UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

TWEEKERKENSTRAAT 2
B-9000 GENT
Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER

Linking Entrepreneurial Strategy and Firm Growth*

Johan Bruneel†

Bart Clarysse‡

Mike Wright§

April 2009

2009/571

* A previous version of this paper was presented at The Dynamics of Science-based Entrepreneurship Conference 2008. This paper is accepted for presentation at the 2009 Babson College Entrepreneurship Research Conference. We would like to thank the participants of the PICO project for their helpful comments on earlier versions of this paper. We gratefully acknowledge the financial support of the Sixth Framework Program of the European Commission.
† Corresponding author, Ghent University, Department of Management, Innovation, and Entrepreneurship
‡ Ghent University, Department of Management, Innovation, and Entrepreneurship
§ Nottingham University Business School

D/2009/7012/23

ABSTRACT

The growth of young, technology-based firms has received considerable attention in the literature given their importance for the generation and creation of economic wealth. Taking a strategic management perspective, we link the entrepreneurial strategy deployed by young, technology-based firms with firm growth. In line with recent research, we consider both revenue and employment growth as they reflect different underlying value creation processes. Using a unique European dataset of research-based spin-offs, we find that firms emphasizing a product and hybrid strategy are positively associated with growth in revenues. The latter strategy also has a positive influence on the creation of additional employment. Contrary to expectation, however, we find that firms pursuing a technology strategy do not grow fast in employment. Our study sheds new light on the relationship between entrepreneurial strategy and firm growth in revenues and employment.

LINKING ENTREPRENEURIAL STRATEGY AND FIRM GROWTH

INTRODUCTION

Young, technology-based firms have received considerable attention in the literature as a result of their importance for the generation and creation of economic wealth. A dominant literature stream addressing the growth of new ventures is the resource-based view (Wernerfelt, 1984). This literature pictures the organization as a bundle of resources: physical capital resources, human capital resources, and organizational capital resources. Resources that are valuable, rare, imperfectly imitable, and not substitutable may provide the firm with competitive advantages (Barney, 1991). Researchers using the resource-based perspective linked the resources of firms with firm growth. A common finding in these studies is the influence of the entrepreneurial team's experience on spurring the growth of the firm (e.g. Heirman and Clarysse, 2005). Arguably, resources are only one part of the story. Firms employ resources to attain organizational goals, i.e. they deploy a strategy. Besides resources, the strategy of entrepreneurial firms has an important influence on their subsequent growth (Feeser & Willard, 1990).

The strategy literature has traditionally focused on how companies build competitive advantage to enter product markets. Studies in this literature stream applied different strategy typologies such as the frameworks proposed by Porter (1980) and Miles and Snow (1978). This has been later refined to take into account the specific context of young, resource-poor companies (e.g. McDougall and Robinson, 1990). The performance of companies has typically be operationalized using financial indicators, especially revenue growth. Update literature + more emphasis on product markets

More recently, researchers argue that firms may focus their efforts on targeting technology markets (Arora et al, 2001). Companies that enter technologies markets do not have to invest in production-related activities but can focus their efforts on building stocks of intellectual property. The choice of entering the product or technology market is highly dependent on the appropriability regime and the extent to which complementary assets are held by existing companies (Teece, 1987). So far, the literature on product and technology markets has mainly focused on explaining market choice (e.g.

Gans, Stern, and Hsu, 2001), without examining the effects of the chosen commercialization strategy for firm growth.

Furthermore, growth is not a unidimensional construct. In the literature, we find two important aspects of growth: size and dominant type. The *size* of growth is the most often examined aspect (Delmar et al., 2003). The size of growth is usually measured using indicators such as relative or absolute growth in turnover, total assets, total profits, cash flow, employees or capital. Delmar et al. (2003) argue that these indicators are not correlated among each other, nor are they determined by the same independent variables. In addition, some researchers have argued to make differences among the *dominant types* of growth. As aforementioned, growth can be measured along several indicators such as total assets, capital, profits, employees, revenues and cash flow. Growing on one dimension does not necessarily mean that companies grow on the other. Chandler et al., (2005) have for instance shown that growth in revenues is not highly correlated with growth in employees and is much more volatile. Because of these apparent differences in the dominant type of growth, scholars have argued that research should focus on the differences in dominant type and the determinants of these differences.

In this paper, we extend previous literature by focusing on the relationship between entrepreneurial strategy and firm performance conceptualized as growth in revenues and employment (Wiklund and Sepherd, 2003). We consider three different commercialization strategies for young, technology-based firms: product strategy, technology strategy and hybrid strategy (Clarysse et al, 2007). We propose that the extent to which the firm grows in revenue and/or employment is dependent on the strategy deployed. More specifically, we propose that revenue growth is the result of a product strategy while employment growth is the result of a technology strategy. We further propose that firms with an emphasis on a hybrid strategy will grow in both revenues and employment. We test these hypotheses using a unique hand-collected dataset of 80 research-based spin-offs in five countries.

By addressing the influence of different types of entrepreneurial strategies on growth in revenues and employment, we make two important contributions to the strategy literature and literature on nev

venture growth. First, current research in the strategic management literature has mainly focused on how firms target product markets. We extend this literature by incorporating the technology market as a target market. Studies in this literature stream typically operationalize firm performance using financial indicators such as revenue growth or return on assets. Revenue growth represents the firm's success in its ability to market products. We use employment growth as a performance indicator in the context of entrepreneurial strategy as a proxy for the accumulation of resources and knowledge (Kogut and Zander, 1992).

