Vlerick Leuven Gent Management School
the Autonomous Management School of Ghent University and Katholieke Universiteit Leuven

Vlerick Leuven Gent Working Paper Series 2003/22

STARTING RESOURCE CONFIGURATIONS OF RESEARCH-BASED START-UPS AND THE INTERACTION WITH TECHNOLOGY, INSTITUTIONAL BACKGROUND, AND INDUSTRIAL DYNAMICS

ANS HEIRMAN
Ans.Heirman@vlerick.be
BART CLARYSSE
Bart.Clarysse@vlerick.be
VICKY VAN DEN HAUTE
Vicky.VanDenHaute@vlerick.be

D/2003/6482/23

STARTING RESOURCE CONFIGURATIONS OF RESEARCH-BASED START-UPS AND THE INTERACTION WITH TECHNOLOGY, INSTITUTIONAL BACKGROUND, AND INDUSTRIAL DYNAMICS

ANS HEIRMAN
Ans.Heirman@vlerick.be
BART CLARYSSE
Bart.Clarysse@vlerick.be
VICKY VAN DEN HAUTE
Vicky.VanDenHaute@vlerick.be

Contact
Professor Bart Clarysse
Vlerick Leuven Gent Management School
Reep 1, 9000 Gent, Belgium
Tel: ++32 9 210 98 80
Fax:++32 9 210 97 00
E-mail: Bart.Clarysse@vlerick.be

ABSTRACT

We study the starting resources of start-ups, which develop and market new products or services based upon a proprietary technology or skill. We define these companies as research-based start-ups (RBSUs). We look at how technological, financial and human resources at founding cluster together to form different starting resource configurations. Using a unique hand-collected dataset of RBSUs in Belgium, we find four different types of starting configurations: “Venture Capital-backed start-ups,” “Prospectors,” “Product start-ups” and “Transitional start-ups”. This study shows that these different types of starting resource configurations are not only empirically distinct but can also be conceptually explained by internal factors such as the entrepreneurial orientation at start-up and external factors such as the origin of the firm and the characteristics of the industry in which the firm competes.

INTRODUCTION

Research-based start-ups (RBSUs) are new business start-ups, which develop and market new products or services based upon a proprietary technology or skill. RBSUs have received a great deal of attention from academics in the last two decades (e.g. Utterback et al., 1988; Roberts, 1991; Autio & Yli-Renko 1998; Shane, 2001). These studies revealed that RBSUs, or New Technology-Based Firms (NTBFs) in more general, contribute significantly to an economy in terms of exports, employment, taxes paid, research and development, and innovations (Utterback et al., 1988) and play an important role in bringing new technologies to the market (Henderson, 1993; Christensen, 1997).

In this study, we explore whether we can distinguish dominant starting resource configurations among RBSUs. This research is attractive from a practical and a theoretical viewpoint. Firstly from a practical standpoint, there is a clear need for a multi-dimensional resource-based typology of RBSUs. Roberts (1991) found that different types of resources of RBSUs are linked and that the interrelationship alters the relationship between individual resources and firm performance. Chandler & Hanks (1998) found that human and financial capital appear to be substitutable. Most researchers, however, do not control for possible interaction effects between different types of resources. Without a deep understanding about resource typologies, it is difficult to draw meaningful conclusions and recommendations from research on RBSUs. Secondly, we want to contribute to the Resource-Based View (RBV) theory. A future challenge for RBV-scholars is to answer 'how' questions such as "How do resources interact/ compare with other resources?" (Priem & Butler, 2001).

In order to examine how different types of resources relate to each other, we use cluster analysis procedures to distinguish dominant patterns in starting resources and to develop a resource-based taxonomy of RBSUs. Implicit in this line of thinking is a belief that the search for a resource-based explanation of firm performance without an understanding of how resources relate to each other leads to conflicting theories of firm performance. Next, we analyze how different starting resource configurations are related to differences in technological domain, industry characteristics, organizational origin and entrepreneurial orientation. These analyses can also be seen as testing the external validity of the clusters. If the clusters do not differ on variables not used in the cluster analysis, they are unlikely to represent distinct empirical categories (Ketchen & Shook, 1996).

LITERATURE REVIEW

Starting Resource Configurations

Several scholars studied different characteristics of RBSUs at start-up such as the financial resources (Roberts, 1991; Hellmann & Puri, 2000ab; Manigart et al., 2002), personal characteristics of the founders or entrepreneurial team (Utterback et al., 1988; Roberts, 1991, p. 47 – 99; Feeser & Willard, 1990; Shane, 2001; Shane & Stuart, 2002; Burton et al. 2002), and the technology (Utterback et al., 1988). These studies show that "starting resources" is a multidimensional construct and RBSUs differ considerably along different resource dimensions.

The next step towards a better understanding of starting resources is to capture major patterns in this variation while making abstraction of other factors. One popular response to this challenge has been to identify "organizational configurations": groups of firms sharing a common profile of organizational characteristics (Meyer et al., 1993; Miller & Mintzberg, 1984). Examination of organizational configurations has been conducted under many labels, including strategic groups (Hatten and Schendel, 1977), organizational typologies (Miles and Snow, 1978), taxonomies (Galbraith and Schendel, 1983), and archetypes (Miller and Friesen, 1980). Regardless of the specific label, the underlying assumption is that configurations represent a way to meaningfully capture the complexity of organizational reality and to understand the relationship between organizations and their environments and performance outcomes (Ketchen et al., 1997).

We position this study in the resource-based-view (RBV) of the firm (Wernerfelt, 1984; Barney, 1991; Barney et al., 2001; Teece et al., 1997). The RBV tradition argues that firm-specific resources and capabilities, which are both rare and valuable, determine the competitive advantage of a firm. When such resources are simultaneously *not imitable* (i.e. they cannot easily be replicated by competitors), *not substitutable* (i.e. other resources cannot fulfill the same function), and *not transferable* (i.e. they cannot be purchased in resource markets), those resources may produce a competitive advantage that is long lived (i.e. sustainable).

Most empirical research has studied one or more types of resources at one point in time and independently from each other and analyzed the relation between one type of resources and performance. Such a static approach fails to appreciate the interaction effects of different types of resources and overlooks the dynamism of the system. However, RBV

theorists acknowledge that resources may become specialized to others and evolve in a dynamic system (Mosakowski, 1993; Teece et al., 1997). Recently, resource-based scholars have begun thinking about methods to study resources as a dynamic system (Brush et al., 2001; Chandler & Hanks, 1998). We argue that if resources are indeed linked to each other then one should be able to distinguish different types of resource configurations. In order to explore this, we use cluster analysis procedures to develop a starting resource-based taxonomy of RBSUs.

