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WORKING PAPER

The Need for Innovation Support Services unraveled. The case of New Technology Based Firms

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THE NEED FOR INNOVATION SUPPORT SERVICES UNRAVELED. THE CASE OF NEW TECHNOLOGY BASED FIRMS

ABSTRACT

New Technology Based Firms (NTBFs) are considered to contribute significantly to the economy. As a result, these firms have received extensive attention from academics over the past decades. Given that NTBFs are faced with many challenges and liabilities, the academic literature has tried to identify how public policy measures could help to overcome challenges related to innovation, amongst others by identifying NTBFs' needs for innovation support services. Our study contributes to this stream of research by exploring the determinants of the need for innovation support services. We find that technology-related services are highly needed by VC-backed companies, whereas market-related services are searched for by NTBFs in an early development stage pursuing a strategy of playing on the product market. Further, financial-related services were needed by NTBFs with a high level of informal protection, in an early development stage and targeting at playing on a technology market. Finally, soft services were looked for by teams with high levels of technical human capital, in an early development stage, and pursuing a product market strategy.

INTRODUCTION

New Technology Based Firms (NTBFs) are new, relatively small firms seeking to commercialize innovative ideas (Audretsch, 1999). These firms have received a lot of attention from academics over the past two decades (Gans and Stern, 2003) given their expected contribution to four cardinal areas of economic activity: innovation, new employment creation, export sales growth, and regional development (Rothwell and Zegveld, 1982; Freeman, 1983; Oakey, 1995). It is also acknowledged that these firms face a number of challenges, which have commonly been referred to as liabilities of newness and smallness (Henderson, 1999). Many of these challenges are related to the gaps in the NTBF's human resource and knowledge base. Ensley and Hmieleski (2005) and Franklin et al. (2001) indicate that the top management team composition in NTBFs remains to a large extent homogeneous. According to Klofsten and Jones-Evans (1996), the top management team in NTBFs typically disposes over superior technical skills but is less competent in the area of business development. Further, NTBFs rarely commercialize technology which is market ready. As a

consequence, the firm requires knowledge surrounding the technology in order to modify and tailor the technology and associated products and services to meet customer requirements (Zucker et al., 1998).

As a result, NTBFs will be highly dependent on the external environment in order to overcome these liabilities and challenges (Pfeffer & Salancik, 1978). Relevant parties that can help NTBFs to bridge these challenges include, amongst others, venture capitalists and board members as well as policy makers. Subsequently, the academic literature has tried to identify how policy measures could help to overcome challenges related to innovation (Heydebreck et al., 2000). According to Heydebreck et al. (2000), the majority of studies have so far analyzed the utilization of external resources instead of examining the degree to which companies' needs are actually satisfied. This is in line with Kaufmann and Tödtling (2002) arguing that there may be a mismatch between the support offered and needed on the one hand and between the firms targeted and the firms which need support on the other hand. As a result, they argue that the heterogeneity of small firms should be taken into account when studying specific problems and needs of different firms and innovation support measures.

The Heydebreck et al. (2000) paper focuses on a subset of the group of small firms and subsequently provides a clear overview of the need for innovation support services by NTBFs, including technology-related services, market-related services, finance-related services and soft services. While we appreciate the focus on NTBFs which the Heydebreck et al. study applied, we build upon earlier findings indicating that significant heterogeneity occurs within the group of NTBFs (e.g. Druihle and Garnsey, 2004; Heirman and Clarysse, 2004). Consequently, we argue that differences in innovation support needs may exist between NTBFs and study the determinants which drive these innovation support needs.

More specifically, we argue that differences in the firm's resources, growth stage and commercialization strategy may affect the NTBF's need for innovation support services. First, researchers in the resource based view have argued that the extent to which firms dispose over technological, human and financial resources will affect their performance. Building on the arguments of resource dependency, asserting that a firm will be dependent on its environment to gain access to resources, we argue that, the higher the availability of these resources within the firm, the less likely it will need to call upon the environment to gain access to these resources. This is in line with Kaufmann and Tödtling (2002) arguing that innovation support will be most relevant in the case of resource-intensive innovation processes. As a result, the need for innovation support services available in the environment will also be affected by the NTBF's resource base. Second, we argue that the need for innovation support services by NTBFs will be dependent on the stage of growth the NTBF is in. According to Kazanjian (1988), NTBFs in different stages of growth are typically faced with different dominant problems. While the early growth stages are mostly associated with challenges in resource acquisition, technology development and production start-up, firms in later stages typically suffer from problems related to sales growth generation, profitability and internal control. As a result, firms in different stages may also have different innovation support needs. Third, firms may differ in their commercialization strategy. Whereas some companies target at building complementary assets in order to commercialize products or services and subsequently play on a market for products, other companies try to build a strong technology position and play on a market for ideas, with other parties commercializing their technological developments (Gans and Stern, 2003). We argue that the commercialization strategy will also affect the NTBF's need for innovation support services.

