-economic factors associated with the entrepreneurs, on the national framework conditions affecting entrepreneurship and on the financial architecture of the firms. The survey data of 103 TBSFs shows that 82 percent of entrepreneurs finance their firms with their own personal savings at seed stage. The debt-financing funds mostly in the form of government subsidies of all kind and commercial bank loans are the secondary source of finance and together constitute the biggest portion of total external finance. 26 percent of these firms had at start-up stage been recipient of venture capital funds and 20 percent of "angel" funds. There is also evidence that as firms get older the proportion of internal finance decreases while external finance first increases at start-up, peaks at early growth, and gradually decreases at later stages of development. Several strengths and weaknesses of the Belgian framework conditions for entrepreneurship are identified. The results also allow to better understand the key socio-cultural determinants of entrepreneurs themselves. 97 percent of technology-based small firm entrepreneurs are male. Over 80 percent of entrepreneurs in the survey have a university degree and 42 percent hold post-graduate degrees. We briefly discuss these findings in light of existing literature.

Keywords: technology-based small firms, entrepreneurship, start-up financing, survey data.

JEL: M13, G20, M21.

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1. INTRODUCTION

The role of innovative enterprise as an engine of economic growth has gathered the attention of a vast number of scholars and policy makers. Much of this attention stems from the belief that successful innovation is vitally dependant on entrepreneurial activity. Entrepreneurial activity is often referred to as a prerequisite for productivity and long term employment growth. Given this strong association between entrepreneurship and economic growth, policy-makers have increasingly focused on developing and implementing strategies that sustain entrepreneurial activity. The European Commission (EC) promotes the need to “*nurture a culture of entrepreneurship.*” The Organization for Economic Co-operation and Development (OECD) advocates “*entrepreneurship to be central to the functioning of market economies and entrepreneurs to be essential agents of change who accelerate the generation, application and spread of innovative ideas.*”

The recent evidence shows that entrepreneurial activity depends on a number of different factors. One of the important factors is the lack of overall entrepreneurial culture in Europe in comparison with the United States (US). The level of entrepreneurship in Belgium, for example, is very low (Global Entrepreneurship Monitor-GEM, 2002). This lack of entrepreneurial culture in Belgium mainly originates from social and educational culture as well as both the micro and macro-economic environment. In other words, the research and development (R&D) activities, physical, commercial and professional infrastructure, public policy, and financial markets have an impact on the level of entrepreneurship for a given country.

Lack of financial resources is another major problem that these start-ups face (Gompers and Lerner, 2001). There is a large volume of literature on capital market imperfections associated with asymmetric information, moral hazard, and adverse selection making external finance for small and medium-sized enterprises (SMEs) more costly and less flexible. The financing of TBSFs differs from traditional SMEs mainly because they lack tangible assets in their earlier stages that may be used as collateral. Secondly their value is linked primarily to longer-term growth potential derived from scientific knowledge and intellectual property. Finally their products initially have little or no track record in markets and are sometimes subject to high rates of obsolescence.

Our research objective is to make an in-depth analysis of the three main factors that affect entrepreneurship: Firstly the framework conditions, secondly the socio-cultural factors and finally the financial system. To the best of our knowledge, these factors have not yet been empirically addressed for the Belgian TBSFs. In a nutshell, the following questions are to be tackled during our forthcoming investigations:

- Who are the Belgian innovative entrepreneurs? What motivates them? What makes Belgium more or less entrepreneurial than other countries?
- Where does the entrepreneurial finance come from? How actually these innovative firms are financed? How are the availability, accessibility and appropriateness of entrepreneurial capital in Belgium?

Our research activity will aim to address these questions in order to examine how public sector initiatives should be targeted to promote entrepreneurial activity and improve the access to entrepreneurial finance in Belgium. We ultimately seek to provide potential avenues for policy implementations intending to increase the level and effectiveness of small and innovative enterprises.

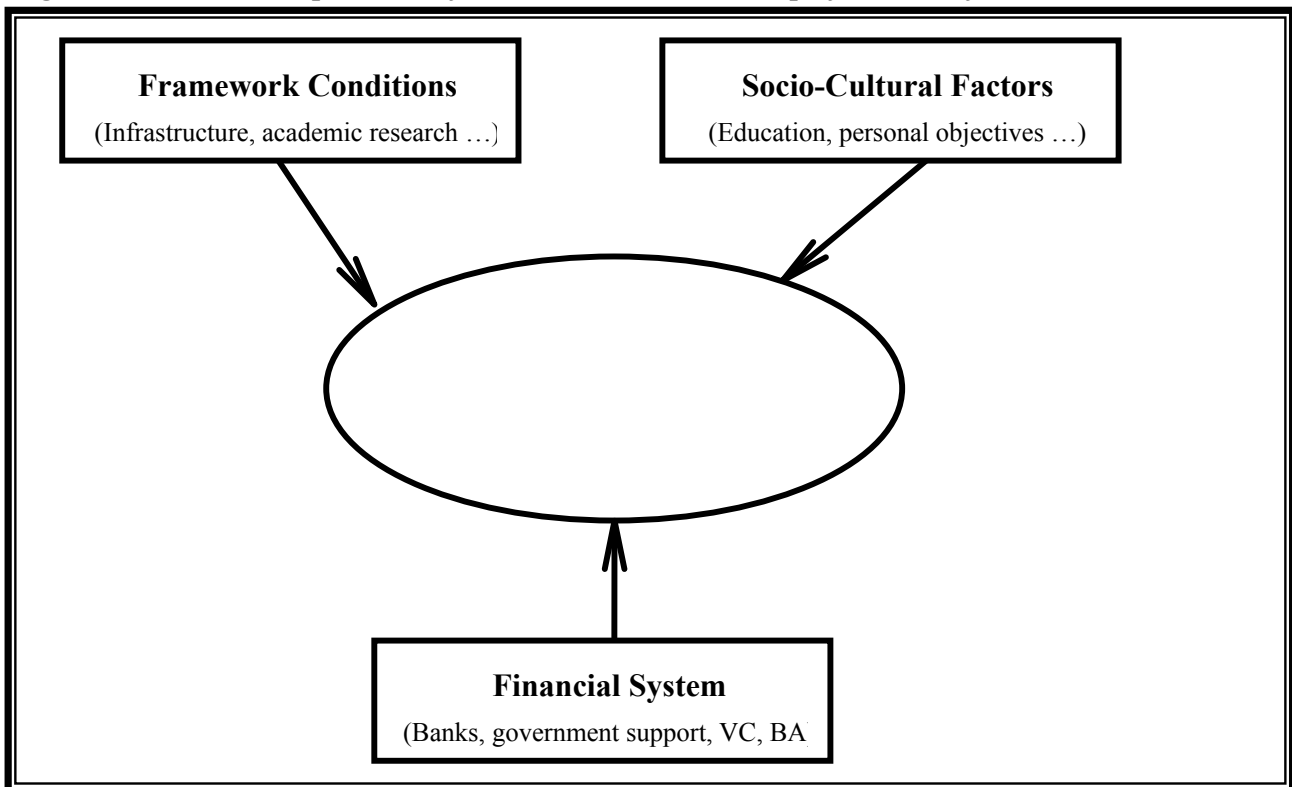
In order to get relevant and accurate information for our economic analyses we had to build a new database on Belgian new technology-based firms (NTBFs). The objectives of this paper is first to describe our survey methodology questionnaire content. Secondly, we summarize the basic preliminary findings on 103 NTBFs that were established in Belgium between 1985 and 2002.

The paper is organized as follows. Section 2 outlines the questionnaire methodology. Section 3 details the construction of TBSF database. Section 4 discusses the survey methodology. Section 5 summarizes the preliminary findings and Section 6 concludes with several suggestions for further research.

2. THE QUESTIONNAIRE FOR TBSF

The questionnaire's content was driven by our desire to get an accurate insight into the three main factors that might influence the creation and performance of NTBFs. These main factors are pictured in Figure 1. They are the framework conditions (e.g., the quality and availability of infrastructures and communication channels, the level of academic and public research, ..), the socio-cultural factors associated with the entrepreneurs and their environment (e.g., level of education, their parent's education, gender...) and the financial system (availability of public funds, role of venture capitalists, availability of business angels,...).

Figure 1. Factors with a potential influence on the creation and performance of NTBFs



The questionnaire is detailed in following paragraphs. [Appendix 2](#). It is constructed in 4 main parts¹:

- Header: Respondent Information.
- Part 1. Company Information.
- Part 2. Financing
- Part 3. Entrepreneur

The respondents are asked to complete the questionnaire by:

- Filling in the “Yes” or “No” boxes.
- Filling in the Corresponding box(es) against a statement or question.
- Filling in the blank field(s) provided.
- Filling in the *Likert-Scale* Statements – from a scale of 1 to 5 (1=strongly disagree, 5=strongly agree).

The following subsections detail each part of the questionnaire:

¹ The questionnaire is available upon request. Please contact astrid.romain@ulb.ac.be for a copy of the questionnaire.

Respondent Information

The header information is requested to be completed by the respondent. The respondents are asked to provide their full names, telephone and fax numbers, e-mail addresses and their current position in the company. The target of the questionnaire was one of the founding entrepreneurs.

Company Information

Part 1 is constructed in 5 main sections. Some sections are further divided into sub-sections for clarity.

1.1 Company Information includes company mail address and postal code, location, VAT number, year of establishment, legal Form, start-up capital, and countries of business activity.

1.2 Technology-Based Industry Criteria includes 9 industries both manufacturing and services, listed by OECD (1997) as “High Technology” and “Medium High-Technology” classification. The questionnaire also includes additional “other” field for unlisted main sectors of activity (see section 3: Step 1 for details).

1.3 Small Size Criteria includes questions to validate responses against the EC definition of a “small” firm (EC, 1996). The validation is further divided into 2 sub-criteria: size and ownership. Size criteria include (from year 2000 to 2002) total number of employees, annual sales (turnover), and annual balance sheet totals. Ownership criteria include number of start-up founders, number of owners with 25 percent or more ownership, and ownership by a parent company (see section 3: Step 1 for details).