Critical Starting Resources for RBSUs

The most fundamental step in cluster analysis is the selection of variables along which to group firms. We use a combination of a deductive and cognitive approach to identify the appropriate variables for this study. Firstly, we follow the RBV theory to select a framework of different types of resources. Secondly, we use the perceptions of expert informants, i.e. founders of RBSUs, to select the cluster variables.

To examine the variation in starting resources, we adopt the general, often used classification of Barney (1991). Barney classifies resources into 4 dimensions: financial, physical, human and organizational resources. In order to focus on the most important resources for RBSUs and select the specific measures for each type of resource, we use insights from our field study. The first question in the interviews was open-ended and asked the founder to tell in general terms about "How the firm was started?" Most founders spontaneously talked about their technology or product, the founding team and the financing. This enhances our confidence that these three resource dimensions are appropriate to explore starting resource configurations. To derive a resource-based taxonomy, we don't take into account organizational resources, because founders almost never talked spontaneously about them and RBV theory argues that this type of resources is not elaborated at start-up. However, we acknowledge that some aspects of organizational resources, such as the firms' entrepreneurial orientation (Lumpkin & Dess, 1996), may vary among start-ups. Therefore, we study in the second part of this paper how heterogeneity in entrepreneurial orientation relates to different starting resource configurations.

In the following paragraphs we briefly discuss the financial, physical and human resources and give a RBV explanation for the specific aspects we use to develop a resource-based taxonomy of RBSUs. *Financial resources* include all the different money resources that firms can use such as capital from the entrepreneurs, from equity investors and debtors. A

start-up that invests disproportionately more financial resources early on is likely to accumulate a larger stock of strategic assets than peer ventures that lack the financial resources at founding (Lee et al., 2001). Several scholars argue that a lack of financial resources is a key component of the liability of newness (Stinchcombe, 1965) which starters face (Schoonhoven et al., 1990). Therefore, we argue that the amount of financial resources at founding can be a source of competitive advantage for RBSUs. We take into account the total amount of starting capital and the debt ratio of the firm during the first year. Next, we also distinguish between firms that raised capital form venture capital firms (VCs) during the first year and those that did not. Besides money, VCs also provide legitimacy, management know-how and financial expertise (Hellmann & Puri, 2000b). Hence, venture capital involvement at founding might be a source of competitive advantage.

Physical resources include the physical technology used in the firm, a firm's plant and equipment, its geography and its access to raw materials. By definition RBSUs are companies whose mission is to develop and market technologically new or improved products, services or processes. Hence, the technical resources are mostly the most important aspect of physical resources compared to access to raw materials and plant and manufacturing. Further, we keep the geographic location constant in this study (see method section). Hence, in this study, we focus on the technology resources - as a type of physical resources. Empirically, we found that RBSUs differ considerably along three dimensions of technology resources and RBV thinking indicates that these three dimensions might be important sources of competitive advantage. Firstly, RBSUs are not in the same stage of the product-development cycle at founding, because the extent of pre-founding efforts varies considerably among firms. Entrepreneurs may develop a technology/ product while working at a prior employer and transfer this technology/product to the start-up. These pre-founding efforts may give the start-up a competitive advantage over firms that start from scratch. Therefore, we consider the stage of development of the firm's core product at founding as an important starting resource. Next, RBSUs differ in the scope of their product-technology. Some firms develop one specific product, while others develop broad platforms, which can serve as the base for several products (Meyer at al., 1997). Thirdly, RBSUs differ considerably in the newness or innovativeness of their core technology and innovativeness can be an important way for start-ups to differentiate themselves from incumbents and might be an important source for competitive advantage (Schumpeter, 1934; Lee et al, 2001). Following Hellmann & Puri (2000a) and Burton (1996), we distinguish between innovators and imitators. An innovator is a firm that creates mainly new, proprietary knowledge. An imitator, on the other hand, rather

uses existing knowledge and focuses on making (minor) improvements to it or synthesizes several existing technologies in its own proprietary products.

Human resources include the training, experience, judgment, intelligence, relationships, and insight of individual managers and workers in the firm. For new ventures, the entrepreneur(s) is/are the most critical – if not the only – human capital present in the firm (Van de Ven et al., 1984; Roberts, 1991; Shane & Stuart, 2002). His/her or their experience and training seem to be key. Hence, we focus on the size of the entrepreneurial team and the experience in the sector of the firm and the management experience. Next, we also take into account whether the firm attracted professional managers with more than 10 years of experience during the first year.

To summarize, the first research question we address in this paper is: "Can we distinguish different starting resource configurations based on measures of three resource dimensions: financial, technical and human?"

Key Contingencies of Starting Resource Configurations of RBSUs

Stinchcombe (1965) was one of the first to argue that environmental conditions at time of founding strongly define the initial characteristics of an organization and that these influences were long-lasting. Especially start-ups depend for their resources upon their environment. In this study, we want to go beyond the notion that environment matters and bring insights in 'how' environmental factors differ between different starting resource configurations. More specifically, we study heterogeneity in technological domain, organizational origin, and characteristics of the industry that the firm targets at founding. By design, we control for non-measured macro-environmental factors such as the natural environment, demographic and social structure, and overall national and international economic conditions (see Method section). Figure 1 gives an overview of the contingencies we address in this paper and in the following paragraphs we explain the rationale for studying each of them.

Insert Figure 1 About Here

Heterogeneity in technological domain

Many scholars study high tech start-ups in particular technological environments such as biotechnology (Zahra, 1996; Clarysse, 1996; Deeds et al., 1999; Stuart et al., 1999). Others focus on semi-conductors (Schoonhoven et al., 1990), computers (Eisenhardt & Tabrizi, 1995), or software and dot-coms (Yoffie & Cusumano, 1999; Amit & Zott, 2001). The underlying rationale behind these technology specific studies is that the technological regime influences to a large extent the business model a start-up can follow and the resources needed to execute it. Hence, we expect to find different types of starting configurations in different technological domains

Heterogeneity in organizational origin

In the study of research-based start-ups, researchers often compile samples lumping together ventures from completely different parent institutes, without controlling for institutional level differences. Burton et al. (2002) show that career histories and characteristics of the prior employer influence the financing at start-up and the initial strategy of new ventures. This finding suggests that the organizational origin influences the ability to acquire certain types of starting resources. We aim to test the influence of prior organizational context from which the firm emerges on starting resources. We distinguish between firms that spun-off from a parent organization and independent start-ups. Among the parent organizations, we make a distinction between "private corporations" and "universities". We expect that we will find different starting configurations among the group of corporate spin-offs, academic spin-offs and independent start-ups.