Our research question can subsequently be formulated as follows: what determinants drive the NTBF's need for innovation support services? In order to study this research question, we build upon a dataset of 86 NTBFs in Flanders, a region in Belgium. This research has implications for policy makers and NTBFs and their stakeholders. Whereas the first may benefit from understanding which type of support measure to target to what type of NTBF, the latter can benefit from understanding how differences in resources, growth stage and commercialization strategy will affect the need for innovation support services. Furthermore, we complement previous research on innovation support services by providing a detailed overview of innovation support needs by NTBFs and the determinants of these needs. In what follows, we first discuss potential determinants of innovation support services, followed by a description of the methodology, results and discussion and implications.

DETERMINANTS OF THE NEED FOR INNOVATION SUPPORT SERVICES

Heydebreck et al. (2000) identified four types of innovation support services. The first are technology-related services, including execution and management of R&D, technological consultancy and search for R&D cooperation partners. Market-related services consist of assistance in the marketing of products and technologies, search for customers and suppliers and assistance with new product launches. Finance-related services include assistance with European Community support schemes, mediation of contacts to financiers and support in the financing of innovation projects. Finally, soft services comprise seminars and information provision, general networking and education. In what follows, we unite a number of theoretical perspectives that are likely to inform our research question, namely the resource based view, the stage-growth model and commercialization strategy, and we argue how these factors may affect the NTBF's need for innovation support services.

1. Resources

Researchers in the resource based view of the firm have argued that the performance of firms is dependent on the characteristics of the firm's resource bundle (Barney, 1991). A firm's resource bundle includes its technological resources, such as product and technology (Roberts, 1991), its financial resources (Hellmann and Puri, 2000) and its human resources, such as founding team and entrepreneur (Shane and Stuart, 2002). In the next paragraphs, we elaborate on the different resources that NTBFs can possess, given that the extent to which a firm has resources at its disposal or seeks access to resources may affect its need for innovation support services.

1.1 Technological resources

Technological resources refer to firm-specific products and technology (Borch et al., 1999). Mc Cann (1991) and Lee et al. (2001) highlight the importance of technological protection through patents to create value in high tech new ventures. In particular, the appropriability regime of the firm's product or technology is one of the key aspects of its technological resources. However, patenting depends on the appropriability regime, which describes the degree to which innovations can be protected against imitation. Moreover, patenting is only one form of protection. Hurmelinna and Puumalainen (2007) elaborate on the following protection types: institutional protection (e.g. patents), nature of knowledge (tacit or codified), human resource management (e.g. mobility of employees), lead time (e.g. market entry) and practical means (e.g. secrecy and passwords). Hurmelinna and Puumalainen (2007) further indicate that formal protection (including patents, copyrights, trademarks, design rights and trade secrets) will be more efficient than informal protection (including the other protection mechanisms). Indeed, many authors emphasize the potential benefits of businesses built upon one type of formal protection, namely patents, indicating that the

presence of patents may help firms to sustainably differentiate themselves from competition (Teece, 1986; Mann, 2005) and may help to create value and to gain competitive advantage (Lee et al., 2001; Audretsch et al., 2006). We subsequently argue that the extent to which the NTBF's product or technology can be protected by formal or informal protection mechanisms will affect the need for innovation support services. For instance, NTBFs that have already patent protected their technologies may be in need of technology-related services to a less extent.