Second, this has be more focused/delete sections on operationalization we also contribute to the literature on firm growth. Researchers have argued that it is important to differentiate the *dominant types* of growth (Delmar et al, 2003). Growth can be measured along several indicators such as total assets, profits, employees, and revenues. Growing on one dimension does not necessarily mean that companies grow on the other. Chandler et al., (2008) have for instance shown that growth in revenues is not highly correlated with growth in employees. Because of these apparent differences in the dominant type of growth, scholars have argued that research should focus on the differences in dominant type of growth and the determinants of these differences. Firm growth is considered to be multidimensional construct that represent different underlying value creation processes. Previous studies on firm growth have used revenue and employment growth interchangeably but have not conceptualized these differences. By explicating the role of entrepreneurial strategy, we offer theoretical insights into the mechanisms underlying revenue and employment growth

The remainder of the paper is organized as follows. First we begin with an examination of the existing literature on firm new venture strategy to identify the relevant variables and relationships. Based on this review, we develop hypotheses that link the different entrepreneurial strategies with revenue and employment growth. Next we describe the sample and measures used in our study. Then we present the results of the hypothesis tests of an empirical study of research-based spin-offs. We conclude our paper with a discussion of our findings and implications for provide some avenues for future research.

COMMERCIALIZING STRATEGIES: PRODUCT AND TECHNOLOGY MARKETS

Previous studies on the relationship between firm strategy and growth draw on the frameworks developed by Porter (1980) and Miles and Snow (1978). The former approach distinguishes between three generic strategies firms may adopt: cost leadership, differentiation, and focus strategy. The latter uses the firm's response to the environment as a point of departure and developed a taxonomy consisting of four generic strategies: prospectors, defenders, analyzers and reactors. Sandberg and Hofer (1987) used longitudinal case histories of 17 ventures to study how firm strategy influences the success of firms, conceptualized as return on equity. They found that entrepreneurs should build their competitive advantage around a unique product or service. Also, they show that the success of focus and differentiation strategy is dependent on the industry in which the firm operates. In a sample of 307 new ventures, Baum et al (2001) found that firms following differentiation strategies through quality and/or innovation achieve higher growth than firms employing low cost or focus strategies. Further, these authors found that the environment indirectly effects growth via strategy, which suggest greater managerial discretion than some macro economic theories suggest (e.g. Pfeffer and Salancik, 1978). In contrast, however, Siegel et al (1993) studied the characteristics distinguishing high-growth ventures and found that following a focused strategy was one of strongest discriminators between low-growth and high-growth companies. these organizations followed a focused strategy. Others have shown that the choice between low cost, focus, and differentiation strategy is dependent on the technology intensity of the sector in which high growth companies operate (Covin et al, 1990). These strategy frameworks have been developed to explain the performance of primarily large, established firms, which may cause the mixed findings. As raised by Sandberg and Hofer (1987), these strategy frameworks provide useful insights in the strategy of new ventures but are also incomplete and not tailored to the specificities of new and small firms.

As a result, researchers have used the frameworks suggested by Porter and Miles and Snow as a point of departure to develop alternative schemes that take the specific context of new ventures into account. For example, McDougal and Robinson (1990) found that new venture strategy is linked to the strategic scope (niche versus aggressive) and the broadness of market coverage and identified eight archetypes of

new venture strategies accordingly. Similarly, Carter et al (1994) used a sample of new firms across different industries and identified six strategy archetypes of new venture strategy, of which several parallel those in the study of McDougal and Robinson (1990). Carter et al (1994) argue that the type of strategy adopted by the venture is dependent on its position in the supply chain. Another framework is the one developed by Bantel (1998). She builds on both the Porter and Miles and Snow frameworks and classifies the strategies adopted by young, technology-based firms using the breadth of the domain (narrow versus wide) and basis of competition (efficiency versus first-to-market) as important dimensions. A common denominator among these studies is the focus on how new firms build competitive advantages to enter the product market.

More recently however, researchers have found that firms may also enter market for technology referring to "transactions for the use, diffusion and creation of technology" (Arora et al, 2001: 423). Recent evidence show that markets for technology are developing at an accelerating speed, especially through technology licensing (Arora et al, 2001). To manage the explosive growth in IP right, which increases the search and transaction costs, different types of IP access systems have been created (Aoki and Schiff, 2008). For example, IP clearing houses function as a matchmaker between the demand and supply side of intellectual property rights. This is a third party organization that facilitates exchange between the owners and users of intellectual property, improving the efficiency of markets for technology and provide more opportunities to license (Arora and Fosfuri, 2003). With the formation of efficient markets for technology, firms can specialize in developing technology without having to invest in downstream complementary assets and capabilities to enter product markets (Arora and Ceccagnoli, 2006). Firms targeting technology markets build agreements with existing firms to commercialize intellectual property through licensing or through the acquisition of the firm by an incumbent. Also, firms downstream the value chain are more likely to substitute internal development for outsourcing when an efficient, large market for technology is present. Furthermore, well functioning markets for technology facilitate technology diffusion and adaption which provide buying firms the opportunity to diversify into new product markets (Cesaroni, 2004). The rise of technology markets also triggered the awareness of firms about the strategic important of knowledge management practices which positively

influences the technological performance (Guillou et al, 2008). The increased competition on markets for technology have even forced companies to enter these markets that would normally not license their technology (Fosfuri, 2006).