Heterogeneity in industry and market characteristics

Not all RBSUs develop a technology, which fits nicely into the existing industrial environment and for which all complementary assets are in place to commercialize it. RBSUs often have to create a new industry infrastructure and/or alter an existing industry infrastructure to commercialize their new technologies, products or services (Utterback & Suárez, 1993; Aldrich & Fiol, 1994). Many authors have stressed the collective nature of innovative activity and pointed out that an organization is seldom solely responsible for, or has control over, the process of innovation (Aldrich & Fiol, 1994; Rickne, 2000). Rarely does any firm possess all the necessary resources and capabilities to create a new industry infrastructure. Instead several actors shape the innovation process, for example through providing resources or blocking them (Collis, 1991, p. 51; Rickne, 2000, p.12). Therefore, we

think that the complexity in terms of different actors in the value added chain is a first important item to characterize the industry environment of RBSUs. We could expect that RBSUs assess the complexity which they face in their business plan and, hence, in their starting resources. We explore then whether RBSUs with different starting configurations face a different industrial environment, worked out in terms of complexity of the value chain.

The marketing literature indicates that the final part of the value added chain – the buyer-seller relationship – is of outmost importance for RBSUs (Meyers & Athaide, 1991; Loftus & Meyers, 1994). If the RBSU targets a market of corporate clients, the decision to adopt its innovative product will usually be made jointly by numerous individuals representing various functions and departments (Lewin & Bello, 1997). The characteristics of such a buying center in terms of number and accessibility of decision makers, determine the complexity of the selling process. Start-ups might organize themselves in different ways to deal with these selling processes. In this paper, we explore whether start-ups adopt different starting resource configurations to deal with different degrees of complexity of the buying center of the initial targeted customers.

Several studies showed that RBSUs differ considerably in the size and geographic dispersion of the markets they target at start-up. Some start-ups focus on a small niche market, others target a large mass-market from inception and other RBSUs focus initially on a niche market but have the specific intention of entering a large mass-market later on (Tiler et al., 1993). The venture capital literature (e.g. MacMillan et al., 1985) suggests that the ability of an RBSU to obtain risk capital is strongly related to the size and international scope of its targeted market. In addition the international management literature (Oviatt & McDougall, 1994) suggests that start-ups that target an international market from inception might need and have access to more and different resources than firms that do not. Hence we explore whether firms that target different markets in terms of size and geographical scope adopt different starting configurations to do so.

To summarize: we explore how different starting resource configurations are linked with heterogeneity in four industry characteristics, namely the complexity of the value chain, the complexity of the customer's buying center, the size and geographic scope of the targeted market.

Heterogeneity in Entrepreneurial Orientation among Starting Resource Configurations

The reasons and motivations leading to start-up are considered important elements influencing not only the start-up of the new business but also its characteristics (Birley & Westhead, 1994; Hofer and Sandberg, 1987; Roberts, 1991, p. 149). Our field study revealed that some RBSUs are founded mainly as a vehicle for self-employment, while other ventures are rather started because the entrepreneurs saw a unique opportunity that could not be pursued within their former work environment. This corresponds to two important dimensions of entrepreneurial orientation, namely proactiveness and autonomy (Lumpkin and Dess, 1996). In this paper, we explore how differences in those two important aspects of entrepreneurial orientation relate to different starting resource configurations.

METHODOLOGY

Population of RBSUs

We define "Research-Based Start-Ups" (RBSUs) as new business start-ups, which develop and market new products or services. "Start-up" points to the fact that firms under study are 'young'. We focus on RBSUs that are between five and eleven years old, which is presumably the time it takes for a new venture to mature and to overcome its liability of newness (Stinchcombe, 1965). Previous research indicates that the earliest this might occur would be three to five years after its creation, and more usually, not until the venture is eight to twelve years old (Quinn & Cameron, 1983; Kananjian & Drazin, 1990). "Research-based" refers to firms that have their own R&D and/or develop their own products (Utterback and Reitberger, 1982).

Sampling

To study how different types of resources relate to each other, it's important to reduce the non-measured variance among firms resulting from the environmental conditions. Therefore, we study RBSUs in a homogeneous region. We choose Flanders, which is a small, export-intensive economy, located in the Northern part of Belgium. Flanders is considered as an emerging high tech region, experiencing a fast process of convergence between old and

new technologies and thereby improving its competitive position (Cantwell & Iammarino, 2001).

We adopt a guided sampling technique to construct the sample frame of RBSUs in Flanders, founded between 1991 and 1997. Three specific subgroups of the RBSU population are identified to construct the sample frame. It is important to highlight that the subgroups are not mutually exclusive, i.e. a firm can belong to one or more subgroups. We first select the subgroup of academic spin-offs. In previous research, Clarysse et al. (2001) identified all academic spin-offs in Belgium. Twenty-five companies in the sample frame are academic spin-offs, which all meet the profile of RBSUs. Secondly, we select the subpopulation of start-ups that have received risk capital from Venture Capitalists and Business Angel Funds located in Flanders. Fifty-seven firms in these portfolios were founded between 1991 and 1997, and 18 of them met the definition of RBSUs. Only 8 of these were "new" RBSUs that did not appear as academic spin-offs. Thirdly, we identify the group of RBSUs that have received innovation or R&D grants from the Flemish government. One hundred eighty-two (182) start-ups in the period 1991-1997 had received such grants. Forty-seven (47) firms met the profile of RBSUs and 4 of these companies were already identified via other ways. Finally, we complemented the three groups with a random sample of 480 firms, drawn from the entire population of companies that were founded in Flanders between 1991 and 1997 and have a NACE-code that is classified in high-tech and medium-high-tech industries according to the OECD classification (DSTI 1997/2). This population comprises 7775 companies in total, of which 1861 are classified in manufacturing industries and 5914 in service sectors. Only seven new RBSUs could by identified using this random sampling. This confirms our intuition that the three subgroups, which we identified before represent a large part of the total population of RBSUs and that purely relying on random sampling would be a slow and cumbersome process to identify RBSUs.