1.4 R&D Information includes 5 “Yes or No” questions to collect information on respondents’ R&D activities. Two additional questions collect broad percentage of R&D budget and commercialisation of R&D.

1.5 Patenting Information is constructed in two sub-sections: Likert-Scale and patenting activity. The scale aims to establish the background information as regards to patenting issues. The 10 statements are concerned with cost issues, market conditions, secrecy, efficiency, and administration of patenting activities. The second part establishes whether the respondent relies on the patent system and if so what are the volume and the broad percentage of commercialised patents.

The Financial System

Part 2 is constructed in 5 sections:

2.1 Current Stage of Development - This section includes two questions to establish the current stage of development (lifecycle) of the respondents’ enterprises. The four stages of development are based on Mayer (2002) and include: “seed”, “start-up”, “early growth”, and “expansion/development.” The definition of each stage is included in the questionnaire as brief footnotes.

2.2 Sources of Funds Matrix lists ten sources of funds across four stages of development as per 2.1. The nine sources plus “other” are listed in order to collect information from “internal” and “external” sources of finance. Internal sources include: personal, family and friends’ funds, and retained earnings. External sources include: commercial bank loans, government subsidies of all kind, non-financial institutional funds, other debt-finance, business angel funds, venture capital funds, and other equity-finance. The respondents are asked to select their sources of funds for each stage by filling in the matching box.

2.3 Bank Financing Information is divided into two sub-sections: Bank Financing Likert-Scale and Banking Activity. Bank Likert-Scale aims to detail respondents’ perception against/for the bank financing of TBSF. The 12-statement scale is based on Awareness, Availability, Appropriateness, and Accessibility (**4A’s**) of bank financing in Belgium. The Banking Activity sub-section has two “Yes or No” questions and collects information as regards the timing, name, and amount of bank financing.

2.4 Venture Capital Financing Information is also divided into two sub-sections: Venture Capital (VC) Financing Likert-Scale and VC Financing Activity. The 14-statement scale is also based on 4A’s-model to detail the perceptions of respondents as regards to VC financing in Belgium. The second section has two aims.

The first is to detail the timing, name, amount, and government scheme information of VC financing source(s). The second is to collect information using seven “Yes or No” questions about the senior management composition and future alliance plans.

2.5 Business Angels Financing Information is also divided into two sub-sections: Business Angels (BA) Financing Likert-Scale and BA Financing Activity. In parallel with 2.4 the 14-statement scale is also based on 4A’s-model to detail the perceptions of respondents as regards to BA financing in Belgium. The second section has two aims. The first is to detail the timing, name, amount, and government scheme information of BA financing source(s). The second is to collect information using five “Yes or No” questions about the senior management composition and future alliance plans.

Entrepreneurs’ Socio-cultural Background and Framework Conditions

Part 3 is requested to be completed by at least one of the founding members or entrepreneurs. It is constructed in 4 main sections.

3.1 Entrepreneur Profile includes 21 questions based on a combination of “Yes or No”, Fill-in the Blanks, and Fill-in the matching Box(es). It is further divided into five sub-sections for clarity reasons: demographics, genesis of TBSF, educational background, family background, and previous work experience.

- The **demographic information** includes Age, Gender, Marital Status and Permanent Residence (location).
- The **genesis of TBSF** identifies four options to define the establishment: “Start-up”, “corporate spin-off”, “university spin-off”, and “Other”. The three definitions (“start-up”, “corporate spin-off”, and “university spin-off”) are explained briefly in the questionnaire footnotes. Three Additional questions are used to establish the genesis of the idea, duration and association of founders.
- The **Educational background** sub-section gathers information about the founders’ latest academic degree, field of study, name of institution, and any entrepreneurial-related courses attended.
- The **Family background** section collects information about the founders’ mothers and fathers’ education background and employment.
- The **previous work experience** section has five questions to outline the work experience of entrepreneurs detailing the duration, field of activity, last position held, and number of staff supervised.

3.2 Entrepreneurial Opportunities in Belgium is a section constructed around 24-statement measured with a Likert-Scale to gauge the respondents’ perception of Belgium as regards to entrepreneurial opportunities in terms of availability and accessibility. It is grouped in five sub-sections: physical infrastructure, commercial and professional infrastructure, social and cultural norms, national research and technology development (RTD) system, and government policies and programs.

- In **physical infrastructure** sub-section, respondents are asked to rate availability and accessibility to Belgian physical infrastructure such as transportation networks, utilities, and communication networks.
- The **commercial and professional infrastructure** refers to all commercial and professional parties such as business consultants, analysts, lawyers, and supplies available to support new and growing TBSFs. The respondents in this section are asked to rate availability of and access to such services.
- The **social and cultural norms** sub-section deals with questions as regards to the social welfare system, taxing, and multi-lingual culture of Belgium for starting up or developing a young TBSF.
- The **National research and technology development (RTD) system** subsection refers to the extent to which national research and development will lead to new commercial opportunities and whether or not these are available for new or growing firms. Respondents in this section are asked to rate availability and accessibility of the main actors involved in technology transfer including technology

science parks, incubators, science labs, Intellectual Property Rights (IPR) administration, university-industry networking, science and technology graduates, industry R&D, and networks among industries.

- The **Government policies and programs** subsection highlights questions dealing with the availability and accessibility of government policies and programs that support the National RTD system. It further asks questions to rate the administration of the available programs.

3.3 Entrepreneurship Motives section is a 7-statement Likert-Scale constructed to better understand the motivations (realization of a novel idea, personal challenge, money, activity, risk, experience) for starting up a new TBSF.

3.4 Entrepreneur Objectives Outlook section is a 9-statement Likert-Scale. The statements include later-stage lifecycle objectives as regards to improving existing product/services/processes, develop additional new products/services/processes, changing or improving organization structure, changing or improving management information systems, train/educate workforce, and eliminate brain drain from workforce.

3. THE TBSF DATABASE

Technology-based small firms (TBSFs) are innovative enterprises also widely known as high-technology start-ups. According the definition of Allen (1992) TBSFs are “*businesses whose products or services depend largely on the application of scientific or technological knowledge, or as businesses whose activities embrace a significant technology component as a major source of competitive advantage.*” These businesses are generally located in industries such as aviation, communications, information technology, biotechnology, electronics, and medical/life sciences (McNally, 1995). The definition of “small” company adopted by the EC focuses on the measurable parameters of size (number of employees, sales turnover, and balance sheet total) and control (less than 25 percent of equity should be owned by one or a joint enterprise). Small companies according to EC definition employ less than 50 employees and generate maximum of €7 million annual sales (turnover) with a balance sheet total not exceeding €5 million.

As we were not aware of an existing published or created Belgian high technology firms’ directory, we created a new database directory of Belgian TBSF between October 2002 and December 2002. The TBSF Database (TBSF dB) is constructed in 4 parts or “tables”:

Table 0: Address_Book

Table 1: Company_Information

Table 2: Finance_Table

Table 3: Entrepreneur_Table

We created the Address_Book in 3 steps. Step 1 is based on the definitions of technology-based and “small” firm established in Belgium covering 3 geographical regions namely, Brussels-Capital, Flanders, and Wallonia. Step 2 covers the identification of technology-based small firms using a wide range of sources. Finally, Step 3 involves the physical entry of enterprises into the Address_Book of TBSF dB.

Step 1:

Address_Book is being created according to the OECD (1997) revision of the high-technology sector definition. The present study includes the companies as classified as “High-Technology” and “Medium-High Technology” in OECD classification.

[Insert Table 1 around here]

The High Technology in TBSF dB includes Belgian companies operating in Aerospace, Computers and Office Machinery, Electronics and Telecommunications, and Pharmaceuticals.

The Medium-High Technology in TBSF dB includes Belgian companies operating in the sectors of Scientific Instruments, Electrical Machinery, Chemicals, Non-electrical Machinery, Motor vehicles and other transport equipment.

We use the definition of a small firm adopted by the European Commission² (EC). The EC focuses on the measurable parameters of Size (Number of employees, Annual sales or turnover, Balance sheet total and Control: Less than 25% of equity should be owned by one or a joint enterprise).

Small firms according to EC definition employ less than 50 employees and generate maximum of € 7m annual sales (turnover) with a total balance sheet not exceeding € 5m.

Step 2:

We employed a combination of methods to collect company information. These methods include: 1) internet search, 2) private and confidential listings from sources of information (i.e. FEDICHEM, AGORIA and BVA), 3) Interviews with senior management (i.e. m-Brussels, UNICE and ESA), 4) Member Directories (i.e. IMEC, VIB, AGORIA, EVCA and BBA), 5) Belgian companies database (i.e. BEL-FIRST), and 6) Publications (i.e. IMF, Eurostat, OECD and World Bank).

Table 2 details the sources of information and access links used to create and maintain company Address_Book.

[Insert Table 2 around here]

Accordingly, we identified 650 companies operating in manufacturing and/or service industries as outlined above. Subject to availability of information, almost 40 percent of the companies are entered into Address_Book full in 3 subsections. The remaining companies have at least one contact detail for future updates of the TBSF dB. The following outlines the sections of the Address_Book:

Section 1- Company Header details include company name, legal form of establishment, year of establishment, Belgian VAT number, mailing address, postal area (zip) code, phone number, fax number, e-mail, and web address.

Section 2- Contact Person(s) details includes full names and positions of senior management that personalized letters along with the questionnaire were planned to be mailed.

Section 3- Survey Follow-up Management, aims to keep track of the surveying logistics and includes key information such as the date of mailing, the language of questionnaire, the follow-up reminder and means of reminder (i.e., telephone, e-mail, mail, and fax).

A unique company number (key) set in Address_Book is used to create and maintain company information in 3 additional tables: Company_Information, Finance_Table, and Entrepreneur_Table. Each field in these tables is created in order to match one-by-one the information asked from respondents as outlined in details in Section 2: Construction of the Questionnaire.