The extent to which technology-based ventures can profit from innovation through the technology or product market is contingent on the commercialization environment in which these firms operate (Gans and Stern, 2003). Two key elements shape the strategy of technology-based ventures: the strength of the appropriability regime and the extent to which complementary assets are controlled by incumbents (Teece, 1986). Gans, Hsu and Stern (2002) examined whether firms earn rents through product market competition or via collaboration in technology markets using a sample of start-up innovators active in different industries. They found that strong intellectual property regimes facilitate markets for technology. Firms in environments where the protection of technology via patents is difficult and the investment cost in downstream complementary assets is low are more likely to commercialize their innovations through product markets. Gamberdella and Giarratana (2008) extend this research and show that also the general nature of the technologies is an important determinant of markets for technology. The more general the technology, the higher the number of potential market applications and thus opportunities to license in submarkets.

This literature considers the market choice to be dichotomous, product market versus technology market, depending to a large extent on the effectiveness of the intellectual property regime. For example, Pries and Guild (2008) studied the commercialization strategies of start-ups arising from universities. They found that start-ups entering product market invest in both technology and production activities whereas those entering technology markets only invest in technology related activities. Clarysse et al (2007) elaborated on the "market for products/market for technology" model and found that young, technology-based firms may target technology markets, even if the appropriability regime is weak. These firms cannot protect their technology efficiently and are therefore forced to enter product markets. Since time to market plays a much more important role than for firms operating in technology markets only, firms with a hybrid strategy tend to engage in acquisitions to secure market share more

rapidly. As a result, these firms will develop a hybrid strategy combining elements of a strategy to enter product and technology markets.

So far, empirical studies have addressed the factors that determine market choice without examining the effects of the commercialization strategy on firm outcomes such as performance. This is an important omission in the literature since there seems little point in engaging in effort to decide on market choices if it makes a difference. In the following, we will develop hypotheses how the choice of strategy, product, technology or hybrid, influence the growth of young, technology-based firms.

HYPOTHESES

Firms with a product market strategy develop capabilities and access complementary assets to offer an integrated value proposition to customers. These firms build their competitive advantage on superior product characteristics and target niche markets. Since product strategies are primarily found in environments which provide limited intellectual property protection, firms will have to establish a strong market presence by entering numerous market segments in broad geographical markets (McDougall and Robinson, 1990). To achieve this vital fast commercialization, firms with a product strategy position themselves in the middle of the supply chain and create large networks of distributors or resellers (Carter et al, 1994). Therefore, these firms do not have to allocate significant resources to build downstream complementary assets. This provides the firm with the possibility to achieve a high sales volume with a limited number of staff. This leads to the following hypothesis:

> *H1: A product strategy will be positively associated with revenue growth, but not with employment growth*

Technology strategy is viable in environments where intellectual property rights are efficient and incumbents control the complementary assets necessary for commercialization. These environments, like for example the biotechnology industry, are characterized by technological complexity and highly specialized skills and know-how. Young, technology-based firms have strong research and development competencies, while marketing and sales skills are the core competences of the large, established

companies active further down the value chain. These companies need to collaborate with large established players, since the latter own the necessary complementary assets to bring new products to the market (Arora and Gambardella). As a result, young, technologybased firms can focus their efforts on building a strong, pervasive technology platform whereas the large companies have the cash needed for worldwide product roll-out. These firms typically start with an immature technology which is at an early stage of the development cycle. This makes product sales in the first years after start-up unlikely. As a result, it is very likely that for firms with an emphasis on a technology strategy, growth in employment will occur before any sales are be generated. We therefore hypothesize:

H2: A technology strategy will be positively associated with employment growth, but not with revenue growth

The above discussion seems to imply that firms have a dichotomous choice between product or technology markets. When the appropriability regime is high, firms can enter technology markets, otherwise firm have to launch products (Gans et al, 2002). However, firms may develop new, pervasive technologies in environments where intellectual property regimes are inefficient as a protection mechanism. For example, the IT sector has been characterized by new firms that develop platforms technologies that gave rise to new markets (Zittrain, 2005). The environment prevents such firms from appropriating rents through licensing agreements with incumbent firms, which is more appropriate in markets for technology. Therefore, they will have to further develop the technology into novel customer value and enter product markets. Clarysse et al (2007) labeled these firms as following a hybrid strategy. Firms with a hybrid strategy develop multipurpose technologies and simultaneously unfold a product pipeline to create market share as a form of protection. Consequently, these firms will have to build the critical mass necessary for developing the technology and set up an aggressive niche strategy to commercialize products. These arguments lead to the following hypothesis:

H3: A hybrid strategy will be positively associated with both revenue and employment growth.

Summarizing, we argue that there will be different effects of product, technology and hybrid strategies on revenue and employment growth, respectively. First we hypothesized that revenue growth is the

result of product and hybrid strategies. Second, we hypothesized that firms with an emphasis on technology and hybrid strategies will enjoy employment growth.