Eighty-three (83) RBSUs[1] participated in our study. At time of the data collection (2002), the surviving RBSUs are between 5 and 11 years old. On average the RBSUs in our sample are 7 years old. Most of the 83 firms, namely 86%, survived as independent entities. The other 12 RBSUs (14%) dissolved, i.e. failed to exist as independent entities, by 2002. Half of these, i.e. 7% of the total sample were acquired by other firms during their early growth path and the other 7% went bankrupt. During the first year after founding the number of employees (in full time equivalents) ranged between 0 and 305, with an average of 8

[1] Due to missing data, only 76 firms are used in the cluster analysis

employees during the first year. In 2002, the number of full time employees ranged between 1 and 520, with an average of 33 employees.

Data Collection

The primary data source is a structured questionnaire with mainly closed questions. This questionnaire is conducted during face-to-face interviews with the founder of the company. The founders or CEO's were targeted because they typically possess the most comprehensive knowledge on the organization's history, the firm's strategy, and its performance (Carter et al., 1994). The interviews typically have duration of one hour to one hour and a half and are conducted by two researchers. One of the interviewers asks the questions and the other person fills in the questionnaire and takes notes. Immediately after the interview, the researchers crosscheck facts and impressions. Next to the collection of primary data, we double-check the financial data (e.g. revenues, capital, subsidies, loans, profits) with data available via the National Bank of Belgium and/ or company balance sheets. These audited data sources enhance the reliability of the measures. Finally, we collected additional information on each firm from secondary data sources such as web sites, company brochures, newsletters and press releases.

Starting Resources: Measures and Descriptive Statistics

In the theoretical section we elaborated the resource-based view of the firm in the context of RBSUs. We argued that 10 variables along three resource dimensions, namely technology, financial and human resources, are appropriate to describe the resource-base of RBSUs at founding. Table 1 describes how these 10 variables are measured.

Insert Table 1 About Here

All variables are based on specific questions in the questionnaire and are thus rated by the interviewee, except for the measures of technical scope and innovativeness. The two interviewers scored these variables based on the qualitative information obtained during the interview and additional information about products and technology from secondary sources. When consensus could not be reached a third experienced researcher was asked to review the

interview reports and other information and score the variable. We choose to score these variables ourselves because these variables are less factual than the other items and founders lack a frame of reference when asked to evaluate the innovativeness and scope of their basic technology. We believe that researcher-based scoring improves the consistency of these measures. Table 2 provides an overview of the descriptive statistics of the resource variables.

Insert Table 2 About Here

Key Contingencies and Entrepreneurial Orientation: Measures and Descriptive Statistics

Table 3 describes how the 6 contingency variables and entrepreneurial orientation are measured. Table 4 gives the descriptive statistics of these measures. Firstly, we look at the heterogeneity in the technological domain. Table 4 shows that our sample contains considerably more software firms (49%).

Insert Table 3 and 4 About Here

This might limit our ability to pronounce upon the link between technology and starting configuration. Secondly, we study the heterogeneity in organizational origin. More specifically, we distinguish between RBSUs that spun-off from universities or research institutes, RBSUs that spun-off form private companies and firms without a link with a parent organization, i.e. independent start-ups. These three types of firms are equally represented in our sample. Thirdly, we study the heterogeneity in industry characteristics. More specifically, we study the heterogeneity in the size and geographic scope of the target market at founding. These variables are scored by the founder during the interviews. Next, we developed measures for the complexity of the value added chain that the firm faces and the complexity of the selling process to the direct customer of the firm. The two researchers who interviewed all the firms scored these two variables using all the qualitative information from the interviews and secondary data and taking into account the other RBSUs as a frame of

reference to code each individual firm. Finally, the entrepreneurial orientation to start the company is measured with two items, autonomy and proactiveness. These variables are scored by the founder on a 5-point scale in a telephone follow-up interview. Due to the present low response rate[2] of these follow-up interviews, we also use a dummy, which measures the main motivation for founding the firm. This variable is scored by two researchers based on the answers to the first open-ended question in which the founder was asked to talk about how the firm was started.

Cluster Analysis

We explore which different types of starting resource configurations can be distinguished among RBSUs by use of cluster analysis. Cluster analysis encompasses a number of different classification algorithms, which can be classified into two broad families: hierarchical and non-hierarchical clustering. Ketchen & Shook (1996) suggest using both procedures as complements to each other: first a hierarchical procedure can be used as an exploratory methodology to determine the desired number of clusters and as input to the non-hierarchical step. In this paper, we follow this two-step approach. To perform the hierarchical cluster analysis, we follow Ward's procedure with squared Euclidean distance as linkage measures (Hambrick, 1983). As inputs in the cluster analysis, we used the different measures of technological, financial and human resources described above. Following the criteria of Hair et al. (1992), we find a four clusters solution as the most appropriate for our data. Subsequently, we performed a k-means clustering with four as the predefined number of clusters and the same variables as inputs.

RESULTS AND DISCUSSION

Starting Resource Configurations

The F-statistic of the analysis of variance and the descriptive statistics for each cluster are given in table 5. We found that all variables were significant at the 0.05 level or better. The cluster characteristics are discussed below. For ease of interpretation, we have given each cluster a name, which reflects the starting resource configuration of the companies in the cluster.

[2] At time of writing, the telephone follow-up is ongoing and more data points are forthcoming

Insert Table 5 About Here

CLUSTER 1 (14 firms or 18.4%) corresponds to the *Venture Capital (VC) backed start-ups* extensively described in the financial literature (e.g. Manigart et al., 2002; Hellmann & Puri, 2000a). In contrast to all other categories, these RBSUs start up with external capital, either from institutional VCs, or corporations. They usually have a proprietary, innovative technology that can be used for different applications (platform), but at start up they are far from a market ready product. They usually have a large founding team, on average consisting of three founders. The average founding team of VC-backed start-ups has high management experience but low experience in the sector of the firm. VC-backed start-ups often attract experienced managers during the first year after founding.