1.2 Financial resources

High tech start-ups often face a considerable lack of financial resources (Lockett et al. 2002; Wright et al., 2006). Several researchers (Romanelli, 1989; Schoonhoven et al., 1990) however indicate that this lack of financial resources is a key determinant of the liabilities of newness and smallness. Often being unable to finance the venture from internal resources (Oakey, 1984), entrepreneurs will invariably need to call upon external finance. Di Giacomo (2004) and Lerner (1999) however point out that high tech start-ups do not have access to funding from banks or other private financing institutions because they are considered too risky and have little collateral. Business angel funding is often inappropriate since angels are usually unfamiliar with the underlying technology (Wright et al. 2006). As a result, venture capital is often seen as the primary source of financing available to high tech start-up companies (Gompers and Lerner, 2001).We argue that the extent to which NTBFs have managed to secure VC financing will affect their need for innovation support services. VC-backed companies may have higher chances of bridging the liabilities of newness and smallness on their own, and build critical mass crucial for their success and survival (Davila et al., 2003), and therefore may experience less need for specific innovation support services. For instance, VC-backed companies may require less financing-related innovation support

services, given that they have already managed to acquire financing, but may be eagerly looking for other types of services.

1.3 Human resources

Firm-specific human capital in NTBFs is embodied in the human capital of the founding team (Welbourne and Andrews, 1996). Human capital comprises the stock of knowledge and skills that reside within individuals (Becker, 1964). Since knowledge and experience have been shown to be crucial in enabling NTBFs to successfully implement and adapt to changes in technology, human capital resources are particularly important for high tech ventures (e.g. Siegel, 1999; Siegel et al., 1997). It is further acknowledged that one of the most important challenges faced by NTBFs relates to the human resource and knowledge base. Ensley and Hmieleski (2005) and Franklin et al. (2001) indicate that top management team composition in NTBFs remains to a large extent homogeneous in terms of education, industry experience, functional expertise and skills and is very much technical oriented. Knockaert et al. (2011) found that commercial expertise and mindset are also required in the founding team, and formulated conditions under which heterogeneous teams uniting commercial and technical human capital could build successful ventures. As such, we argue that the extent to which the founding team has technical and/or commercial human capital at its disposal will affect the need for innovation support services.

2. Stages of growth

Kazanjian (1988) investigated the problems NTBFs encounter as they proceed through different stages of growth in the life-cycle. He distinguished between four consecutive stages, namely conception and development, commercialization, growth and stability. The validity of this stages-of-growth model was tested by examining the link between dominant problems

and the stage in which they occur. The most important problems for the first stage were product or technology development and resource acquisition. The acquisition of resources was also a key concern in the commercialization stage. Sales and marketing are the essential problem in stage three and the stability stage was characterized by strategic positioning, organization and administration as main issues.

We use this classification and interpretation of Kazanjian (1988) to investigate whether or not the growth stage has an impact on the need for innovation support services. Given that firms in different growth stages experience differences in dominant problems, we argue that they will also exhibit differences in their need for innovation support services.

3. Commercialization strategy

There are two main routes to valorize the knowledge or technology built within an early stage company. Building on Teece (1986)'s seminal work, Gans and Stern (2003) define two types of markets that companies can play on: the market for ideas and the market for products. In the first case, the company focuses on technological development and collaborates with a partner that holds power in the value chain and that markets the product. This first strategy is referred to as a "technology strategy". In the latter case, the company develops all complementary assets that are necessary to market the product, such as production, marketing and distribution facilities and complementary technologies. In this case, the company enters into competition with the existing parties on the market, and thus plays on a market for products. This second strategy is referred to as a "market strategy". We argue that the extent to which a company plays on either of both markets and as such makes the commercialization strategy decision, will affect the company's need for innovation support services. When firms aim at playing on a market for ideas, they will build a strong technological position and focus on establishing collaborations with existing players. Firms aiming at playing on a market for

products will most likely engage less in strengthening their technological position and will target on building complementary assets towards the end of the value chain, including distribution and marketing facilities. Given that choosing for either commercialization strategy entails differences in the positioning of the firm in the value chain and the extent to which firms focus on technological and market development, we argue that the commercialization strategy will affect the NTBF's need for innovation support services.

METHODOLOGY

Data collection and sample

Following Heirman and Clarysse (2005) we define NTBFs as firms that develop and commercialize own products and/or services based upon a proprietary technology or skill. Given that the study was commissioned by the IWT (the Flemish Institute for the promotion of innovation in Flanders), our sample of high tech start-ups is drawn from the Flanders region of Belgium. Flanders is a small, export-intensive economy, located in the northern part of Belgium, and considered to be an emerging high tech region (Cantwell & Iammarino, 2001). The advantage of using this region is that it provides us with a sample that is homogenous in terms of context, without losing the generalizability of the research results. The region has a relatively high R&D intensity, and has venture capital funds on the market that invest in the early phase of a high tech start-up. The R&D intensity of the region is comparable to that of Denmark and France, with only a few European countries (Sweden, Germany and Finland) having a higher R&D intensity.