DATA & METHODS

Sample

To test our hypotheses, we use a unique hand-collected sample of 80 research-based spin-offs in six European countries: Italy, Portugal, France, Slovenia, Belgium, and the UK. Research-based spin-offs are defined as entrepreneurial firms that develop and commercialize technologies which originated at universities or public research organizations (Wright et al., 2007). The dataset of research-based spin-off ensures heterogeneity in terms of strength of appropriability regime. To construct the sample frame, we integrated the databases of spin-offs from universities and public research organizations in each country. For this study, we limit the sample to the research-based spin-offs in our sample that are founded between 1995 and 2002. These companies have survived the first critical years, yet do not resemble established firms (Biggadike, 1979). Several reasons guided our thinking in setting the upper and lower age limit for defining the sample frame. Given the focus on growth, we need to include companies that already have some history so we set the lower bound for the research-based spin-off's founding year at 2002. In earlier research (Moray and Clarysse, 2004), it has been shown that companies exit between nine and eleven years after their formal incorporation. Therefore, we set the upper bound of the firm's founding at 1995. The period from the mid-1990s is characterized by a professionalization of technology transfer offices in continental Europe as a result of government actions stimulating entrepreneurial activity (Wright et al, 2007).

To ensure the spin-offs have a growth ambition, we use the legal form of the companies as a proxy for growth orientation. When established, organizations have different options of how to be incorporated. The legal form of incorporation has an influence on the amount of issued capital and the flexibility to attract external financing. For example in Belgium, firms that are incorporated as NV require a higher amount of issued capital but offer more possibilities to increase the capital provided by external investors. Setting up a company as an NV arguably indicates the company's intention to raise external

capital and thus its ambition to grow. Given our focus on growth, we therefore sampled research-based start-ups that are incorporated as NV in Belgium or an equivalent legal form in the other countries. We have a extracted a stratified sample to further ensure we have variance in growth and sector diversity.

Data

We used two sources to collect the data for our study. First, we consulted financial databases, which are publicly available through Bureau van Dijk per country, to collect data on revenue and employment growth. Through these databases, we also determined the age of the research-based spin-off. Data on the firm's strategy, founding team and sector were collected during face-to-face interviews with the founder or top management of the firm. In line with the strategic management literature (Kumar et al., 1993), we targeted the key informant, i.e. the founders or top management team members, as they are best qualified to assess strategy given the unavailability of archival data. Using two different sources for the dependent and independent variable reduces the potential for common method bias. To test for potential common method bias in a more formal way, we further performed the Harmon's one factor test, which resulted in seven factors with eigenvalues greater than one (Podsakoff & Organ, 1986). Since more than one factor occurs with the first factor only accounting for 19.9% of the variance, common method bias is not a problem in our data.

Measures

Dependent variables: Growth in revenue and employment

The dependent variable in this paper is the growth of the research-based spin-off in revenues and employment. Previous research has used different measures for firm growth and success: sales growth, employment growth, and financial indicators such as ROA.. Financial indicators are often useless since most young, technology-based firms are still in the stage of product development and do not generate any profit (Hart, 1995). In line with recent research on growth of young firms, we therefore focus on revenues and employment growth (Wiklund and Shepherd, 2003). These two growth indicators are less sensitive to particular research question and empirical settings than financial indicators. Also, growth in revenues represents the extent to which a product is accepted in the market (REF) whereas growth in

employment is an indicator of resource and knowledge accumulation (Kogut and Zander, 1992) For this study, we chose to operationalize firm growth using revenues and employment in 2006 as dependent variable, controlling for the initial revenue and employment. By including the lagged form as an independent variable, we control for possible autocorrelation (Fombrun and Ginsberg, 1990).

Independent variables: Entrepreneurial strategy

The independent variable is entrepreneurial strategy consisting of three components: product, technology, and hybrid. We build on recent work by Clarysse et al (2007) to measure the entrepreneurial strategies deployed by the research-based spin-offs. We used the specific characteristics of each strategy to develop a list of several 7-point Likert scale questions. We further complemented this questions with statements from previous operationalizations of entrepreneurial strategy (e.g. McDougall and Robinson, 1990). The list of entrepreneurial strategy items was further refined during several rounds of discussions with leading entrepreneurship scholars. The final list of ten items was then pretested with several founders and CEOs of research-based start-ups. The responses to the ten items were subjected to factor analysis using varimax normalized rotation, a structure of three underlying factors with eigenvaliue greater than one emerged, explaining 63.0% of the variance. The result of this analysis can be found in table 1.

-----INSERT TABLE 1 HERE-----

We calculated the first strategy item by combing the items one, two and the inverse of eight (alpha = .75). Firms emphasizing this strategy expand their activities through acquisitions. We label this strategy variable as hybrid strategy (Clarysse et al, 2007). The second strategy variable consists of the items three, four and ten (alpha = .63). Firms with an emphasis on this strategy have a business model based on product sales. These firms invest in marketing and sales and develop distribution channels. This strategy, which is very much in line with the niche perspective (Carter et al, 1994), is labeled product strategy. The final factor, items five, seven and nine, compromises activities such as the development of technology platforms and building strong IP positions (alpha = . 71). We label this strategy variable as

technology strategy. All chronbach alpha values are above the required minimum of . 60 (Nunnaly, 1978).