CLUSTER 2 (15 firm or 19.7%) represents the *prospectors.* Comparable to the VC-backed start-ups, prospectors are in an early stage of product development at founding, on average in the α-prototype stage or earlier. Prospectors as a group seem however to be less innovative and less involved with platform technologies than VC-backed start-ups. The average size of the founding team is comparable to that of VC-backed start-ups, but prospectors have less management experience and none of them attracted experienced managers during the first year after founding. This seems to be related to the fact that prospectors are on average started with smaller amounts of starting capital than the VC-backed start-ups. Hence, prospectors mostly don't have the financial resources to attract experienced managers. None of the firms in the prospector group received venture capital at start-up, neither from an institutional VC nor a corporate one.

CLUSTER 3 (18 firms or 23.7%) represents the *product start-ups.* In contrast to the other groups, product start-ups usually have a product that is close to market in a first version at time of founding. As a group the product start-ups are less involved with platform and innovative technologies than VC-backed firms but more than the prospectors. The typical product start-up consists of one or two entrepreneurs, who have been working in the sector for a number of years. The management experience of the founding team is low and only few product start-ups attract experienced managers during the first year. At start-up, most product start-ups do not look for external capital because they expect revenues from product sales shortly after founding. Their working capital seems to be financed with a high degree of debts during the first year.

CLUSTER 4 (29 RBSUs or 38.2%) represents the *transitional start-ups*. These firms started as technical consultants without a concrete product idea. Typically, transitional start-ups started as one or two-person companies. The entrepreneurs have a lot of experience in a particular domain and founded the firm to commercialize their expertise. These companies are selected in our sample because later on they evolved into a product-oriented company. However, at start, most of these companies are focused upon the service aspect. Transitional start-ups are started with small amounts of money and without venture capital and have high debt ratio during the first year.

The cluster analysis renders four different types of starting configurations among RBSUs. The first category, the VC-backed RBSUs are described extensively in the finance literature (Manigart et al., 2002; Hellmann & Puri, 2000a). Whereas this literature takes the fact that VC-backed firms are a different category of companies as a point of departure, we find indeed that these companies also differ in terms of human and technical resources. Our analysis indicates that venture capital financing is related to broad and innovative technologies and larger founding teams with more management experience. VC-backed firms are also more likely to attract experienced managers during the first year. The finance literature tends to treat the non-VC backed RBSUs as a homogeneous category. However, our analysis shows that the non-VC backed category is much more heterogeneous. We found three types of RBSUs that start without venture capital and also differ significantly in their other resources. We labeled these three types as the prospectors, the product start-ups and the transitional starters.

The transitional start-ups tend to be founded by entrepreneurs who commercialize their technical knowledge or skills rather than a proprietary technology. The founding characteristics of these start-ups correspond to those of the “life-style” oriented SMEs, the traditional SME and the family-owned SME described by other researchers (Birley & Westhead, 1994). This group of start-ups seems to grow very slowly over time or do not grow at all (Roberts, 1991; Autio & Yli-Renko, 1998). Maintaining ownership and creating income for the founder and its family are more important than growth for most of these companies (Lumpkin & Dess, 1996). Several researchers report that the technical consultants comprise the majority of high tech start-ups, spin-outs or new technology based firms. Roberts (1991, pp. 166 – 170) points out that a large number of the technical consultant start-ups get stuck in their consulting mode and never evolve into a company with tangible products. We only selected the technical consultants that made the transition to a product-oriented company over the first 5 to 11 years of their life cycle. However, these transitional start-ups remain the

largest group in our sample (33%), which indicates that the technical consultancy business model is a prevalent starting resource configuration for RBSUs.

The prospectors and product start-ups can be seen as two hybrid types of starting resource configurations. The idea of a "hybrid" type of firm showing characteristics of VC-backed and technical consultants was first launched by Tiler et al. (1993) and later on confirmed by Clarysse et al. (2001) and Degroof (2002) in a study of academic spin-offs. These studies observed a category of start-ups that did not grow in the first years, but started to growth later on. They also mentioned that although these companies did not show growth in the first years, they were started with a specific aim to grow later on. In this study we find two hybrid types of firms based on their starting resources. The starting configuration of the product start-ups is very similar to the one of transitional starters in terms of human, and financial resources but they differ considerably in their technical resources. Product start-ups have a close to market product, which they either commercialize in a small niche or use as a back office tool for customized consulting services. The second hybrid group is the prospector group. As the typical VC-backed RBSU, prospectors start with a product in a very early development stage. However, the qualitative insights from the interviews teach us that prospectors have a less clear idea about the market they want to address than VC-backed start-ups. At founding the base technology of prospectors is less clear and, as a group, prospectors seem to be involved with less broad and less innovative technologies. As a result prospectors do not (or are unable to) raise venture capital and start on a smaller scale than VC-backed companies. They have, however, the intention to fasten their growth later on.

KEY CONTINGENCIES OF STARTING RESOURCE CONFIGURATIONS

Heterogeneity in technological domain

To test the association between the variation in technological segment and resource configurations, we perform chi-square tests (See Table 6).

Insert Table 6 About Here

Overall, we find that technological segments do not differ significantly between clusters for software (p=0.183), telecom (p=0.722), and other domains (p=0.661). Only among the transitional start-ups we observe 3.9 times more software start-ups than would be expected. One explanation for this might be that in the early- and mid-nineties large companies started to outsource their IT departments. As a result, a number of start-ups were created which provided services to these large firms. Firms active in medical-related technologies do differ significantly between clusters (p=0.006). These companies are less represented in the transitional starters and more in the product start-ups. However, the number of medical related companies in our sample is too low (13%) to draw strong conclusions based on these statistics.

Heterogeneity in organizational origin

To test the link between organizational origin, i.e. academic or corporate spin-out or independent start-up, and starting resource configuration, we calculate Pearson Chi-square statistics (See Table 7). We find that academic spin-offs are significantly more represented in the clusters of the VC-backed start-ups, prospectors and product start-ups.