To construct the sample frame, all high tech start-ups at Public Research Organizations, venture capital backed firms, and new ventures that received R&D subsidies were identified. Next, the sample was complemented with a random selection drawn from the

entire population of companies that are active in high-tech and medium high-tech industries. In total, our sample comprises 238 firms founded in Flanders (Belgium) between 1990 and 2007.

In order to optimize response rates, we used the Total Design Method, during which respondents were contacted through different channels. First, the IWT sent an e-mail with a link to the online questionnaire, followed by a letter one week later. This first phase resulted in 37 responses. Subsequently, the research team engaged in an intensive follow-up period, during which respondents were contacted over e-mail and telephone, resulting in another 79 responses. A total of 116 responses were received, of which 86 were complete. The respondents addressed were the founders or CEOs as these typically possess the most comprehensive knowledge on the organization's history, the firm's strategy, its processes and performance (Carter et al., 1994). We eliminated the incomplete responses from our dataset, as such resulting in a response rate of 36%. Face-to-face pilots with eight respondents were carried out and led to the optimization of the questionnaire.

Measures

The initial goal of our study was to directly assess the NTBF's need for innovation support services. However, our pilot phase, during which we had respondents fill out the questionnaire and comment on it in our presence, revealed that the respondents faced difficulties in answering the question on innovation needs. While we provided them with a list of potential innovation support services, and asked them to indicate the extent to which they needed those services, we often received comments relating to the fact that they did not understand what was meant by "need". One respondent commented: "I do need a lot of support at the level of technological development. However, there are a good deal of parties on the market that can help me with this. So if you ask me whether I need support at the

technological level, I would say I need it very much. However, I do not find it very difficult to find parties that can help me with that". A thorough discussion with our respondents revealed that it may be more reliable to ask respondents to indicate the importance of specific innovation services, and then to ask for the accessibility of these services on the market. When combining both (and reverse coding the accessibility), we would get a more reliable response to the need for innovation support services, without having to ask respondents directly. As such, we decided to split up our original question on need for innovation support services into "importance of innovation services" and "access to innovation services" and to ask respondents to rate all items on two scales relating to importance and accessibility. When we communicated this change in questionnaire design to the commissioner of the project, IWT, they were in favor of making this change. Given that they commissioned this study in order to redesign and target their innovation support services towards NTBFs, it was very useful for them to understand which services were important to NTBFs, but were at the same time easily accessible on the market. The policy instruments initiated by IWT, and by many policy mechanisms, are further supposed to complement services offered on the market, without disturbing market mechanisms or taking over from commercial parties on that market.

Dependent variables

As a result of the pilot study, our main dependent variable is composed by multiplying the respondent's score on "importance of innovation services" times the reverse coded "access to innovation services". Given that the analysis of both subdimensions revealed interesting insights, in what follows, we also discuss these dimensions. More specifically, we provided each respondent with a list of potential innovation support services, and asked to indicate on a seven-point Likert scale 1) how important the service is for the firm's innovation (with 1=very low importance and 7= very high importance), and 2) how accessible the service

is to the firm (with 1=very low accessibility and 7= very high accessibility). As a result, our main dependent variable “need for innovation support services” ranged between 1 and 49 (with 1 indicating a very low need for innovation support services and 49 indicating a very high need for innovation support services). Cronbach Alpha’s for each of the used measures were above acceptable standards, with the lowest Cronbach Alpha .78 (importance to technology-related services).

The table below provides an insight into the different items that were integrated in the questionnaire. These were based upon Heydebreck et al. (2000)’s innovation support services, complemented with insights from the pilot study and meetings with the experts at IWT.

<<<Insert Table 1 about here>>>

Table 1 indicates that NTBFs attach a lot of importance to assistance in developing a new product or application, marketing products and services, establishing contacts with other companies, attracting public financing and finding suitable innovation staff. Overall, the most important services are market-related services. These services also seem to be the least accessible to NTBFs, just as finance-related services. As a result of both dimensions, respondents indicated to experience the highest need for assistance in marketing products or services, assistance in the search for business partners, assistance in finding suitable innovation staff and attracting public financing.