Step 3:

² Commission Recommendation of 3 April 1996 concerning the definition of small and medium-sized enterprises (96/280/EC) [Official Journal L 107 of 30/04/1996]

We entered 607 enterprises out of 650 into our newly created TBSF dB as 43 enterprises were no longer active in business as of October-December 2002.

4. THE TBSF SURVEY METHODOLOGY

The survey for this study is structured in 3 parts.

Part 1: Pilot Testing of Questionnaire

Part 2: Interviews

Part 3: Mailing

Pilot Testing of Questionnaire

In order to improve the quality of the questionnaire we conducted 3 trial interviews with entrepreneurs whom we had previous contacts. Each session lasted between 1.0 and 1.5 hours and conducted in mother tongue (Dutch or English or French) of respondent. These companies represented biotechnology, computers and office machinery, and electronics and telecommunications industries. The results of these initial interviews were not included in the final study. The questionnaires were corrected as per interview discussions and corrected/improved for clarity. Revised questionnaire were then sent to all 607 identified companies.

Interviews

We chose companies with complete information as per section 3 Step 1 and Step 2 discussions from the following industries:

Aerospace,

Computers and Office Machinery,

Electronics and Telecommunications,

Life Sciences (including pharmaceuticals, biotechnology, medical equipment), and

Chemicals.

We then created 35 personalized letters in mother-tongue (Dutch, French or English) of the contact person. The letters briefly explained the reasons for the study and asked the participant's assistance for cooperation with full assurance of confidentiality. We mailed the letters in the first week of November 2002 and followed with courtesy calls after five and ten working days.

A total of 28 (80 percent response rate) companies accepted to participate in the study and interviews were conducted in the months of November and December 2002. We used the revised questionnaire and supervised the respondents to complete the questionnaires by themselves. The completion of the questionnaires lasted 10 25 minutes. Further analysis of interview information based on technology and size criteria proved that 3 interviews out of 28 (11 percent) needed to be excluded resulting a total of 25 interviews for the study.

Mailing

We mailed 582 letters in language (Dutch, French or English) based on the mail address of the enterprise. Both French and Dutch versions are included for the Brussels-Capital region to reflect the bilingual nature of the region. Again, the cover letters briefly explained the reasons for the study and asked the participants' assistance for cooperation with full assurance of confidentiality. 308 of these letters were mailed directly to the contact person with full name and position details. The remaining letters (274) were addressed to the attention of General Manager/Managing Director of the company. We mailed the letters in two batches of similar size. The first batch mailed in mid-January 2003 and the second batch mailed 15 days later. We e-mailed courtesy reminders to non-responding companies after 15 days of mailing. The number of usage of fax-message, telephone, and mail reminders was not significant.

By January-March 2003 we received a total of 86 responses (14 percent). After entering those into TBSF dB and validating based on industry, size, age, and completeness we eliminate 8 responses (9 percent) as void. As

result we manage to collect 78 (13.4 percent) valid mail questionnaires to be analysed in this study. These questionnaires were added with the ones of the 25 personal interviews.

5. PRELIMINARY FINDINGS

Based on 103 observations the following paragraphs summarize the preliminary findings of this study.

5.1. Part 1: Firm Characteristics

Age, Size and Industry

The size of the company as factor of growth is a field of research well developed. Harada (2003) works on newly established firms in Japan and shows that the initial size of the firm has an impact on its future success. Larger firms tend to have higher probabilities of success. Agarwal and Audretsch (1998) provide an in-depth review of this literature and suggest that evidence on this probability of success is hazardous. They further confirm that small companies have less probabilities of survival but argue that this result is the opposite for mature high-tech products. In the technology-based industries where the entry is less because of radical innovation and more because of strategic niches, there is an inversion of the impact of size on the probability to survive.

We approach the company size with our main variables in the questionnaire. Small companies are 1) independently owned; 2) employ less than 50 employees; 3) with annual sales of €7 million maximum; 4) total assets capitalization of €5 million.

None of the firms in our sample had an initial public offering (IPO) and were traded in public markets in any ways. They were established between the years 1985 and 2002. Table 3 illustrates TBSF size characteristics from year 2000 to 2002 inclusive. Table 4 outlines TBSF employee size for a defined range at industry level and Table 5 details enterprise age and current stage of development.

[Insert Table 3 around here]

[Insert Table 4 around here]

[Insert Table 5 around here]

R&D and Patenting

R&D is one of the important drivers in the development of innovative enterprises. Engel and Fire (2000) find that the establishment of technology centres as a kind of specific infrastructure to grow companies stimulate the number of high-tech start-ups within or around such centres. Patent is another important determinant of entrepreneurship. Patents add value to intangible asset-base of a young and small innovative company. It further provides protection and possible sources of income due to future royalty fees. On the other hand, the cost of patenting, limited financial and human resources, lack of in-house competence, lack of secrecy, imitation, low value creation because of no development, and administration represent the negative aspects of patenting process.

In line with these major findings, we asked entrepreneurs in our sample whether they perform R&D activities. Table 6A and 6B outline the summary findings on R&D activity.

[Insert Table 6A and B around here]

A very large number (85 percent) of these NTBFs are active in research activities. This search for new knowledge is not performed only in house, as 50 percent of the firms are involved in active cooperation with a higher education institution. Half of the NTBFs received public support for their R&D activities, whereas only 14 percent benefited from tax deductions for these activities. R&D seems to be very important for their long term sustainability, as they allocate on average 27 percent of their budget to R&D expenses and exploit commercially more than 40 percent of their innovation output.

Furthermore we asked whether they have filed a patent since their establishment. This result depends largely on the industries in which the company is included (Table 7A). Table 7B outlines the summary findings on patent related questions. In order to have a better understanding of entrepreneurs' perception on patenting process, an 11-statement Likert-Scale is presented. The results of this scale are shown in section C of Table 7.

[Insert table 7A, B and C around here]

More than 60 percent of the NTBFs in the pharmaceutical and Instruments sectors have filed at least one patent. This ratio is much lower in the sectors of aerospace, computer and electronics for instance, where the appropriability conditions do not seem to be reinforced by the patent system. The patenting NTBF seem to make an active use of their patent portfolio, as about 60 percent of their patented inventions are exploited commercially and 11 percent licensed to third parties.

5.2. **Part 2: Financing of TBSF**

Berger and Udell (1998) argue that, given their limited operating history, start-ups are the most *informationally opaque* firms in the economy. Lack of financial resources is one of the major problems that these start-ups face. Gompers and Lerner (2001) further argue that innovation fails to create value when firms cannot attract the resources required to sustain their development and rapid growth.

Where Does The Money Come From?

Mayer (2002) summarizes the development of high technology firms in four stages. The first is the seed stage when a concept has still to be proven and developed. The second is the start-up stage when products are developed and initial marketing takes place. The third is the early growth stage development when the firm is expanding and producing but may well remain unprofitable. Expansion/Development stage includes expansion of an established company that requires increasing its production capacity, marketing, and sales to grow before a possible initial public offering (IPO).

The availability of, access and need for financial sources for the young and informationally opaque firms differ at different stages of their lifecycle. Berger and Udell (1998) and Rosen (1998) outline that the initial development almost invariably comes from personal savings and "almost internal" funds such as friends and relatives. On the debt-finance side, commercial banks are the main supplier of funds to these informationally opaque firms. Governments have long had a role in financing the development of private sector technology (Lerner, 1999). On the equity-finance side, *business angels* (wealthy private investors) and venture capitalists (VC) are the major supplier of funds to entrepreneurial firms (Wright and Robbie, 1998). Venture capitalists play a greater role in the early-growth phase rather than seed or start-up stage (Freear and Wetzel, 1990; Mason and Harrison, 1993; Lerner, 1998).

Major works as summarized above studied relatively large firms including medium-low technology enterprises. For example, Petersen and Rajan (1995) and Berger and Udell (1995) use the National (US) Survey of Small Business Finances to analyse how various financial arrangements are structured. There have been only a few empirical studies investigating the financing of small entrepreneurial firms (Fluck *et al*, 1998). In addition to a number of European studies (Camarero and Lazaro, 1995; Laranja, 1995; APCE, 2000; Giudici and Paleari, 2000), Manigart and Struyf (1997) study the financing of 18 high technology Belgian start-ups and conclude that the most important sources of financing at the start-up stage are the entrepreneurs themselves and the banks. Their findings suggest that the role of government is not significant.

Consistent with the theoretical arguments (see Bank of England, 2001 for a comprehensive review), and recent studies for Europe we find that internal finance is critical for entrepreneurs to start-up new technology-based firms. The personal funds of the founders are the primary source of seed finance in 82 percent of cases. The “debt-finance” funds mostly in the form of government subsidies of all kind and commercial bank loans are the secondary sources of finance and together constitute a bigger portion of total external finance. 26 percent of these firms had at start-up stage been recipient of venture capital funds and 20 percent of business angel funds. **Table 8** and **Figure 2** illustrate internal and external sources of funds have been used by entrepreneurs at different stages of their development or lifecycle.

[Insert Table 8 around here]

[Insert Figure 2 around here]

Our findings also support the results of Fluck *et al*, (1998). As firms get “older”, the proportion of internal finance decreases while external finance first increases at start-up, peaks at early growth, and gradually decreases at later stages of development. Figure 3 plots the evolution of sources of finance for TBSFs during their stages of development.

[Insert Figure 3 around here]

Venture capitalists provide the highest average amount of funds (€919.5 thousand) to TBSFs. Commercial banks follow this with an average of €569.4 thousand. Business angels in our sample invest an average of €200.0 thousand. The entrepreneurs themselves invest an average of €124.4 thousand from their own personal savings. Table 9 outlines the average amounts invested by different sources of finance. The second-round financing both for business angels and venture capitalists is also included in the Table.