Insert Table 7 About Here

The number of corporate spin-offs, on the other hand, is significantly higher among the group of transitional starters. Hence, our data indicate that the organizational origin differs significantly between different types of starting resource configurations. Employees that work in a large corporation are more likely to start up as technical consulting firm, which may make the transition to product-oriented companies later on. This might be partly explained by the fact that in the early and mid-nineties, corporate venturing in Flanders was not known at all. Instead, corporate spin-offs most often resulted from restructuring or outsourcing activities. Most of the corporate spin-offs are based on personal technical skills or know-how of the entrepreneur(s). Academic spin-offs on the other hand are more often based on a (patented) technology developed at the university, which is mostly formally transferred to the start-up. Hence, academic spin-outs mostly have a strong and proprietary technical base, which makes them interesting investment opportunities for venture capitalists. The prevalence of academic spin-outs among the hybrid prospectors is also noteworthy. In the early and mid-nineties the

technology transfer offices in the Flemish universities did not offer extensive support to finance, structure and professionalize its spin-out companies. As a result many academic spin-outs in this period started as prospectors, i.e. firms that start with limited amounts of financing and with an early stage technology for which the product market was not clear at founding but which have the specific intention to become a high growth company later on.

Heterogeneity in industry characteristics

To study the heterogeneity in industry characteristics among different starting configurations, we used the Kruskal-Wallis statistic (see Table 8).

Insert Table 8 About Here

We found that the complexity of the value chain differs significantly between clusters ($p=0.002$). More specifically, we found that VC-backed start-ups face a significantly more complex value chain than the other three groups. One explanation may be that due to a complex value chain these firms need more resources to bridge the gap between product development and market sales. Alternatively, it might be that more complex value chains are associated with more ambitious projects with potential higher returns (and higher risk), which are more attractive to risk capital investors.

Next, we find no significant differences in the complexity of the buying center between the four clusters ($p=0.237$). Although not significant, we observe that VC-backed start-ups face a more complex sales process than the three other groups of firms. They mostly sell complex and expensive products/ services in a business-to-business context and have to deal with multiple decision makers inside the customer organization.

Estimated market size and geographic scope at start-up differ significantly among the four clusters ($p<0.001$ for both). Especially the difference between VC-backed and product start-ups is noteworthy. Product start-ups tend to start in a specific small niche market, which is usually global or at least European. VC-backed start-ups on the other hand tend to target mainstream markets of a much larger size and are international from the start. This confirms that large and international markets are attractive to investors or alternatively that start-ups need sufficient financial resources in order to penetrate a large and international market. The transitional start-ups target a small and local market.

Heterogeneity in entrepreneurial orientation

Finally, we tested the difference of the entrepreneurial orientation between the different clusters. Firstly, we use our self-scored dummy, which indicates the main motivation to found the company. The Pearson Chi-square statistic shows that clusters differ significantly in their main motivation ($p<0.001$). Not surprisingly, the entrepreneurs that started a company mainly because they had recognized a concrete opportunity were most prevalent among the VC-backed start-ups. In line with this, we find significantly more self-employment driven entrepreneurs among the transitional starters. Next, we use the founder-coded scales for the importance of self-employment (autonomy) and anticipation of a concrete opportunity (proactiveness) to start the firm (KW-tests see Table 9).

Insert Table 9 About Here

The clusters do not differ significantly in the importance of self-employment to start the firm ($p=0.312$). Clearly, being independent is a main driver for almost every entrepreneur irrespective of the type of firm he starts. The importance of the recognition of a concrete opportunity as a main driver to start the firm does differ significantly among the clusters ($p=0.004$). More specifically, we found that VC-backed start-ups score significantly higher on the proactiveness scale than the other groups and transitional start-ups score significantly lower.

CONCLUSIONS, LIMITATIONS AND RESEARCH DIRECTIONS

Conclusions. In this study, we present a resource-based typology of RBSUs. Typologies are useful tools because they sharpen our analytical thinking and label variation and they are a way to meaningfully capture the complexity of organizational reality. Most prior research on RBSUs does not control for possible interaction effects between different types of resources in studying the link between resources and firm performance. Conner (1991) argues, however, that the return to a resource is dependent on its relationship to other resources held by the firm so that, if a resource is more specialized to other resources, it may

yield higher returns. Hence, without a deep understanding about resource typologies, it is difficult to draw meaningful conclusions and recommendations from research on RBSUs.

In this paper, we study the financial, technical and human resources of RBSUs. Our cluster analysis indicates that based on these resources, we can distinguish four types of RBSUs. We labeled these different types of starting resource configurations as “VC-backed start-ups”, “prospectors”, “product start-ups”, and “transitional start-ups”. These different types of starting resource configurations are empirically distinct and conceptually comprehensible. Hence, this study shows that there is no such thing as the typical RBSU. Rather, there are different types of RBSUs with different starting resource configurations. We found that raising venture capital goes hand in hand with a broad and innovative technology and larger founding teams with more management experience. VC-backed start-ups are also more likely to attract experienced managers during the first year. This in contrast to the prospector companies, which lack a broad innovative and proprietary technology in which VCs tend to be interested. Without a strong technical base, no external capital can be collected although their business model might imply the need for such capital. They are also not able to attract experienced management. This indicates that more of one type of resources leads to more of another and vice versa.

Thirty-three percent of the companies that today bring an innovative product on the market, never intended to do so at start-up. We called them “transitional starters”. These firms changed their business model from a purely consulting to a product oriented one. It would be interesting to analyze which factors have lead to a change in business model and whether this change has lead to successful performance. Our qualitative data shows that the venture capital society, which was mushrooming in the mid-nineties, played an important role. This suggests that availability of capital conducts strategy.

We also found that more of one resource does not necessarily lead to more of another. For instance, start-ups with a concrete market-ready product are typically founded by experienced entrepreneurs, who choose to finance their working capital with debts rather than venture capital. The desired amount of capital needed seems to be much less than among the VC-backed. This means that the relationships between different types of resources go beyond a simple correlation metric. Not only leads more of one to more of another type, but also a different composition of one type of resources is linked to a different composition of the other. We think that the insights in starting resources and our typology are a first step towards a better understanding starting resources and the relationships between them.

We also found that starting resources are systematically related to non-resource factors. More specifically, we found that the starting resource configurations are linked to the firms' history in terms of the parent institute that spun off the firm. The emergence of pro-active technology transfer policies at universities is reflected in the prevalence of academic spin-outs among the prospectors (Clarysse et al., 2003). Also, spin-outs from corporations have significantly different starting configurations as their academic equivalents. Previous research has looked at the effect of institutional structures and policies on the patenting and licensing of research organizations and laboratories, however the institutional imprinting of a parent institute on the venturing process and its starting configuration has largely remained an unexplored theme.