Subsequently, we carried out regression analyses, with the importance of innovation support services, accessibility of innovation support services and finally need for innovation support services as dependent variables. The independent and control measures we used in the models are described below.

Independent variables

1. Resources

1.1 Technological resources

In order to measure the technological resources, a distinction was made between formal and informal protection (Hurmelinna and Puumalainen, 2007). Both constructs were measured using a six-item scale. The items for formal protection are as follows: contracts, patents, copyrights, trademarks, design and trade secrets. Informal protection consists of the following items: secrecy, complexity of the product design or technology platform, fast standardization, use of passwords, restriction of the internal mobility of the personnel and speed to gain market share. Respondents were asked to indicate how important these protection modes were for their company using a seven-point Likert scale, ranging from 1 (completely unimportant) to 7 (extremely important). On average, NTBFs in our sample relied to a larger extent on informal protection mechanisms (average of 4.23) than formal protection mechanisms (average score of 3.46).

1.2 Financial resources

Financial resources were measured by asking the respondents whether or not they had raised venture capital and therefore takes the form of a dummy variable. 30.6% of the respondents had raised venture capital, whereas 69.4% had not raised venture capital financing. It is not surprising that a high proportion of firms raised venture capital financing, given that this type of financing is often seen as one of the most appropriate ways of financing for NTBFs (Gompers and Lerner, 2001).

1.3 Human resources

Technical and commercial human capital are used to measure the human resources in the founding team. The respondents were asked to indicate for each of the founding members the number of years of R&D experience and commercial experience they had. Next, the cumulative sum was taken over the founders to determine the total R&D experience, respectively commercial experience. On average, the cumulative R&D (commercial) experience is 18.9 (16.1) years, with a standard deviation of 15.9 (16.6).

2. Stages of growth

To determine the stages of growth the 86 respondents were asked to indicate which of four statements suited the situation of their company best. We refer to Kazanjian (1988) for a detailed description of each stage, which we reproduced literally in our questionnaire. Each statement corresponds to a stage of growth, namely conception and development, commercialization, growth and stability. 27% of the firms are in the conception and development stage, 42% in the commercialization stage, only 8% belongs to the growth stage and 23% is part of the stability stage. Throughout our analyses, we use the growth stage as a reference category.

3. Commercialization strategy

The commercialization strategy was measured by the extent to which the NTBF focused on a technology or market strategy, using measures developed by Clarysse et al. (2007). For the market strategy, respondents were asked to which extent they agreed with the following statement: “To launch our products and services we need to invest in a marketing and sales department and we need to set up distribution channels”. Responses were recorded using a seven-point Likert scale, ranging from 1 (completely disagree) to 7 (completely agree). For

the technology strategy, we asked the respondents to score the following items using the same Likert scale: “Building a strong intellectual property position is an important element of our strategy” and “The protection of our technology is important for potential stakeholders, such as investors”. The scores on the two items were integrated in a summated scale for technology strategy. The average score for the market strategy was 4.87, while technology strategy received an average score of 4.38.

Control variable

We control for firm age as the different innovation needs may vary between younger and older firms. The firm age is derived from the year of business formation. Average firm age is 9.29 years.

An overview of the descriptive statistics is provided in Table 2.

<<<Insert Table 2 about here>>>

RESULTS

First, Table 3 provides an insight into the determinants of *importance* of innovation support services. We find statistically significant models for all 4 types of innovation support services. We find technology-related services to be particularly important for people building firms upon strong formal protection, and firms that have raised venture capital. In line with this finding, firms with a technology strategy find this service particularly important. Further, higher levels of (both technical and commercial) human capital lead to a higher importance attached to the technology-related services. We also find firms that have reached the stability

phase to attach importance to these services. For market-related services, we mainly find firms that are in a very early stage, the conception and development phase, to attach importance to these services, just as firms that follow a market strategy. Finance-related services are thought of as important by firms in a conception and development phase and stability phase and by firms following a technology strategy. Finally, soft services matter the most to firms with a lot of commercial experience in the founding team, firms in a very early stage and those firms targeting a technology strategy.

<<<Insert Table 3 about here>>>

Second, Table 4 provides an insight into the determinants of *accessibility* of the innovation support services. We find statistically significant models for technology-related services, finance-related services and soft services. Firms experiencing high levels of formal protection experience easy access to technology-related services and finance-related services.

<<<Insert Table 4 about here>>>

Third, Table 5 provides an insight into the determinants of *need* for innovation support services and informs our main research question. We find statistically significant models for all four innovation support services.