Control variables

We include the commercial experience of the founding team as a control variable. An organization's development and success are greatly influenced by its founders (Eisenhardt & Schoonhoven, 1990). Firms created by founders which have prior commercial experience are associated with faster growth in revenue and employment (Heirman and Clarysse, 2005). Also, We therefore include the number of founders with prior commercial experience as a control variable. Next, we also include the age and the initial size during the first year of operations of the as controls. Older firms might have more experience and resources which are typically accumulated over time. This advantage of older firms might enable them to grow at a faster pace and to sustain growth. Previous research shows that the founding conditions of the firm have an imprinting effect on later growth and performance (Boeker, 1989). The initial resources of the firm at start-up have an important influence on the development of future capabilities and opportunities (Barney, 1991). Firm age is the number of years since founding. Initial size during the first year of operations is operationalized as revenues (K Euro) and employment (FTE) in the first year in the models on revenue and employment growth, respectively. Finally, we include the country and sector dummies as control variables in the model. The institutional environment in which the firm operates influences the extent to which the research-based spin-off can accumulate resources. The country where the research-based spin-off is located captures the institutional environment. Further, countries differ in the policy set up to support and foster research-based spin-offs (REF). The following countries are represented in the sample: Italy (n=13), Portugal (n=6), France (n=20), Slovenia (n=4), Belgium (n=15), and UK (n=22). Previous research has also shown that the industry in which the firm competes influences its propensity to grow. We grouped our firms in the following industry sectors: ICT (n=23), Electronics (n=10), Instrumentation (n=16), Biotechnology (n=24), and Others (n=7). We used the UK and Others as the default country and industry sector respectively.

RESULTS

Table 2 represents summary statistics and correlations among the variables. The different entrepreneurial strategies are not correlated. This indicates that the research-based spin-offs place an emphasis on one of the entrepreneurial strategies: product, technology or hybrid strategy. Table 2 shows that younger firms place a higher emphasis on technology strategy than younger firms. The table further shows that founder teams with commercial experience tend to follow more acquisitive strategies. The commercial experience of the founding team is also coupled with the initial revenues of the firms in our sample. The hypotheses were tested using multiple regression analysis. We examined the variation inflation factors for all independent variables in the models (see Table 3) to test for potential multicollinearity. The variance inflation factors range from 1.17 to 3.84; we find that all factors are well below the 10 cut-off (Neter et al, 1990).

----INSERT TABLE 2 HERE----

The results of the hypotheses tests are summarized in table 3. In the first hypothesis we argued that product strategy will be positively associated with revenue growth, but not with employment growth. This hypothesis received strong support. Table 3 indicates that product strategy was positively related to revenue growth (beta = .28, $p \leq .05$). As for the control variables, we further observe that the age of the company and initial revenues have a positive association with revenue growth.

The second hypothesis deals with the relationship between entrepreneurial strategy and employment growth. Specifically, we hypothesized that research-based spin-offs following a technology strategies would achieve high employment growth but not revenues growth. The results show that this hypothesis is partially supported. A technology strategy is not significantly associated with employment growth. Interestingly, we find that technology strategy is negatively associated with revenue growth (beta = -.25, $p \leq .05$).

Our third hypothesis stated that hybrid strategies are positively associated with both revenue and employment growth. Such strategy involves the development of a platform type technology and also entering product markets due to low appropriability. The results show that hybrid strategy is significantly and positively related to growth in both revenues (beta = .27, $p \leq .05$) and employment (beta = .30, $p \leq .01$), supporting hypothesis 3.

----INSERT TABLE 3 HERE----

Robustness checks

We conducted a series of checks to further evaluate our results. More specifically, we performed additional analysis using 1) alternative calculations of growth and 2) different conceptualization of the industry sector in which the firm competes. Based on previous research (e.g. Delmar et al, 2003), we measured growth as the annual absolute revenue growth and annual absolute employment growth. These alternative dependent variables were calculated as the number of revenues in 2006 (thousands Euro) minus the amount of initial revenues (thousands Euro) divided by the age of the company[**]. The results of our hypotheses test remain the same. Next we conceptualized the industry sector by appropriability regime and the complementary assets (Teece, 1986). The appropriability regime is a two item measure and consist of the following items: 1) to what extent is it effective and possible in the sector to protect the technology[††] and 2) how important are patents to protect innovations to your enterprise ($\alpha = .74$). A high score represents an environment with a strong IPR regime. We created a two-item measure assessing whether complementary assets are controlled by incumbents (Gans et al, 2002). We used the following items to render the variable: 1) to what extent does the firm actually control the key resources and competences associated with capacity to sell the technology, product or service in terms of marketing and advertising, and 2) to what extent does the firm actually control the key resources and competences associated with the capacity to sell the technology, product or service ($\alpha = .72$). A low score indicates that the market for complementary assets is controlled by incumbents and hence the

[**] Similar method was used to calculate the annual absolute growth in employment.
[††] This item is reverse coded

companies are dependent on incumbents to commercialize their technology, products or service. All items are measured on a 7-point Likert scale. Product strategy becomes weakly, positively associated with revenue growth whereas the other results remain robust. Overall, we obtain essentially the same results with these alternative models.