[Insert Table 9 around here]

Angel Financing and Venture Capital

The seminal work on the study of business angels was conducted by Wetzel (1983). Later works studying the US angel market include Freear, Sohl and Wetzel (1994, 1997; Sohl, 2002). In Europe, the study of business angels has been pioneered by Mason and Harrison (1992, 1995) who have examined UK business angels with respect to market imperfections, business introduction services, and the role of public policy (Mason, 1996). Recently, the study of business angels has spread from these origins in the US and the UK to include research on business angels in Sweden (Landstrom and Olofsson, 1996), The Netherlands (K+V, 1996), Finland (Lumme *et al*, 1998), Japan (Tashiro, 1998) and Australia (Hindle and Wenban, 1997).

On the venture capital market side, the initial empirical research was conducted by Tyebee and Bruno (1984) and Bygrave and Timmons (1986, 1992) and followed by a larger volume of literature comparing VC to angel market. Van Osnabrugge (1998) concludes that VC is the visible segment of the early stage equity market, and with this visibility is the ability to identify and access venture capital firms for research purposes, especially in contrast to the informal market (angels). Similar to the evolution of research on venture capital, the early researchers in angel markets focused on the US market (Sapienza 1992). More recently, this stream of literature has begun to include European nations as the unit of study (Murray 1995a). Recent cross-country comparisons of the venture capital industry (Sapienza *et al*, 1996; Murray 1995b) are indicative of the international dimension (Sohl, 2002).

In contrast to the research on specific segments and processes as briefed in this section, the intent of this paper is to provide a broad overview of the business angel and venture capital industry for technology-based small Belgian firms. We intend to better understand the types of finance on offer, the finance providers, and the perception of entrepreneurs themselves as efficient and effective. We like to think of this in terms of the “4A’s”: Awareness, Availability, Appropriateness, and Accessibility.

In order to build our 4A’s model, we developed Likert-Scale questions on a scale of 5 on statements regarding business angel and venture capital financing. **Awareness**, the first A, relates on how aware both finance

providers and entrepreneurs are of the markets where they might exchange information and resources. More specifically it focuses on questions including: Do finance providers have the structure to service and support TBSF entrepreneurs? How do entrepreneurs perceive themselves to initiate and conclude deals? How aware are these entrepreneurs of available public programs or schemes? In many cases, the **availability** of finance is a bigger issue for TBSFs than its actual cost. Availability is to be affected by a number of issues, above all the macro-economic conditions (Bank of England, 2001). The most **appropriate** form of finance for a TBSF is another important factor that needs to be carefully observed. A TBSF may not meet all of its financial needs from any one source. It would rather create a “basket” of finance preferable tailored to its individual requirements and needs during different stages of development. Finance for TBSFs should also need to be **accessible**. The perception of entrepreneurs as regards to access is important. It gives an opportunity to finance providers and policy makers to better understand their needs to put effective and efficient measures in action to be more accessible.

BA and VC from the Belgian Entrepreneurs' Viewpoint

We asked the respondents to rate what makes business angel financing difficult for their high-tech start-ups. Table 10 outlines the scores of TBSF entrepreneurs in our survey with a total of 99 observations regarding business angel financing. We further asked entrepreneurs whether they have used any business angel financing at any stage of their development. 24 percent of our sample used angel financing at one stage. Table 11 outlines business angel-related summary of the survey.

[Insert Table 10 around here]

[Insert Table 11 around here]

We also asked entrepreneurs to respond on statements regarding venture capital financing difficulties faced for their high-tech start-ups. Table 12 outlines the scores of 97 Belgian TBSF entrepreneurs regarding venture capital financing. A total of 38 percent of our respondents used venture capital financing at one stage of their development. Table 13 outlines venture capital-related summary of our findings.

[Insert Table 12 around here]

[Insert Table 13 around here]

It seems that the most important factors (about half of the respondents) that hinder the reliance on BA funding are the limited reliable information on the activities of Bas, the small size of the BA financing market in Belgium, and the limited government policies to promote private investment financing. The reliance on VC funding is hindered by different factors (see table 12). For about 60 percent of the NTBFs, VC is difficult to use because of the unwillingness of VC firms to provide small amounts of capital, their lack of interest in early stage investments, their expectation of high rates of return and of quick exits.

Commercial Bank Financing

Berger and Udell (1998) show that commercial bank loans are the primary source of debt finance in US small business finance. As the firms get “older” the entrepreneurial firms tend to borrow from commercial banks (Rosen, 1998). In recent years a number of commercial banks devoted substantial resources increasing the awareness and skills of lending managers at the branch level (Bank of England, 2001). In addition, in the last decade many European governments introduced public sector initiatives in terms of bank loan guarantee programs and schemes that increased the entrepreneur and bank partnership. For example, 70 percent of successful UK start-ups had at one stage been recipients of awards, usually linked to the government-related schemes (Bank of England, 2001).

A large volume of theories on bank lending for small companies focuses primarily on the role of *information asymmetries* (Stiglitz and Weiss, 1981). More specifically, in Myers' (Myers and Majluf, 1984) *pecking order view of finance* capital structure may be driven by firms' desire to finance new investments in a hierarchical

fashion - first internally, then by low-risk debt, and finally by equity. In Rajan's (1992) *monopoly-lender* theory, the entrepreneur builds a relationship with an informed investor. The investor then acquires private information about the firm. By virtue of this fact, over time the investor acquires an informational monopoly over the firm enabling the investor to earn substantial profits from this lending relationship. On the other hand, Diamond's (1991) *reputation-based* theory emphasizes the fact that even if the initial financier's information is private, as time goes by, outsiders would obtain information, enabling the firm to obtain relatively cheap arm's length financing.

There are a number of important empirical works pioneered by the above-mentioned researchers that have focused primarily on how various financial arrangements are structured. They have studied relatively large firms including medium-low technology enterprises. In this section, we rather attempt to better understand the bank-entrepreneur relationship and the perception of TBSF entrepreneurs as regards to bank financing. We again use 4A's model discussed in previous section to achieve our objective.

We asked entrepreneurs whether they have used any commercial bank financing (bank loan) at any stage of their development. A total of 43 percent of our respondents used bank financing at one stage of their business cycle. We further asked entrepreneurs to respond on statements regarding the difficulties to obtain commercial bank financing. Table 14 outlines the scores of 99 Belgian TBSF entrepreneurs regarding bank financing. Table 15 outlines commercial bank financing-related summary of the survey.

[Insert Table 14 around here]

[Insert Table 15 around here]

The most important reason that explains why it is difficult to get funding from commercial banks is related to the lack tangible assets for collaterals within the TBSF (underlined by 76 percent of the respondents). Then follows the reasons associated with information asymmetries: the lack of firms' track record/credit history with the bank and the lack of market information on technology-based product. These 'drawbacks' of the commercial banks probably explain why less than half of the NTBFs actually relied on this funding source.

5.3. Part 3: Entrepreneurship in Belgium

This part focuses on the characteristics of entrepreneurs and the entrepreneurial environment in Belgium. We have a total of 106 entrepreneur profiles representing 103 enterprises as 2 of those enterprises prefer to submit 2 and 3 responses for this section. There is a large volume of literature on entrepreneurship studying mainly interrelated disciplines of finance, management, sociology, psychology, and education. This section attempts to seek an original platform for discussion on entrepreneurship based on survey data conducted for small technology-based Belgian firms. To the best of our knowledge there is very limited literature specifically conducted in this field except by Manigart and Struyf (1997) who mainly studied the financing of 18 entrepreneurial Belgian firms.

At the core of the subject matter rests the questions: Who are the Belgian entrepreneurs? What motivates them? What are the main opportunities being in Belgium for entrepreneurial activities? In other words, this part of the research has 4 main objectives:

- To analyse the social and educational culture that have an impact on entrepreneurship.
- To study physical, social, commercial and professional infrastructures in a framework to better understand TBSF entrepreneurship.
- To examine the reasons and perceptions that motivates entrepreneurs.
- To recommend possible policy implications to stimulate entrepreneurial activities in Belgium.

A Likert-Scale as detailed in section 2 of this paper was prepared to gather information to achieve these objectives.

Who are the Entrepreneurs?

Harada (2003) finds that the entrepreneur's related business experience before start-up has a positive impact on entrepreneur's success while the age and gender (female in this case) are negatively related. His result concerning the age is in contradiction with the human capital hypothesis of Cressy (1996) who suggests that the age should have a positive impact on entrepreneurial activities. In addition to gender and age, marital status, degree or diploma, past work experience, and parents' background (education and work experience) are other important factors to better understand the genesis of TBSF (Markman and Baron, 2003; DeMartino and Barbato, 2003; Anderson and Miller, 2003; Aldrich and Cliff, 2003).

Intellectual capital is also an important determinant of technology-based entrepreneurial activity. According to Engel and Fier (2000), the considerable importance of human capital at universities can explain the regional concentration of the number of high-tech start-ups. They also explain that districts with universities or technical colleges with faculties of engineering or computer science seem to be of particular interest for start-ups in superior/high-technology industries and technology-intensive service sectors. Start-ups in high-technology industries and non-technical consulting services prefer districts where institutions of higher education with natural sciences faculties are located.

In order to illustrate these affirmations we asked the entrepreneurs to respond on personal data regarding their age, gender, marital status, permanent residence, family, educational background, past work experience, and the education of their parents. Tables 16 to 18 summarize findings on these main factors of entrepreneurial characteristics.

[Insert Table 16 around here]

[Insert Table 17 around here]

[Insert Table 18 around here]

Entrepreneurial Infrastructure

Suzuki et al (2002) compare entrepreneurs in Japan and Silicon Valley (US) based on a framework including supporting infrastructure (accounting, tax, professional services, and institutional supports) and conclude that entrepreneurial activities of a region reflect its business climate and habitat for innovation. Feldman (2001) argues that the existence of supportive social capital, availability of venture capital and entrepreneurial support services as well as actively engaged research universities may be conditions that reflect the successful establishment of an entrepreneurial culture rather than the conditions and context associated with the genesis of entrepreneurship. Zucker et al (1998) study biotechnology industry and show that the growth and location of intellectual human capital was the principal determinant of the growth and location of the industry itself.