We find that the need for technology-related services is high for VC-backed firms. For market-related services, we find that the need is especially high for firms that are in a very early development stage and that are pursuing a market strategy. NTBFs that score high on informal protection, that are in an early stage of development and that pursue a technology strategy are highly in need of finance-related services. Finally, soft services are highly

searched for by teams with high levels of R&D experience, in an early stage of development and that pursue a market strategy.

<<<Insert Table 5 about here>>>

We discuss these findings in the next section.

DISCUSSION

This study was inspired by the fact that, even though previous research provides insights into the need for innovation support services by NTBFs, little is known on the drivers of these needs. Given the heterogeneity that typifies the group of NTBFs, we argue that it is useful to explore the determinants of these innovation needs. Studying a dataset of 86 NTBFs in Flanders and building on the classification and items detected by Heydebreck et al. (2000), we find indications that the NTBF's resources, stage of growth and commercialization strategy affect the need for innovation support services.

First, consistent with the Heydebreck et al. (2000) study, we find that NTBFs have the greatest need for **market-related services**. We further show that especially firms that pursue a market strategy or that are in an early conception and development stage are in need of these services. Even though firms in those situations do not have lower accessibility to these services than others, they find these services very important, resulting in a high need. This can be explained by the fact that NTBFs typically have a strong technology base at founding, but in case they pursue a market strategy, they will have to build marketing and distribution channels and compete with existing parties on the market. This will especially be important in

the early stage of development of the company, when technology has to be translated into a marketable product or service.

Second, NTBFs exhibit a certain need for **technology-related services**. This is especially the case for VC-backed firms, which can be explained by the fact that venture capital financing provides a more comfortable cash position which does not require them to ship their first product for revenues fast (Schoonhoven et al., 1990). As such, VC financing provides the firm with more slack, which can be used to continue working on the technology before turning to commercialization. Further, while we found that firms with a strong formal protection attached much importance to technology-related services, this does not translate into a need for these firms, given that the access to technology-related services tends to be easier for firms with strong formal protection. This may be caused by the fact that a number of parties, such as patent attorneys and technology transfer offices already exist that can provide these firms with technology-related services.

Third, we find that **finance-related services** are mainly needed by firms with high informal protection, in the early stages of their development and when they pursue a technology strategy. The first finding can be explained by the fact that firms scoring high on informal protection often find it more difficult to gain access to financial services, compared to firms that have patent protected their technology or products or have applied other formal protection mechanisms. Indeed, patents may especially be important for start-ups and their investors as they represent a marketable asset in case the firm aims to sell out later (Levin et al., 1987). The importance of patents has further been acknowledged in the VC literature. Several studies found that firms with a larger number of patents have a higher likelihood of attracting VC financing (Hellman and Puri, 2000; Baum and Silverman, 2004; Engel and Keilbach, 2007) and that VC investors rely on intellectual property rights as quality signals when trying to assess potential portfolio companies (Hsu and Ziedonis, 2008). The second

finding indicates that firms in an early development stage are more in need of finance-related services. It is well acknowledged that it is difficult to gain access to financing for companies without track record, given that the number of financing parties that are willing to take risks in an early stage are relatively limited (Gompers and Lerner, 2001). Finally, firms pursuing a technology strategy will need significantly higher amounts of financing than firms pursuing a market strategy. This is because building a strong technology strategy requires investments in skilled labor and machinery, before any revenues can be generated (Heirman and Clarysse, 2005).

Finally, we find that NTBFs that have high levels of R&D experience, are in an early development phase and follow a market strategy are in need of **soft services**. This may be caused by the fact that, especially teams with high levels of technical human capital in an early stage of development need access to education and training and need help in building a network outside of their technical fields. Subsequently, as they pursue a market strategy, they will need to gain access to other information, knowledge and networks, specifically oriented towards commercialization of their technology.

IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH

Our findings have implications for practitioners and academia. First, policy makers can learn from what innovation support services are needed by which firms, and could target their innovation policy to better fulfill those needs. This is especially the case for the stages of growth, which are relatively easy to identify and the firm's resource base. Given the high level of technical human capital that typifies academic spin-offs, for instance, it will be more appropriate to provide these NTBFs with soft services. Further, our study reveals that policy makers can optimally target market-related, finance-related and soft services to NTBFs in

their earliest stages of development, whereas these firms seem to be less in need of technology-related services. By contrast, VC-backed firms may benefit from these technology-related services. Second, NTBFs and their stakeholders can learn from the results of this study. Stakeholders such as investors and board members are expected to help NTBFs in overcoming the challenges and liabilities they are faced with. It may therefore be useful for these parties to understand what needs are the most urgent under which circumstances. Third, this study complements the literature on innovation support needs by studying the determinants of these needs for NTBFs.