DISCUSSION

There is increasing evidence that growth of new and young firms in revenues is not necessarily accompanied by growth in employment. Growth is therefore considered to be a multidimensional construct where growth in revenues and employment represent different underlying strategies. In this paper, we analyzed how the strategy deployed by research-based spin-offs influence growth in revenues and employment respectively. We use the recent development in the literature on entrepreneurial strategy and distinguish between product and technology markets for which research-based spin-offs deploy specific strategies (Gans and Stern, 2004; Clarysse et al, 2008). In this paper, we go beyond the market entry decision, which has been the primary focus in previous research, and argue that firm growth (revenues or employment, or both) is dependent on the type market targeted. More specifically, we argue that research-based spin-offs targeting product markets will grow primarily in revenues whereas their counterparts entering technology markets will growth in employment. Those spin-offs that target product and technology markets simultaneously will grow in both revenues and employment.

We tested our framework using a European dataset of research-based spin-offs and the results suggest that growth of research based spin-offs is multidimensional and that this reflects heterogeneity in the strategy of research based spin-offs. We found revenue growth to be positively associated with product and hybrid strategies while a technology strategy has a negative effect on revenue growth. We also showed that employment growth is positively associated with a hybrid strategy, while there is no significant relationship between product and technology strategies and employment growth.

Our study helps extend the literature in several ways. With respect to the strategy literature, we extend the focus of attention beyond product markets to analyze the influences of technology market strategies

and hybrid strategies on growth in revenues and employment. Our findings lend further support to the view that growth in revenues and growth in employees reflect different underlying constructs in the value creation process. Studies in this literature stream typically use financial indicators such as revenue growth which represents the firm's success in its ability to market products. Our use of employment growth as a performance indicator in the context of entrepreneurial strategy provides a proxy for the accumulation of resources and knowledge (Kogut and Zander, 1992).

Our argumentation and findings contribute to the literature on firm growth. There is considerable debate about how to measure growth (see Davidsson et al., 2007 for a review of the literature). It is recognized that high growth is multidimensional in nature and can be achieved in several ways (Delmar et al., 2003), such as total assets, profits, employees, and revenues. Growth on one dimension does not necessarily mean that companies grow on the other. Chandler et al., (2008) have for instance shown that growth in revenues is not highly correlated with growth in employees and is much more volatile. Because of these apparent differences in the dominant type of growth, scholars have argued that research should focus on the differences in dominant type and the determinants of these differences. Firm growth is considered to be multidimensional construct that represent different underlying value creation processes. Previous studies on firm growth have used revenue and employment growth interchangeably but have not conceptualized these differences. By explicating the role of entrepreneurial strategy, we offer theoretical insights into the mechanisms underlying revenue and employment growth

Our finding that technology strategy has no significant effect on employment growth is puzzling. One possibility may be that the employment effects of a technology strategy are indirect to the focal firm. For example, qualitative insights from our interviews identified cases of research based spin-offs pursuing a technology strategy where the development of the technology was out-sourced to other firms. While this approach helped create employment in supplier firms, the focal firm itself did not grow beyond the core management team. Further analysis is required of the nature of the partner linkages of research based spin-offs and their implications for the nature of growth.

LIMITATIONS & AVENUES FOR FUTURE RESEARCH

As all studies, this one is not without limitations that open up avenues for further research. Our analysis focused on European research based spin-offs. Given the international diffusion of the research based spin-off phenomenon (Wright et al., 2007), further research might usefully undertake comparative analysis of these kinds of firms in the US and Asia. Identifying growing research based spin-offs was not without difficulty since there is no Europe-wide database of such firms and the newness of the phenomenon limited the overall sample size. While we were able to obtain a reasonable sized sample of firms that had a sufficiently long growth track record, the recent surge in research based spin-off activity holds out the possibility for larger samples in future. Moreover, the recent increase in this kind of venture will also in time enable comparisons to be made of the nature of growth paths by different vintages of firms.

A further research agenda concerns the role of founding teams' social capital since, although we measured the founding teams' previous experience, we did not incorporate measures of their social capital and trading networks. The strength of such capital and networks may have implications for the growth and trajectory of research based spin-offs (Lee et al, 2001). Analysis of the development of these networks was beyond the scope of this study but future work could usefully compare the different nature of these networks of partners as between those spin-offs pursuing revenue, employment and hybrid strategies. Our study has also not examined the nature of revenue and employment growth, that is whether the growth occurs organically or through the acquisition of other firms to build revenue streams and/or a broader technology platform. Further research could seek to examine whether research based spin-offs pursuing different growth strategies make relatively more use of organic versus acquisitive approaches to the achievement of growth.

Our study focused on research based spin-offs that had grown but which remained as independent private firms. It was beyond the scope of this study to examine those firms which has exited through a strategic acquisition or IPO on a stock market. A substantial literature has examined the nature of exits through these two options (Cumming and MacIntosh, 2004).

In this context, our analysis has also not distinguished between firms that have received venture capital support and those which have not. Given the objectives of venture capital firms, those spin-offs receiving finance from this support may be more pre-disposed to seek realise capital gains from exiting the business through a strategic acquisition or IPO. Further research might usefully examine whether the growth strategies of spin-offs that have pursued an exit differ from those that have not and whether the growth trajectories of those pursuing an IPO exit route differ from those seeking a trade sale. For example, are those firms pursuing an IPO route more likely to seek to generate revenues as well as building their technology base while those pursuing a trade sale seek primarily to build a technology base that will be attractive to a corporate acquirer? For example, in one of the companies we visited it was put to us that pharma companies are only interested in the quality of the codified knowledge of the firm that is embedded in the patent portfolio and consider large staff and research facilities as liabilities "they have to get rid of". The important highly specialized tacit knowledge that biotech spin-offs typically develop may thus hamper their post-acquisition integration (Schweizer, 2005). This suggests that the introduction of the financial market (i.e., the possibility of exit) introduces the possibility that different organizational forms may be more effective than the traditional ones associated with developing a presence in the product market by building critical mass internally and setting up own research facilities. Further research is needed to examine the scope and applicability of these different organizational forms.