The GEM report (2002) results show that Belgian GEM respondents perceive commercial and professional infrastructures favourable while they find government policy support, low regulation and taxation burden as unfavourable for entrepreneurial activities. The GEM study however fails to differentiate high-technology start-ups from other medium-low technology companies. In this survey using scale statements, we approach TBSF entrepreneurs to better examine their perception and satisfaction of the available infrastructures that would stimulate the genesis and development of entrepreneurship. The first five questions of this scale are about physical infrastructure. The following three questions are on the commercial and professional infrastructures. The following four questions focus on the social and cultural norms. The remaining 12 questions are about national research and technology development system, and government policies and programs. Table 19 represents the responses of TBSF entrepreneurs as detailed above.

[Insert Table 19 around here]

Entrepreneurial opportunities are especially improved by the following factors (factors underlined by more than half of the respondents): a developed communication network, multilingual and multicultural people, developed transportation networks, and the availability of commercial and professional networks. On the

other hand, the respondents disagreed firmly on the positive effects of the following factors (underlined by more than 60 percent of the respondents): the personal income tax system, the corporate tax system, and the administration of public department/agencies.

What Motivates Entrepreneurs?

Suzuki *et al.* (2002) and Herron and Robinson (1993) identify several *individual* factors that might influence someone to become an entrepreneur, such as personality, skills, values, background, and training. They further suggested that entrepreneurial motivation differs from a geographical region to another. For example, Japanese entrepreneurs were more society oriented while Silicon Valley entrepreneurs were motivated by more individualistic factors such as personal achievement and accumulation of personal wealth.

As we are not aware of any studies on this subject for Belgium, we approached the issue with an open-mind to find out what motivates Belgian TBSFs. In order to achieve our objective we construct 16 Likert-Scale questions on the motives and objectives. Tables 20 and 21 respectively outline the summary results.

[Insert Table 20 around here]

[Insert Table 21 around here]

Over 90 percent of the entrepreneurs perceive themselves as having entrepreneurial abilities, and they decided to become entrepreneur mainly to develop an idea, be their own boss, and consider it as being a nice experience and would be ready to do it again. Their main objectives in the early development stage are to improve their existing products or services, rather than the organisational structure of the company and improve the skills of its workforce.

6. CONCLUDING REMARKS

Innovative entrepreneurial activity contributes to the quality of life and economic growth. There remain a number of issues to be tackled in order to nurture a culture of entrepreneurship. The core of these issues concentrates mainly on entrepreneurs themselves and the environment they operate in.

Belgium suffers low entrepreneurial activity particularly in high-growth technology intensive industries. The primary objectives of our forthcoming research are to better understand the key socio-economic determinants of entrepreneurial activity and the extent to which technology-based small firms face important constraints in raising financial resources in Belgium.

Using an original survey data, this paper details the data and methodology employed to examine the entrepreneurs and sources of finance for 103 small Belgian technology-based firms established between 1985 and 2002.

On the financing front, the preliminary findings suggest that TBSF entrepreneurs fail to create a “basket” of finance. Internal finance in the form of personal funds, and family and friends funds are the primary source of capital to start-up a high-tech company in Belgium. Entrepreneurs invest from their own personal savings at seed stage in 82 percent of the cases. The government funds in the form of subsidies of all kind and commercial bank loans are the secondary source of finance at start-up stage. This portion of external financing (debt-finance) exceeds the combined angel funds and venture capital funds (equity-finance) at earlier stages. Among others, it implies that a number of issues still remain to be tackled in improving the flow of early stage private equity funds to entrepreneurs who are essential agents of change and accelerate the generation, application and spread of innovative ideas.

On entrepreneur front, the preliminary results firstly show that TBSF entrepreneurship is a male dominated world representing 97 percent of respondents. Secondly, 80 percent of entrepreneurs in this study have a

university degree while 42 percent hold post-graduate degrees (i.e. master's, and doctorate). There seem to be continuing difficulties to stimulate highly educated both female and male Belgians for innovative entrepreneurship.

Avenues for Further Study

The following headings identified for further research will be performed in order to examine how public sector initiatives should be targeted to promote entrepreneurial activity and improve the access to entrepreneurial finance in Belgium. We seek to provide potential avenues for policy implementations intending to increase the level and effectiveness of innovative enterprises.

On financing side, our investigations will include:

- The financial architecture of TBSF in Belgium.
- A probabilistic model forecasting combination of the “basket” of finance at aggregate and industry level.
- A conceptual framework on 4A's-model (Awareness, Availability, Appropriateness, Access) for angel funds, venture capital, and commercial banks based on Likert-Scale responses.

On the entrepreneur side, our investigations will include:

- Entrepreneurship at regional and aggregate level – Belgium opportunities and challenges.
- Main characteristics of Belgian entrepreneurs at industry level.
- Conceptual framework for entrepreneurial motivation.

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ANNEX:

1.) Tables and figures

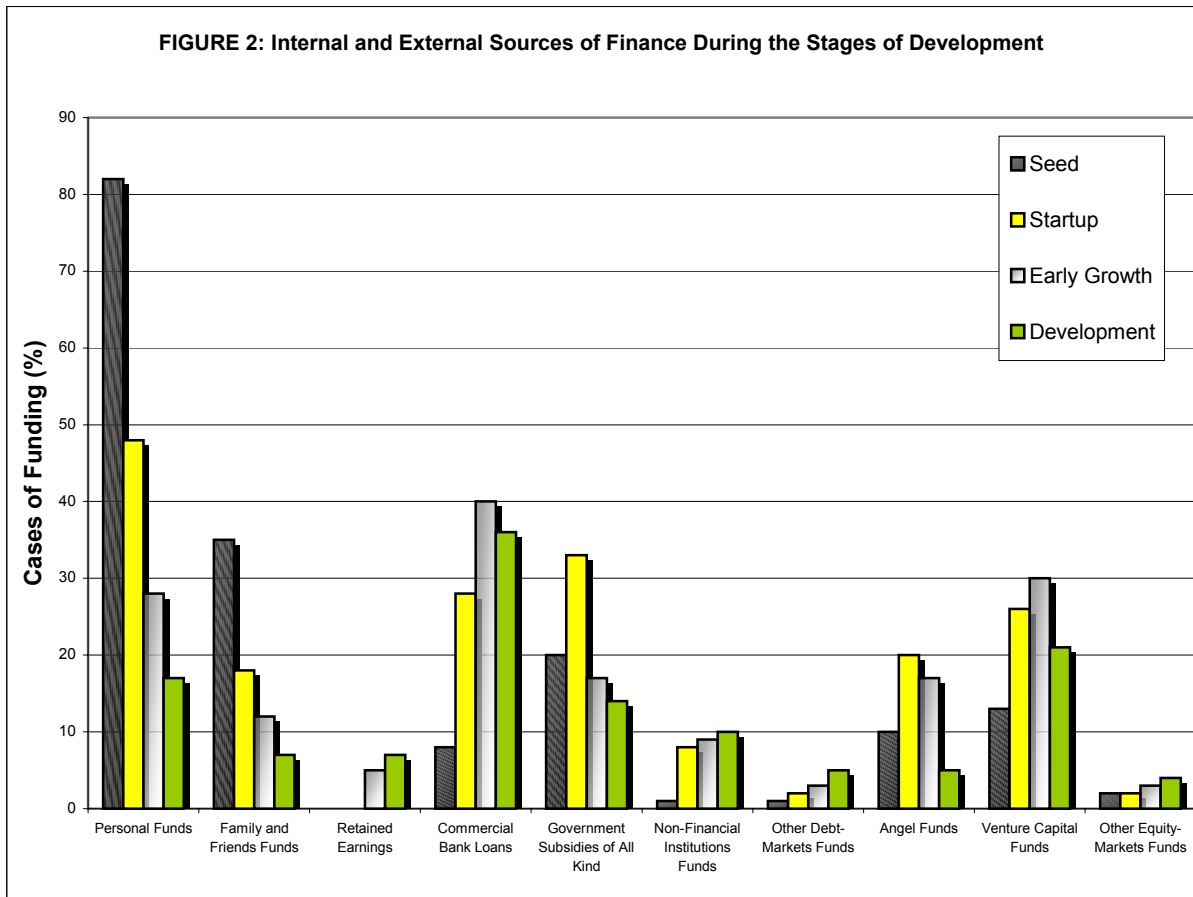


FIGURE 3: Evolution of Internal and External Finance During the Stages of Development