Next to the institutional link, also heterogeneity in the characteristics of the industry that the firm targets at start-up is linked to different starting resource configurations. This finding contributes to the ongoing debate in strategic management literature on this interplay. The study confirms the findings in the VC literature that VCs tend to invest in start-ups, which target mainstream, international markets of a significant size. VCs also take risks. They invest in companies that face a very complex sales process and an interrelated value chain. Product start-ups also target an international or at least European market, but in a specific niche. Our data show that these companies start without venture capital either because VCs do not want to invest in these companies or because they simply do not look for external capital. Finally, transitional starters target a very local market. There is thus ample evidence that there exists at least an interaction between the characteristics of the targeted market and the starting configuration.

Limitations. The study has several limitations. Firstly, we have a limited population of 76 useful responses. Therefore, a more complex analysis such as a logistic multinomial regression is not possible. This kind of analysis should allow us to test the predictive power of the different explanatory variables simultaneously. Hence, the results reported in this paper remain first indications, which should be tested in larger samples in the future. Secondly, our study only contains data on Flemish RBSUs. We deliberately choose a small geographic coverage in order to reduce the influence of non-measured variance in our study. The trade-off, however, is that one might question the external validity of this region and our findings. Future research in other regions is needed to test the existence and prevalence of the different starting resource configurations. However, we think that the Flemish region is very comparable to most emerging and developing high tech regions. Therefore, we believe that the external validity of this study is probably higher than studies focusing on highly developed

and unique high tech environments such as Silicon Valley and Boston. A third limitation is that our study relies on retrospective data. Several scholars argue that such data can impose bias because the respondents' lack of trust-worthiness especially when the time lags between date of interview and the questioned period increases. This type of bias is one of the most difficult to overcome in entrepreneurship research. However, to reduce such problems, we crosschecked the information obtained from the founder(s) as much as possible with publicly available data (websites, company brochures, business plans, and database of the national bank of Belgium). Next, most of the founder-scored data are factual. The more qualitative, subjective measures (e.g. innovativeness) are rated by the researchers, which use the other firms in the sample as a frame of reference. Finally, we try to deal with survival bias by including survivors as well as dissolved firms in the sample and by studying firms that are between 5 and 11 years old, which is a much earlier stage than do most other databases.

Research directions. This study is a first step in a better understanding of how and why firms differ in their starting resources. Future research should study the validity of the four types of starting resource configurations in different regional environments and in larger samples. Next, future research should address the path dependencies of the RBV (David, 1985; Arthur, 1988). Stinchcombe (1965), Van de Ven et al. (1984) and others argue that the early development of organizations has profound influence on what they subsequently become. Hence, an interesting direction for future research would be to explore how these different types of firms evolve during their early growth path. The ultimate test of the proposed taxonomy will be to test its accuracy in the prediction of growth, evolution of resources and performance of firms. Finally, strategy scholars argue that the return of a resource is likely to be dependent on the environment, and the fit between the resource, environment and strategy. Future research should explore this relationship in more detail.

REFERENCES

Aldrich, H. & Fiol, M. (1994). Fools rush in? The institutional context of industry creation. Academy of Management Review, 19 (4), pp. 645 – 670.

Amit, R. & Zott, C. (2001). Value creation in e-business. Strategic Management Journal, 22, (6/7), pp. 493 – 520.

Arthur, W.B. (1988). Competing technologies: an overview. In: Dosi, G. et al. Technical Change and Economic Theory. NY, Columbia University Press, pp. 509 – 607.

Autio, E. & Yli-Renko, H. (1998). New, technology-based firms in small open economies – An analysis based on the Finnish experience. Research Policy, 26, pp. 973 – 987.

Barney, J.B. (1991). Firm Resources and Sustained Competitive Advantage. Journal of Management, 17, (1), pp. 99 – 120.

Barney, J. B., Wright, M. & Ketchen, D.J., Jr. (2001). The Resource-Based View of the Firm: Ten Years after 1991. Journal of Management, in print.

Birley, S. & Westhead, P. (1994). A Taxonomy of Business Start-Up Reasons and their Impact on Firm Growth and Size. Journal of Business Venturing, 9, pp, 7 – 31.

Brush, C.G., Greene, P.G. & Hart, M.M. (2001). From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. Academy of Management Executive, 15 (1), pp. 64 – 78.

Burton, D.M. (1996). The Emergence and Evolution of Employment Systems in High Technology Firms. Doctoral Dissertation, Stanford University.

Burton, M.D., Sorensen, J.B. & Beckman, C.M. (2002). Coming from Good Stock: Career Histories and New Venture Formation. Social Structure and Organizations Revisited, 19, pp. 229 – 262.

Cantwell, J. & Iammarino, S. (2001). EU Regions and Multinational Corporations: Change, Stability and Strengthening of Technological Comparative Advantages. Industrial and Corporate Change, 10, (4), pp. 1007 – 1037.

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. & Hanks, S.H. (1998). An Examination of the Substitutability of Founders Human and Financial Capital in Emerging Business Ventures. Journal of Business Venturing, 13, pp. 353 – 369.

Christensen, C.M. (1997). The Innovator's Dilemma. HarperBusiness, NY, 286 p.

Clarysse, B. (1996). From Research Collaboration to Product Commercialization. A Study of Power and Efficiency Along the Biotech Life Cycle. Doctoral dissertation, Ghent University. p. 306.

Clarysse, B., Heirman, A. & Degroof, JJ. (2001). "Het fenomeen spin-off in België", VTO studies, 21. ISBN 806488.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E. & Vohora, A. (2003) Forthcoming, Journal of Business Venturing.

Collis, D. (1991). A Resource-Based Analysis of Global Competition: The Case of the Bearings Industry. Strategic Management Journal, 12, pp. 49 – 68.

Conner, K.R. (1991). A Historical Comparison of Resource-Based Theory and Five Schools of Thought within Industrial Organization Economics. Journal of Management, 17, pp. 121 – 154.

David, P.A. (1985). Clio and the Economics of QWERTY. American Economic Review, Vol. 75, No 2, pp. 332 – 337.

Deeds, D.L., DeCarolis, D., Coombs, J. (1999). Dynamic Capabilities and New Product Development in High Technology Ventures: An Empirical Analysis of New Biotechnology Firms. Journal of Business Venturing, 15, p. 211 – 229.

Degroof, JJ. (2002). Spinning Off New Ventures from Research Institutions Outside Developed High Tech Entrepreneurial Clusters. Doctoral Dissertation, MIT Sloan School of Management, 2002.