Even though we believe this study contributes to practitioners and academics, we acknowledge that it has some limitations which may lead to further research directions. First, this study was cross-sectional in nature. As a consequence, we measure innovation support needs and their determinants at one moment in time. Further research could purposefully follow up on a sample of NTBFs and illustrate how innovation support needs change over time or as firms gain access to more or other resources, or change their commercialization strategy. Second, this research was limited to a specific region, Flanders. Although this focus may be appropriate for homogeneity reasons, it may lead to difficulties in generalizing the research findings. Further research could purposefully analyze the extent to which our results hold in other contexts. Further, it could also link the perception of NTBFs' innovation support needs to the established innovation policy measures and as such assess the appropriateness of these measures.

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Table 1: Overview of items used to assess the need for innovation support services

Type	Importance of services (1)		Access to services (2)		Need for innovation support services (3)	
	average	st. dev.	average	st. dev.	average	st. dev.
Technology-related services						
Management assistance for the realization of innovation projects	4.25	1.86	3.88	1.66	17.34	10.19
Technological consulting	3.91	1.62	3.99	1.58	14.73	6.73
Assistance in the search for cooperative partners for innovation projects	4.04	1.56	3.69	1.46	17.35	8.37
Assistance in finding additional technological knowledge	4.24	1.69	4.06	1.63	16.13	8.29
Specialized test infrastructure	3.51	1.75	3.86	1.59	13.85	7.03
Assistance in protecting the innovation	4.36	1.62	3.96	1.64	16.89	9.75
Assistance in developing a new product or application	4.66	1.70	3.92	1.56	18.65	10.30
Overall average/standard deviation	***4.16***	***1.10***	***3.92***	***1.30***	***16.54***	***6.16***
Market-related services						
Assistance in marketing products or services	4.79	1.65	3.69	1.66	20.54	11.75
Assistance in establishing contacts with other companies	4.76	1.56	3.90	1.70	19.25	11.02
Assistance in the search for business partners	4.59	1.69	3.51	1.55	20.13	9.97
Marketing assistance	4.43	1.75	3.69	1.69	18.96	10.93
Assistance in identifying needs and opportunities	4.13	1.78	3.71	1.54	17.58	10.16
Overall average/standard deviation	***4.53***	***1.41***	***3.70***	***1.43***	***19.33***	***9.00***
Finance-related services						
Assistance in establishing contacts with funders	3.52	1.81	3.79	1.68	14.16	8.31
Assistance in attracting public financing	4.72	1.88	3.66	1.72	19.47	11.51
Assistance in attracting equity financing (venture capital, business angels, …)	3.49	1.92	3.52	1.61	15.44	9.89
Assistance in attracting loans	3.55	1.83	3.76	1.61	14.72	9.71
Assistance in applying for fiscal incentives	4.33	1.71	3.66	1.55	17.88	9.26
Overall average/standard deviation	***3.92***	***1.45***	***3.68***	***1.33***	***16.48***	***7.49***

Soft services						
Seminars	4.06	1.66	5.10	1.62	10.88	5.84
Education and training	4.27	1.71	5.17	1.56	11.54	6.51
Business consulting	3.86	1.56	4.39	1.65	13.95	7.89
Assistance in generating new ideas	3.65	1.56	4.13	1.61	14.51	7.89
Assistance in developing an innovation strategy	3.99	1.63	3.69	1.55	17.81	9.54
Assistance in developing an organizational structure and innovation processes	4.02	1.57	3.74	1.55	17.12	8.57
Assistance in finding suitable innovation staff	4.47	1.72	3.38	1.69	21.68	12.52
Assistance in developing a business plan	3.54	1.52	4.06	1.50	14.45	7.86
Assistance in contacting people who are engaged in similar research	3.60	1.64	3.61	1.59	15.64	8.35
Assistance in identifying the parties within the sector	3.78	1.78	3.77	1.46	15.64	8.95
Assistance in identifying competitors and potential customers	4.15	1.74	3.81	1.46	17.84	10.29
Overall average/standard deviation	***3.94***	***1.13***	***4.09***	***1.13***	***15.63***	***5.46***