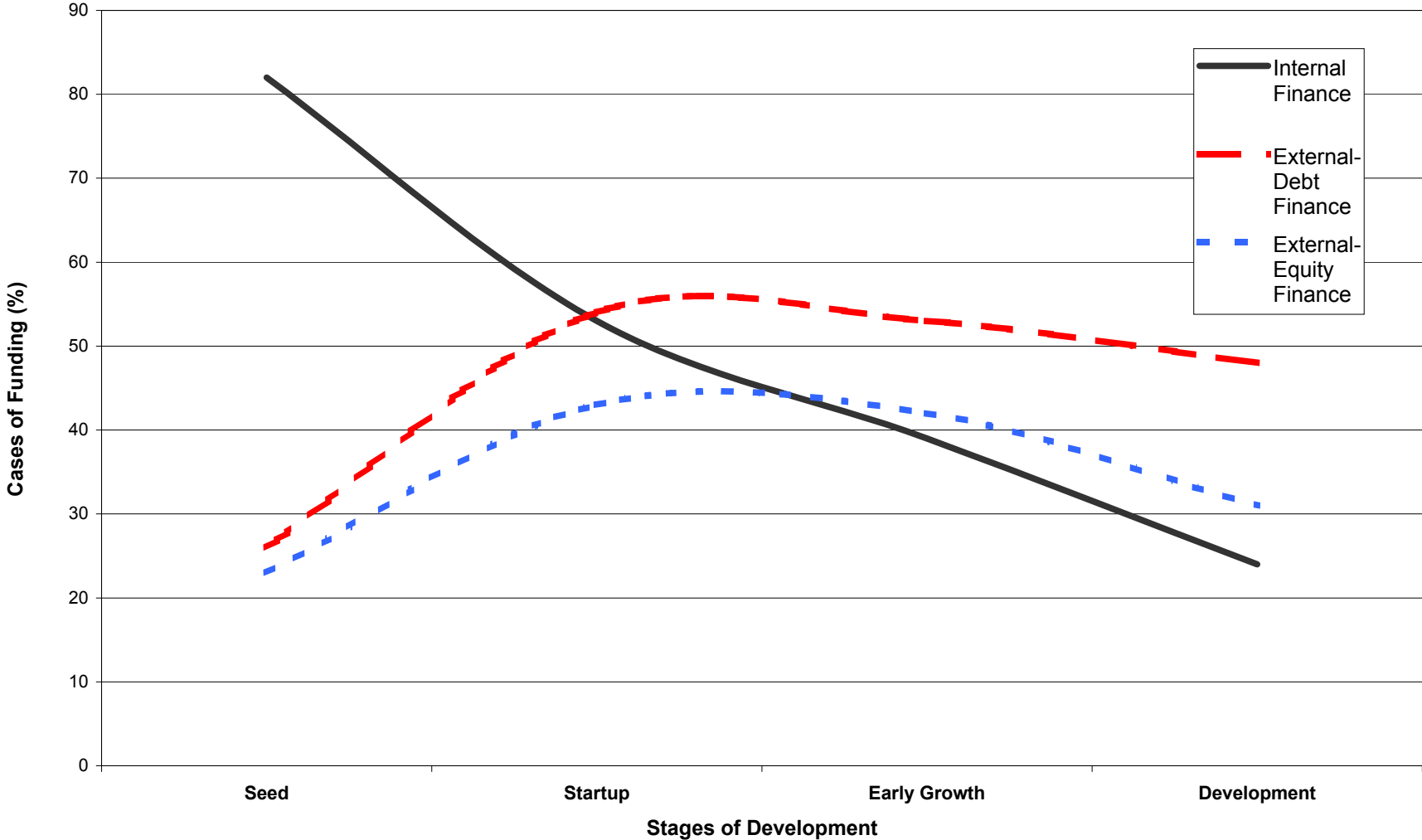


Table 1: OECD Industry classifications based on global technology intensity.

| | <i>ISIC Rev.3</i> |
|--|-----------------------|
| Aircraft and spacecraft | 353 |
| Pharmaceuticals | 2423 |
| Office, accounting and computing machinery | 30 |
| Radio, TV and communications equipment | 32 |
| Medical, precision and optical instruments | 33 |
| Electrical machinery and apparatus, n.e.c. | 31 |
| Motor vehicles, trailers and semi-trailers | 34 |
| Chemicals excluding pharmaceuticals | 24 excl. 24 |
| Railroad equipment and transport equipment, n.e.c. | 352 + 359 |
| Machinery and equipment, n.e.c. | 29 |
| Building and repairing of ships and boats | 351 |
| Rubber and plastics products | 25 |
| Coke, refined petroleum products and nuclear fuel | 23 |
| Other non-metallic mineral products | 26 |
| Basic metals and fabricated metal products | 27-28 |
| Manufacturing, n.e.c.; Recycling | 36-37 |
| Wood, pulp, paper, paper products, printing and publishing | 20-22 |
| Food products, beverages and tobacco | 15-16 |
| Textiles, textile products, leather and footwear | 17-19 |
| Total manufacturing | 15-37 |
| High-technology industries | |
| Medium-high-technology industries | |
| Medium-low-technology industries | |
| Low-technology industries | |

Source: OECD, 1997.

Table 2: Sources of Information for the Company Address_Book

Belgian Universities Spin-off Company Listings:

- Universite Libre de Bruxelles (<http://www.ulb.ac.be/preview/rech/spin-off/index.html>)
Vrije Universiteit Brussel (http://rd-ir.vub.ac.be/valorisatie/KickOff7okt03/KickOff7okt03_BDG.pdf)
Universiteit Antwerpen (http://www.ua.ac.be/main.asp?c=*ENG&n=745)
Universiteit Gent (<http://www.ugent.be/en/research/technology%20transfer/industry>)
Katholieke Universiteit Leuven (<http://www.kuleuven.ac.be/lrd/about/mission.html>)
Universite catholique de Louvain (http://www.parc.ucl.ac.be/locked/enindex_frg.html)
Universite de Liege (<http://www.ulg.ac.be/entreprises/english/valorisation/spin-off-acceuil.html>)
Universiteit Limburg (http://www.luc.ac.be/onderzoek/interfacedienst/luc_spinoff.asp)

Interuniversity Organizations Spinnoff Listing:

- Park Scientific de l'ULB (<http://www.ulb.ac.be/preview/rech/parcs/index.html>)
Flanders Interuniversity Institute for Biotechnology-VIB (<http://www.vib.be/VIB/EN/>)
Interuniversity MicroElectronics Center-IMEC (<http://www.imec.be/wwwinter/business/listspinoff.shtml>)

Trade Organizations and Associations Membership Directories:

- Belgian Venturing Association-BVA (<http://www.bvassociation.org/>)
Belgian Multi-Sector Federation for the Technology Industry-AGORIA (<http://www.agoria.be/gen-en/home-en.htm>)
Federation of Chemical Industries of Belgium-FEDICHEM (<http://www.fedichem.be/EN/AFF/affen.htm>)
Belgian Biotechnology Association-BBA (http://www.bba-bio.be/common/bba_members_list.asp)
European Venture Capital Association-EVCA (http://www.evca.com/html/member_search.asp)
European Space Agency-ESA (<http://smed.esa.int/>)
Union of Industrial and Employers' Confederations of Europe-UNICE (www.unice.org)

Incubators and Technology Park Companies:

- Liege Science Park (<http://www.ulg.ac.be/entreprises/english/parc/index.html>)
Antwerp Innovation Centre n.v Research park Waterfront (<http://www.antwerpinnovation.com>)
Flanders Science and Technology Parks (http://www.gomantwerpen.be/engels/e_pub/fbn/archief/winter2001.html)
Wallonia Science Parks (<http://www.investinwallonia.be/an/biotechnologie/potentiel01.htm>)
MBrussels (incubator) Village (<http://www.m-brussels.com/>)
Technopol (<http://technopol.lrt.be/>)

Wallonia Region "4x4 Entrepreneur" Workshop Participants (2202):

- Participating company listings (<http://www.4x4entreprenre.be/>)

BEL-FIRST, Belgian Companies Database

- Bel-First Belgian Companies Information Database CD (1999-2000)
-

Table 3: TBSF Size characteristics.

| Percentage (%) | | | | | |
|-----------------------|------------|------------------------|------------|-----------------------------|------------|
| Staff – 2000 (#78) | | Turnover - 2000 (#78) | | Balance Sheet - 2000 (#78) | |
| 0-10 | 64 | Less than 1.000.000 | 65 | Less than 1.000.000 | 54 |
| 11-25 | 18 | 1.000.000-2.999.999 | 17 | 1.000.000-2.999.999 | 15 |
| 26-50 | 12 | 3.000.000-4.999.999 | 6 | 3.000.000-5.000.000 | 4 |
| More than 50 | 6 | 5.000.000-7.000.000 | 5 | More than 5.000.000 | 14 |
| | | More than 7.000.000 | 4 | No response | 13 |
| No response | | | 3 | | |
| Total | 100 | Total | 100 | Total | 100 |
| Staff – 2001 (#93) | | Turnover – 2001 (#93) | | Balance Sheet - 2001 (#93) | |
| 0-10 | 58 | Less than 1.000.000 | 65 | Less than 1.000.000 | 56 |
| 11-25 | 23 | 1.000.000-2.999.999 | 16 | 1.000.000-2.999.999 | 15 |
| 26-50 | 12 | 3.000.000-4.999.999 | 8 | 3.000.000-5.000.000 | 6 |
| More than 50 | 7 | 5.000.000-7.000.000 | 6 | More than 5.000.000 | 11 |
| | | More than 7.000.000 | 3 | No response | 12 |
| No response | | | 2 | | |
| Total | 100 | Total | 100 | Total | 100 |
| Staff – 2002 (#103) | | Turnover - 2002 (#103) | | Balance Sheet - 2002 (#103) | |
| 0-10 | 58 | Less than 1.000.000 | 64 | Less than 1.000.000 | 55 |
| 11-25 | 21 | 1.000.000-2.999.999 | 17 | 1.000.000-2.999.999 | 16 |
| 26-50 | 14 | 3.000.000-4.999.999 | 4 | 3.000.000-5.000.000 | 4 |
| More than 50 | 7 | 5.000.000-7.000.000 | 8 | More than 5.000.000 | 13 |
| | | More than 7.000.000 | 4 | No response | 12 |
| No response | | | 3 | | |
| Total | 100 | Total | 100 | Total | 100 |

Table 4: TBSF employees by industry (Percentage)

| Number of employees | # | Less than 10 | 11-25 | 26-50 | More than 50 | Total (%) |
|------------------------------|------------|--------------|-----------|-----------|--------------|------------|
| Sectors of activities | | | | | | |
| Aerospace | 8 | 88 | 12 | 0 | 0 | 100 |
| Chemicals | 5 | 40 | 40 | 20 | 0 | 100 |
| Computer | 28 | 61 | 21 | 11 | 7 | 100 |
| Electrical | 2 | 0 | 0 | 100 | 0 | 100 |
| Electronics | 27 | 63 | 23 | 7 | 7 | 100 |
| Instruments | 6 | 67 | 17 | 16 | 0 | 100 |
| Pharmaceuticals | 23 | 48 | 22 | 17 | 13 | 100 |
| Other | 4 | 50 | 25 | 25 | 0 | 100 |
| Total | 103 | 58 | 21 | 14 | 7 | 100 |