Also, the research-based spin-offs in our study, by design, survived in were still in existence at the end of the measurement period. We focused only on the growth of surviving firms rather than all growing firms in the period under study. Future research could extend this study by using longitudinal studies to examine the temporal dynamics of different commercialization strategies on firm survival.

Our findings have implications for practitioners and policy makers as they face the challenges of developing support beyond the creation of research based spin-offs to facilitate their growth. In particular, the heterogeneity of strategies adopted by research based spin-offs indicates a need for support by policymakers and advisers also to be heterogeneous. The policy tools needed to facilitate

high growth in revenues may be different from those that will generate growth in employment. Moreover, policymakers with a focus on generating employment growth may also need to introduce support for revenue generation at the same time. Our evidence of a lack of association between a pure technology strategy and growth but of a positive link between hybrid strategies and growth raises question marks about the feasibility of the former strategy. However, it also suggests that practitioners and policymakers need to consider the indirect as well as the direct employment effects. Firms building the value of technology may do so by outsourcing this activity to laboratories. As a result, the employment size of the focal firm may be very low, but significant employment may be created in the laboratories being contracted to develop the technology. This was the case in one company we visited that had raised over £10 million of venture capital but directly only employed five people, yet its indirect employment creation was probably tens of people. This point also extends to policy concerning the regional impact of research-based spin-offs, since focal firms may appear to be employing few people but indirectly may be creating employment elsewhere in the region. Although it is beyond the scope of this study, this example raises an intriguing area both for policy concerning what are the most effective configuration of organisational forms for the implementation of technology strategies.

CONCLUSION

The influences on and the nature of the growth of young, technology-based firms in general, and research based spin-offs in particular remain much debated and vexed questions. In this study we sought to address these questions by shedding new light on the relationship between entrepreneurial strategy and firm growth in revenues and employment. We have thus extended previous studies beyond examination of different measures of growth and of the factors that determine market choice to consider the effects of different commercialization strategies on the nature of firm performance.

We used a unique European dataset of research-based spin-offs to show that firms emphasizing a product strategy are positively associated with growth in revenues. We also showed that firms using a hybrid strategy achieved growth in both revenues and employment. Contrary to expectation, however, we find that firms pursuing a technology strategy do not grow fast in employment. Our study thus

represents a contribution towards reconciling differences in findings using different measures of the growth of young, technology-based firms. As we have indicated in the discussion, however, this is a first step and further conceptual and empirical developments are anticipated. The approach adopted may help in pointing the way forward.

REFERENCES

Arora, A., Fosfuri, A. & Gambardella, A. (2001). Markets for technology and their implications for corporate strategy. *Industrial and Corporate Change*, 10, pp. 419 – 451.

Barney, J.B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17, pp. 99 – 120.

Boeker, W. (1989). The Development and Institutionalization of Subunit Power in Organizations. *Administrative Science Quarterly*, 34, pp. 388 – 410.

Baum, J. R., Locke, E. A., and Smith, K. G. (2001), A multi-dimensional model of venture growth. *Academy of Management Journal*, 44, 292 – 303

Carter, N.M., Stearns, T.M., Reynolds, P.D. & Miller, B.A. (1994). New Venture Strategies: Theory Development with an Empirical Base. *Strategic Management Journal,* 15, pp. 21 – 41.

Chandler, G.N., McKelvie, A., & Davidsson, P. (2008). Asset specificity and behavioral uncertainty as moderators of the sales growth – employment growth relationship in emerging ventures. *Journal of Business Venturing*, article in press

Clarysse, B., Bruneel, J. & Wright, M. (2007). Growth strategies of young, technology-based firms. Paper presented at the Babson Conference on Entrepreneurship Research 2007

Cumming, D. and MacIntosh, J. G. 2004. The Extent of Venture Capital Exits: Evidence from Canada and the United States. Ch.15 in L.D.R. Renneboog and J. McCahery (eds) *Venture Capital Contracting and the Valuation of High Technology Firms*, Oxford University Press,

Davidsson, P., Achtenhagen, L. and Naldi, L. (2007). *Research on small firm growth: a review*. Working paper at Brisbane Graduate School of Business, Queensland University of Technology.

Delmar, F., Davidsson, P. & Gartner, W.B. (2003). Arriving at the High-Growth Firm. *Journal of Business Venturing*, 18, pp. 189 – 216.

Eisenhardt, K. M. & Schoonhoven, C. B. (1990). Organizational Growth: Linking Founding Team, Strategy, Environment, and Growth among U.S. Semiconductor Ventures, 1978-1988. *Administrative Science Quarterly*, 35, pp. 504 – 529.

Feeser, H.R. & Willard, G.E. (1990). Founding Strategy and Performance: A Comparison of High and Low Growth High Tech Firms. *Strategic Management* Journal, 11, pp. 87 – 98.