(1) How important is access to these services for innovation within your company? (1=very low importance - 7=very high importance)
(2) How accessible are these services for your company? (1=very low accessibility - 7=very high accessability)
(3) Importance x (reverse coded Access)

Table 2: Descriptive statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Need for technology-related services (1)	1									
Need for market-related services (2)	.21	1								
Need for finance-related services (3)	.34**	.55**	1							
Need for soft services (4)	.46**	.39**	.50**	1						
Formal protection (5)	-.18	-.06	.15	-.08	1					
Informal protection (6)	-.04	-.11	.24*	-.02	.53**	1				
R&D experience (7)	-.11	.03	.02	-.18	.15	.01	1			
Commercial experience (8)	.09	-.01	-.06	-.01	.01	-.01	.34**	1		
Technology strategy (9)	-.13	.02	.22*	.03	.35**	.29**	.19	-.11	1	
Market strategy (10)	.06	.25*	.16	.23*	.17	.19	.05	-.03	.15	1
Mean	16.54	19.33	16.48	15.63	3.46	4.23	18.94	16.08	4.38	4.87
Standard deviation	6.16	9.00	7.49	5.46	1.43	0.84	15.94	16.63	1.52	1.86

Pearson correlations level of significance: * p<.05, ** p<.01, N=86

Table 3: Determinants of <u>importance</u> of innovation support services

	Technology-related services	Market-related services	Finance-related services	Soft services
Resources				
Technological resources				
Formal protection	.03**	.50	.13	.52
Informal protection	.96	.42	.14	.78
Financial resources	.00***	.11	.69	.31
Human resources				
R&D experience	.01**	.89	.93	.20
Commercial experience	.02**	.15	.23	.05**
Stages of growth				
Conception and development	.17	.01***	.00***	.06*
Commercialization stage	.92	.26	.15	.71
Stability stage	.04**	.11	.03**	.14
Product/market strategy				
Technology strategy	.02**	.69	.06*	.08*
Market strategy	.21	.00****	.14	.21
Control variable: firm age	.92	.52	.48	.27
R^2	.40	.37	.38	.31
Adjusted R^2	.31	.27	.28	.20
F-statistic	4.48****	3.91****	4.06****	2.95***

N=86, ****p<.001, ***p<.01, **p<.05, *p<.10

Table 4: Determinants of accessibility of innovation support services

	Technology-related services	Market-related services	Finance-related services	Soft services
Resources				
Technological resources				
Formal protection	.00***	.31	.06*	.13
Informal protection	.99	.04**	.32	.47
Financial resources	.42	.99	.06*	.11
Human resources				
R&D experience	.26	.69	.90	.42
Commercial experience	.35	.20	.19	.17
Stages of growth				
Conception and development	.97	.36	.11	.45
Commercialization stage	.53	.48	.21	.57
Stability stage	.13	.93	.55	.82
Product/market strategy				
Technology strategy	.14	.30	.99	.51
Market strategy	.42	.69	.89	.54
Control variable: firm age	.99	.78	.81	.23
R^2	.29	.17	.27	.21
Adjusted R^2	.19	.05	.16	.09
F-statistic	2.76***	1.38	2.51**	1.73*

N=86, ****p<.001, ***p<.01, **p<.05, *p<.10

Table 5: Determinants of <u>need</u> for innovation support services

	Technology-related services	Market-related services	Finance-related services	Soft services
Resources				
Technological resources				
Formal protection	.24	.70	.74	.36
Informal protection	.63	.23	.09*	.85
Financial resources	.01***	.75	.31	.27
Human resources				
R&D experience	.53	.97	.87	.06*
Commercial experience	.72	.91	.78	.77
Stages of growth				
Conception and development	.27	.01*	.00****	.02**
Commercialization stage	.83	.22	.14	.56
Stability stage	.81	.22	.30	.32
Product/market strategy				
Technology strategy	.85	.57	.05**	.31
Market strategy	.10	.01*	.22	.01***
Control variable: firm age	.89	.56	.46	.76
R^2	.25	.21	.34	.28
Adjusted R^2	.14	.09	.24	.17
F-statistic	2.21**	1.74*	3.40***	2.56***

N=86, ****p<.001, ***p<.01, **p<.05, *p<.10