TABLE 5: ENTERPRISE AGE and CURRENT STAGE

(Number of Observations as of 2002)

| Age (yrs) | # | Claimed Current Stage | | | |
|--------------|------------|-----------------------|-----------|--------------|-------------|
| | | Seed | Start-up | Early Growth | Development |
| Under 1 | 9 | 1 | 7 | 0 | 1 |
| 1 to 3 | 28 | 2 | 4 | 18 | 4 |
| 3.1 to 5 | 27 | 1 | 3 | 15 | 8 |
| 5.1 to 7 | 14 | 0 | 0 | 7 | 7 |
| 7.1 to 9 | 2 | 0 | 0 | 2 | 0 |
| 9.1 to 11 | 7 | 0 | 0 | 0 | 7 |
| 11.1 to 13 | 6 | 0 | 0 | 1 | 5 |
| 13.1 to 15 | 5 | 0 | 0 | 1 | 4 |
| Over 15 | 5 | 0 | 0 | 0 | 5 |
| Total | 103 | 4 | 14 | 44 | 41 |

Table 6: TBSF R&D Activities

| Section A | # | Percentage (%) | |
|---|-----|----------------|----|
| | | Yes | No |
| Does your firm perform Research & Development (R&D) activities? | 103 | 85 | 15 |
| Does your firm collaborate in R&D with Belgian higher education institutes? | 103 | 50 | 50 |
| Does your firm collaborate in R&D with Belgian public research centres? | 103 | 26 | 74 |
| Does your firm take advantage of government/public R&D subsidies? | 103 | 50 | 50 |
| Does your firm benefit from R&D tax credit facility? | 103 | 14 | 86 |
| Section B | # | Average | |
| Percentage of annual budget spent for R&D | 89 | 27 % | |
| Part of R&D projects that are exploited commercially through own production | 82 | 43 % | |

Table 7: TBSF Patenting Activities

| Section A | | Percentage (%) | |
|---|---------------------------------|------------------------------|------------------------------|
| | Have you filed a patent? | # | |
| | | | No Yes |
| Sector | | | |
| Aerospace | | 8 | 63 38 |
| Chemicals | | 5 | 80 20 |
| Computer | | 28 | 96 4 |
| Electrical | | 2 | 50 50 |
| Electronics | | 27 | 70 30 |
| Instruments | | 6 | 33 67 |
| Pharmaceuticals | | 23 | 35 65 |
| Other | | 4 | 100 0 |
| Total | | 103 | 68 32 |
| Section B | | # | Average |
| Broad percentage of its patent portfolio actively used by your firm? | | 32 | 60 % |
| Total number of patents used in your firm's patents portfolio in the first year | | 31 | 1.3 |
| Total number of patents used in your firm's patents portfolio in 2001 | | 29 | 1.4 |
| Broad percentage of patents granted that are licensed commercially? | | 31 | 11 % |
| Section C | | | |
| <i>"We do not <u>patent</u> our inventions systematically because:"</i> | | <i>Percentage (%)</i> | |
| | | Agree | Disagree Neutral |
| Cost of fees is high | | 55 | 12 33 |
| Cost of protection is high | | 67 | 7 26 |
| Protection not efficient due to the lack of confidence in the system | | 30 | 28 43 |
| Secrecy is more efficient | | 41 | 20 38 |
| Market lead is more efficient | | 45 | 14 41 |
| Product life cycle is short | | 31 | 31 38 |
| Invention disclosure is risky | | 35 | 28 37 |
| Inability to prevent other firms from copying the technology | | 45 | 18 37 |
| No information or know-how on the patenting process | | 27 | 46 28 |
| Administration is slow | | 32 | 28 40 |

TABLE 8: INTERNAL AND EXTERNAL SOURCES OF FINANCE DURING THE STAGES OF DEVELOPMENT

| | Percentage (%) of Cases During Stages: | | | | | | | |
|----------------------------------|--|-----|--------------------|-----|------------------------|----|-----------------------|----|
| | Seed (N=103) | | Start-up (N=99) | | Early Growth (N=85) | | Development (N=41) | |
| | Yes | No | Yes | No | Yes | No | Yes | No |
| Internal Finance: | | | | | | | | |
| Personal Funds of Founders | 82 | 18 | 48 | 52 | 28 | 72 | 17 | 83 |
| Family and Friends Funds | 35 | 65 | 18 | 82 | 12 | 88 | 7 | 93 |
| Retained Earnings | 0 | 100 | 0 | 100 | 5 | 95 | 7 | 93 |
| External-Debt Finance: | | | | | | | | |
| Commercial Bank Loans | 8 | 92 | 28 | 72 | 40 | 60 | 36 | 64 |
| Government Subsidies of All Kind | 20 | 80 | 33 | 67 | 17 | 83 | 14 | 86 |
| Non-Financial Institutions Funds | 1 | 99 | 8 | 92 | 9 | 91 | 10 | 90 |
| Other Debt-Finance Funds | 1 | 99 | 2 | 98 | 3 | 97 | 5 | 95 |
| External-Equity Finance: | | | | | | | | |
| Business Angel Funds | 10 | 90 | 20 | 80 | 17 | 83 | 5 | 95 |
| Venture Capital Funds | 13 | 87 | 26 | 74 | 30 | 70 | 21 | 79 |
| Other Equity-Finance Funds | 2 | 98 | 2 | 98 | 3 | 97 | 4 | 96 |

TABLE 9: AVERAGE AMOUNT OF FUNDS PROVIDED

| Sources of Funds: | Amount (x000 EURO) | | | | | |
|--------------------------------------|--------------------|------|----------|--------|---------|-----------|
| | # | Min | Max | Median | Mean | Std. Dev. |
| Personal Funds of Founders | 75 | 4.0 | 1,250.0 | 45.9 | 124.4 | 232.9 |
| Family and Friends Funds | 10 | 20.0 | 1,000.0 | 27.5 | 167.3 | 304.1 |
| Commercial Bank Loans | 39 | 5.0 | 5,000.0 | 100.0 | 569.4 | 1,117.9 |
| Business Angel Funds – First Round | 39 | 25 | 5,000.0 | 200.0 | 478.8 | 1,005.6 |
| Business Angel Funds – Second Round | 9 | 20.2 | 3,700.0 | 150.0 | 760.1 | 1,327.5 |
| Venture Capital Funds – First Round | 34 | 12.0 | 9,000.0 | 193.8 | 919.5 | 1,846.9 |
| Venture Capital Funds – Second Round | 15 | 23.8 | 25,500.0 | 385.0 | 3,105.0 | 6,936.7 |

TABLE 10: BUSINESS ANGEL (BA) FINANCING - A Perspective from Belgian Entrepreneurs
(N=99)

"Business Angel (BA) financing for a high-tech start-up has difficulties because of:"

| | Percentages (%) | | |
|---|-----------------|----------|---------|
| | Agree | Disagree | Neutral |
| Lack of understanding the role of BA | 41 | 20 | 39 |
| Lack of technology and industry knowledge of BA | 40 | 14 | 45 |
| Limited reliable information on the activities of BA | 48 | 13 | 38 |
| Small size of BA financing market in Belgium | 52 | 13 | 35 |
| Lack of BA Networks in Belgium | 32 | 26 | 41 |
| Concerns of BA over high-perceived risk | 44 | 9 | 46 |
| Due Diligence difficulties faced by BA | 26 | 14 | 60 |
| Limited exit options for BA | 37 | 14 | 48 |
| Lack of professionalism in BA entities | 20 | 24 | 56 |
| Poor quality of our application and Business Plan | 15 | 41 | 43 |
| Cost of access to commercial and professional infrastructure | 16 | 24 | 60 |
| Historical misperceptions against private equity investments in Belgium | 33 | 18 | 48 |
| Limited government policies to promote private investment financing | 52 | 4 | 44 |
| Administration and bureaucracy of government supported programs | 41 | 10 | 49 |

TABLE 11: BUSINESS ANGEL (BA) FINANCING

Panel A: Summary Findings

| | Percentages (%) | | |
|---|-----------------|-----|-----|
| | # | Yes | No |
| Did You Raise any BA Financing at any Stage? | 102 | 24 | 76 |
| Did You Participate in any Government-supported BA Programs? | 24 | 0 | 100 |
| Did You Employ a Full-time Finance Manager During BA Negotiations? | 24 | 21 | 79 |
| Did You Employ a Full-time Marketing Manager During BA Negotiations? | 24 | 13 | 88 |
| Did You Get Involved with any Incubator Before or During BA Negotiations? | 24 | 33 | 67 |
| Did You Use any Management Consultancy Services During BA Negotiations? | 24 | 21 | 79 |
| Does Any Participating BA Firm Own more than 25% of Your Enterprise? | 24 | 17 | 83 |

Panel B: Country of BA Sources

Percentages (%)

| BA Financing: | # | Local (B | Foreign | Hybrid |
|---------------|----|----------|---------|--------|
| First-Round | 24 | 80 | 16 | 4 |
| Second-Round | 9 | 78 | 11 | 11 |

Panel C: Age at the Time of BA Financing

Years

| BA Financing: | # | Min | Max | Median | Mean | Std. Dev. |
|---|----|-----|------|--------|------|-----------|
| First-Round | 24 | 0.5 | 19.0 | 0.5 | 2.46 | 4.02 |
| Years Elapsed Between First and Second Rounds | 9 | 1.0 | 5.0 | 2.0 | 2.00 | 1.32 |

TABLE 12: VENTURE CAPITAL (VC) FINANCING - A Perspective from Belgian Entrepreneurs

(N=97)

"Venture Capital (VC) financing for a high-tech start-up has difficulties because of:"

| | Percentages (%) | | |
|--|-----------------|----------|---------|
| | Agree | Disagree | Neutral |
| Lack of VC firms' interest in early stage investments | 55 | 16 | 29 |
| Unwillingness of VC firms to provide small amounts of capital | 58 | 15 | 27 |
| Lack of understanding of technology by many VC firms | 34 | 26 | 40 |
| Lack of our firm's registered intangible assets (I.e. patents) | 30 | 26 | 44 |
| Poor quality of our Business Plan and presentation to raise VC funds | 13 | 46 | 40 |
| Lack of our entrepreneurial/managerial skills | 24 | 37 | 39 |
| Our concerns over "loss of control" in the company | 40 | 31 | 29 |
| VC expectations of high rates of return | 59 | 13 | 28 |
| Due Diligence difficulties faced by VC | 27 | 22 | 51 |
| VC firms' expectations of quick exits | 61 | 10 | 29 |
| Lack of our market information on Belgian VC activities | 31 | 31 | 38 |
| Lack of Belgian VC executives with specific knowledge and skills | 46 | 14 | 39 |
| Limited public policies to encourage equity participation | 54 | 7 | 39 |
| Administration and bureaucracy of government-supported programs | 47 | 8 | 44 |