Fombrun, C.J., Ginsberg, A. (1990), "Shifting gears: enabling change in corporate aggressiveness", *Strategic Management Journal*, 11, pp.297 – 308.

Gans, J.S. & Stern, S. (2003). The product market and the market for "ideas": commercialization strategies for technology entrepreneurs. *Research Policy*, 32, pp. 333 – 350

Gans, J.S., Hsu, D. & Stern, S. (2002). When does start-up innovation spur the gale of creative destruction?. RAND Journal of Economics, 33, pp. 571 – 586

Heirman, A. & Clarysse, B. (2005). The imprinting effect of initial resources and market strategy on the early growth path of start-ups. Ghent University Working Paper Series

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3,pp. 383 – 397.

Kumar, N., Stern L.W., & Anderson, J.W. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal,* 36: 1663-1651.

McDougall, P & Robinson, R.B.Jr. (1990). New venture strategies: an empirical identification of eight "archetypes" of competitive strategies for entry. *Strategic Management Conference*, 11, pp. 447 – 467.

Miles, R.E. & Snow, C.C. (1978). Organizational strategy, structure and processes. New York, McGraw-Hill

Neter, J., Wasserman W. and M.H. Kuther, W.H. (1990). Applied Linear Statistical Model (fourth ed.). Richard D. Irwin Inc., Boston, MA

Podaskoff, D.M. and Organ, D.W., (1986). Self-reports in organizational research: problems and prospects., *Journal of Management*, 12, pp. 532-544

Porter, M. (1980). *Competitive Strategy: Techniques for Analizing Industries and Competitors*. New York, The Free Press.

Sandberg, W.R. & Hofer, C.W. (1987). Improving new venture performance: the role of strategy, industry structure, and the entrepreneur. *Journal of Business Venturing*, 2, pp. 5 – 28.

Schweizer, L. (2005). Organizational integration of acquired biotechnology companies into pharmaceutical companies: the need for a hybrid approach. *Academy of Management Journal*, 48, pp. 1051 – 1074

Siegel, R., Siegel, E. & MacMillan, I.C. (1993). Characteristics distinguishing high-growth ventures. *Journal of Business Venturing*, 8, 169 – 180.

Teece, D.(1986). Profiting from technological innovations: implications for integration, collaboration, licensing and public policy. *Research Policy*, 15, 285 – 305

Wernerfelt, B. (1984). A resource-base view of the firm. *Strategic Management Journal*, 5, pp. 171 – 180

Wright, M., Clarysse, B., Mustar, P. & Lockett, A. (2007). *Academic Entrepreneurship in Europe*. Cheltenham: Edward Elgar

TABLES

Table 1: Factor analysis of strategy items

	Factor 1	Factor 2	Factor 3
Strategy item 1	*0.828342*	0.212793	-0.023936
Strategy item 2	*0.879068*	-0.142426	0.081049
Strategy item 3	0.151713	*0.785686*	-0.056716
Strategy item 4	-0.055641	*0.740483*	0.109479
Strategy item 5	0.163568	0.003637	*0.852920*
Strategy item 6	0.427609	0.321962	0.375115
Strategy item 7	-0.000031	0.040776	*0.885674*
Strategy item 8	*-0.657160*	0.418468	-0.111911
Strategy item 9	0.012870	-0.215884	*0.630870*
Strategy item 10	-0.174397	*0.657572*	-0.256781
Eigenvalue	1.69	1.93	2.68
Explained variance	16.9	19.3	21.8

Table 2: Means, standard deviations and correlations of the independent variables

Variable	Mean	stdev	1	2	3	4	5	6
1 Product strategy	4.36	1.78						
2 Technology strategy	5.03	1.67	.00					
3 Hybrid strategy	2.36	1.41	-.07	.16				
4 FT ComExp	.45	.81	.10	.14	.27*			
5 Start-up size: revenues	107.75	272.68	.17	-.05	.12	.25*		
5’ Start-up size: employment	5.00	11.11	.19	.04	.17	.12	.79*	
6 Firm age	7.23	2.09	.12	-.52*	-.11	-.08	.09	.06

*Correlation is significant at the 0.05 level (2-tailed).

Table 3: Results of the multiple regression analysis

	Revenue growth		Employment growth	
	Model 1a	Model 2a	Model 1b	Model 2b
Control variables				
ComExp FT	.16^{+} (.11)	.14^{+} (.11)	.09 (.11)	.05 (.10)
Age	.30** (.11)	.26* (.12)	.25** (.11)	.27** (.11)
Initial size	.22* (.11)	.20* (.11)	.35* (.11)	.32** (.11)
Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Independent variables				
Product strategy		.27* (.14)		-.00 (.12)
Technology strategy		-.25* (.14)		.03 (.12)
Hybrid strategy		.27* (.11)		.30** (.10)
Adjusted R^2	.12	.20	.29	.36
F	1.89^{+}	2.29*	3.72***	3.92***
Δ F		3.95**		3.22*
df	67	64	67	64
Range of VIF	1.17 – 3.49	1.20 – 3.75	1.16 – 3.52	1.24 – 3.84

The coefficients are standardized and standard errors in parentheses. *** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, $^{+}$ $p \leq .10$; one-tailed.