TABLE 13: VENTURE CAPITAL (VC) FINANCING

Panel A: Summary Findings

| | Percentages (%) | | |
|---|-----------------|-----|----|
| | # | Yes | No |
| Did You Raise any VC Financing at any Stage? | 103 | 38 | 62 |
| Did You Participate in any Government-supported VC Programs? | 39 | 5 | 95 |
| Did You Employ a Full-time Finance Manager During VC Negotiations? | 39 | 36 | 64 |
| Did You Employ a Full-time Marketing Manager During VC Negotiations? | 39 | 23 | 77 |
| Did You Get Involved with any Incubator Before or During VC Negotiations? | 39 | 38 | 62 |
| Did You Use any Management Consultancy Services During VC Negotiations? | 39 | 46 | 54 |
| Does Any Participating VC Firm Own more than 25% of Your Enterprise? | 39 | 36 | 64 |
| Do You Eventually Plan to Participate in Management-Buy-Outs (MBO)? | 39 | 49 | 51 |
| Do You Eventually Plan to Participate in Initial-Public-Offering (IPO)? | 39 | 67 | 33 |

Panel B: Country of VC Sources

Percentages (%)

| VC Financing: | # | Local (B) | Foreign | Hybrid |
|---------------|----|-----------|---------|--------|
| First-Round | 34 | 76 | 15 | 9 |
| Second-Round | 15 | 73 | 13 | 14 |

Panel C: Age at the Time of VC Financing

Years

| VC Financing: | # | Min | Max | Median | Mean | Std. Dev. |
|---|----|-----|------|--------|------|-----------|
| First-Round | 34 | 0.5 | 11.0 | 0.75 | 1.84 | 2.48 |
| Years Elapsed Between First and Second Rounds | 15 | 0.5 | 4.0 | 1.00 | 1.70 | 1.01 |

TABLE 14: COMMERCIAL BANK FINANCING - A Perspective from Belgian Entrepreneurs

(N=99)

"Commercial Bank financing for a high-tech start-up has difficulties because of:"

| | Percentages (%) | | |
|--|-----------------|----------|---------|
| | Agree | Disagree | Neutral |
| Lack of market information on technology-based product | 57 | 14 | 29 |
| Lack of our tangible assets for collaterals | 76 | 5 | 19 |
| Lack of our firm's track record/credit history with the bank | 63 | 12 | 25 |
| Lack of our entrepreneurial/managerial experience | 22 | 44 | 33 |
| Poor quality of our application and business plan | 7 | 61 | 32 |
| Poor evidence of repayment | 56 | 17 | 27 |
| Cost of bank financing | 36 | 33 | 30 |
| Conditions of bank financing | 57 | 20 | 23 |
| Slow decision-making process, administration, and bureaucracy of banks | 41 | 22 | 36 |
| Lack of dedicated specialized bank key personnel and units | 45 | 19 | 35 |
| Limited stimulating government-supported loan guarantee programs | 54 | 11 | 35 |
| Administration and bureaucracy of government-supported programs | 56 | 15 | 29 |

TABLE 15: COMMERCIAL BANK FINANCING

Panel A: Summary Findings

| | Percentages (%) | | |
|---|-----------------|-----|----|
| | # | Yes | No |
| Did You Borrow from a Commercial Bank at any Stage? | 102 | 43 | 57 |
| Did You Participate in any Government-supported Bank Loan Programs? | 44 | 11 | 89 |

Panel B: Government Loan Guarantee Scheme

Amount (x000 Euro)

| Guaranteed Bank Loan Financing | # | Min | Max | Median | Mean | Std. Dev. |
|--------------------------------|---|------|---------|--------|-------|-----------|
| Guarantee Covered | 6 | 25.0 | 3,000.0 | 100.0 | 806.3 | 1,463.9 |

Panel C: Age at the Time of Bank Financing

Years

| Bank Financing: | # | Min | Max | Median | Mean | Std. Dev. |
|-----------------|----|-----|------|--------|------|-----------|
| First-Round | 40 | 0.5 | 18.0 | 2.55 | 3.93 | 4.36 |

Table 16: Entrepreneur age and gender (Percentage of the row)

| Gender | No response | Female | Male | Total |
|--------------------------------|-------------|----------|-----------|------------|
| Age of the entrepreneur | | | | |
| No response | 67 | 0 | 33 | 100 |
| Before 30 | 0 | 0 | 100 | 100 |
| 30-39 | 0 | 2 | 98 | 100 |
| 40-49 | 0 | 4 | 96 | 100 |
| 50 and more | 0 | 5 | 95 | 100 |
| Total | 2 | 3 | 95 | 100 |

Table 17: Entrepreneur education by age (Percentage in row)

| Age of the entrepreneur | No response | Before 30 | 30-39 | 40-49 | 50 and more |
|------------------------------------|-------------|-----------|-------|-------|-------------|
| Diploma | | | | | |
| No response | 100 | 0 | 0 | 0 | 0 |
| High school | 0 | 17 | 50 | 0 | 33 |
| Higher education less than 3 years | 0 | 15 | 15 | 46 | 23 |
| Higher education more than 3 years | 0 | 0 | 100 | 0 | 0 |
| University | 3 | 18 | 43 | 23 | 15 |
| Masters | 0 | 6 | 56 | 28 | 11 |
| Ph.D./Doctorate | 0 | 6 | 44 | 28 | 22 |
| Post Doctorate | 0 | 13 | 25 | 13 | 50 |

Table 18: Entrepreneur education by parent higher education degree (Percentage)

| | Father | | | | Mother | | | |
|------------------------------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|------------|
| | No response | No | Yes | Total | No response | No | Yes | Total |
| Diploma of entrepreneur | | | | | | | | |
| No response | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 2 |
| High school | 0 | 5 | 1 | 6 | 0 | 4 | 2 | 6 |
| Higher education less than 3 years | 0 | 8 | 5 | 13 | 0 | 10 | 2 | 12 |
| Higher education more than 3 years | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| University | 1 | 20 | 16 | 37 | 2 | 29 | 6 | 37 |
| Masters | 1 | 8 | 8 | 17 | 1 | 12 | 4 | 17 |
| Ph.D./Doctorate | 1 | 10 | 6 | 17 | 1 | 12 | 4 | 17 |
| Post Doctorate | 0 | 5 | 3 | 8 | 0 | 6 | 2 | 8 |
| Total | 4 | 55 | 40 | 100 | 6 | 73 | 21 | 100 |

Table 19:

“I think Belgium offers entrepreneurial opportunities for high tech start-ups because of:”
(likert scale) in percentage

| | Agree | Disagree | Neutral |
|---|-------|----------|---------|
| Developed transportation networks | 53 | 11 | 35 |
| Developed utilities | 48 | 15 | 37 |
| Cost of utilities | 28 | 24 | 49 |
| Developed communication network | 70 | 5 | 26 |
| Cost of communications | 26 | 20 | 54 |
| Availability of commercial and professional networks | 51 | 15 | 33 |
| Cost of commercial and professional networks | 23 | 18 | 59 |
| Availability of specialized business analysts for high-tech development | 33 | 25 | 42 |
| Multilingual and multicultural people | 75 | 9 | 16 |
| Personal income tax system | 7 | 73 | 20 |
| Corporate tax system | 8 | 65 | 28 |
| Social security and welfare system | 26 | 40 | 34 |
| Administration of public departments/agencies | 11 | 60 | 29 |
| Government & public policies | 20 | 48 | 32 |
| Government/public funds available for Research & Development | 44 | 34 | 22 |
| Technology Regions/Science Parks | 44 | 17 | 39 |
| Administration of Intellectual Property Rights, patents | 12 | 33 | 54 |
| Cost of registration of Intellectual Property Rights, patents | 10 | 34 | 55 |
| Number of Science and Technology graduates | 42 | 23 | 35 |
| Transfers between universities/public labs and industries | 43 | 14 | 43 |
| Technology incubators | 30 | 19 | 50 |
| Networks among industries | 24 | 23 | 53 |
| Applied research at the higher education institutes | 33 | 20 | 47 |
| Research & Development at industry level | 23 | 19 | 58 |

Table 20:

“I consider that my company is a high tech firm and:”

(likert scale) in percentage

| | Agree | Disagree | Neutral |
|--|-------|----------|---------|
| I perceive myself having entrepreneurial abilities | 91 | 1 | 8 |
| My main motivation to create my own company is: | | | |
| to develop an idea | 88 | 7 | 6 |
| to be my own boss | 72 | 16 | 12 |
| to earn more money | 44 | 25 | 30 |
| to find a professional activity | 37 | 41 | 23 |
| the attraction for the risk | 32 | 37 | 31 |
| a nice experience and I'm ready to do it again | 77 | 5 | 18 |

Table 21:

“My objectives at Early Development Stage of my high tech firm are:”

(likert scale) in percentage

| | Agree | Disagree | Neutral |
|---|-------|----------|---------|
| Improve our existing products/services | 79 | 6 | 15 |
| Improve our existing processes | 70 | 9 | 21 |
| Develop additional new products | 78 | 6 | 16 |
| Develop additional new processes | 67 | 5 | 28 |
| Develop additional new services | 75 | 5 | 21 |
| Change/improve organisational structure | 56 | 17 | 27 |
| Change/improve management information systems | 45 | 22 | 33 |
| Train/educate workforce | 46 | 20 | 34 |
| Eliminate brain drain from our workforce | 37 | 30 | 33 |

2.) Survey Questionnaire

SURVEY: Technology-Based Small Firms (TBSFs) in Belgium. The questionnaire can be available upon request to one of the authors, from 2004 onwards.