DSTI 1997/2. Hatzichronoglou T. (1997). Revision of the High-Technology Sector and Product Classification.OECD/GD(97)216. Working Document.

Eisenhardt, K. & Trabrizi, B.N. (1995). Accelerating adaptive processes: Product innovation in the global computer industry. Administrative Science Quarterly, 40, pp. 84 – 110.

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.

Galbraith, C. & Schendel, D. (1983). An Empirical Analysis of Strategy Types. Strategic Management Journal, 4, pp. 153 – 173.

Hair, J.F., Jr., Anderson, R.E., Tatham, R.L., & Black, W.C. (1992). Multivariate Data Analysis with Readings, 3rd ed. New York: MacMillan.

Hambrick, D.C. (1983). An empirical typology of mature industrial-product environments. Academy of Management Journal, 26, (2), pp. 213 – 220.

Hatten, K.J. & Schendel, D.E. (1977). Heterogeneity within an Industry: Firm Conduct in the U.S. Brewing Industry, 1952 –71. Journal of Industrial Economics, 26, pp. 97 – 113.

Hellmann, T. & Puri, M. (2000a). The Interaction Between Product Market and Financing Stratey: The Role of Venture Capital. The Review of Financial Studies, 13 (4), pp. 959 – 984.

Hellman, T. & Puri, M. (2000b). Venture Capital and the Professionalization of Start-up Firms: Empirical Evidence. Working Paper Stanford University, 44 p.

Henderson, R. (1993). Underinvestment and incompetence as responses to radical innovation: evidence from the photolithographic alignment equipment industry. RAND Journal of Economics, Vol. 24, No. 2, pp. 248 – 270.

Hofer and Sandberg (1987). Improving new venture performance: the role of strategy, industry structure and the entrepreneur, Journal of Business Venturing, 2(1), p. 5-28.

Kazanjian, R.K. & Drazin, R. (1990). A Stage-Contingent Model of Design and Growth for Technology-Based New Ventures. Journal of Business Venturing, 5, pp. 137 – 150.

Ketchen, D. & Shook, C.L. (1996). The application of cluster analysis in strategic management research: an analysis and critique. Strategic Management Journal, 17, pp. 441 – 458.

Ketchen, D.J., Combs, J.G., Russell, C.J. et al. (1997). Organizational Configurations and Performance: A Meta-Analysis. Academy of Management Journal, 40 (1), pp. 223 – 240.

Lee, C., Lee, K. & Pennings, J.M. (2001). Internal Capabilities, external networks, and performance: A study of technology-based ventures. Strategic Management Journal, 22, pp. 615 – 640.

Lewin, E.E. & Bello, D.C. (1997). Marketing innovative technology to institutional buyers in eductational settings. The Journal of Business & Industrial Marketing, 12 (1), pp. 7 – 21.

Loftus, B.S. & Meyers, P.W. (1994). Launching emerging technologies to create new markets: Identifying industrial buyers. Logistics Information Management, 7 (4), pp. 27 – 41.

Lumpkin, G.T. & Dess, G.G. (1996). Clarifying the Entrepreneurial Orientation Construct and Linking it to Performance. Academy of Management Review, 21 (1), pp. 135 – 172.

MacMillan, I.C., Siegel, R. & Narasimha, P.N.S. (1985). Criteria used by venture capitalists to evaluate new venture proposals. Journal of Business Venturing, 1, pp. 119 – 128.

Manigart, S., Bayens, K. & Van Hyfte, W. (2002). The Survival of Venture Capital Backed Companies. Venture Capital, 4 (2), pp. 103 – 124.

Meyer, A.D., Tsui, A.S., & Hinings, C.R. (1993). Configurational Approaches to Organizational Analysis. Academy of Management Journal, 36, pp. 1175 – 1195.

Meyers, P.W. & Athaide, G.A. (1991). Strategic Mutual Learning between Producing and Buying Firms During Product Innovation. Journal of Product Innovation Management. 8, pp, 155 – 169.

Meyer, M.H., Tertzakian, P. & Utterback, J.M. (1997). Metrics for Managing Research and Development in the Context of the Product Family. Management Science, 43, (1), pp. 88 – 111.

Miles, R.E. & Snow, C.C. (1978). Organizational Strategy, Structure, and Process. New-York: McGraw-Hill.

Miller, D. & Friesen, P. (1980). Archetypes of Organizational Transition. Administrative Science Quarterly, 25, pp. 268 – 299.

Miller, D. & Mintzberg, H. (1984). The Case for Configuration. In D. Miller & P.H. Friesen (Eds.), Organizations: A Quantum View: pp. 125 – 170. Englewood Cliffs, NJ. Prentice-Hall.

Mosakowski, E. (1993). A resource-based perspective on the dynamic strategy performance relationship: An empirical examination. Journal of Management, 19, (4), pp. 819 – 839.

Oviatt, B.M. & McDougall, P.P. (1994). Toward a Theory of International New Ventures. Journal of International Business Studies, First Quarter 1994, pp. 45 – 64.

Priem, R.L. & Butler, J. E. (2001). Is the Resource-Based “View’ a Useful Perspective for Strategic Management Research? Academy of Management Review, 26, (1), pp. 22 – 40.

Quinn, R.E. & Cameron, K. (1983). Organizational Life Cycles and Shifting Criteria of Effectiveness: Some Preliminary Evidence. Management Science, 29, (1), pp. 33 – 51.

Rickne, A. (2000). New Technology-Based Firms and Industrial Dynamics. Evidence from the Technological System of Biomaterials in Sweden, Ohio and Massachusetts. Doctoral dissertation thesis. Chalmers University of Technology, Göteborg, Sweden, ISBN 91-7197-975-1, 340 p.

Roberts, E.B. (1991). Entrepreneurs in high technology. Lessons from MIT and beyond. Oxford University Press, New York.

Schoonhoven, C.B., Eisenhardt, K.M. & Lyman, K. (1990). Speeding Products to Market: Waiting Time to First Product Introduction in New Firms. Administrative Science Quarterly, 35, pp. 177 – 207.

Schumpeter, J. (1934). The Theory of Economic Development. Harvard University Press, Cambridge, MA.

Shane, S. (2001). Technological Opportunities and New Firm Creation. Management Science, 47, 2, pp. 205 – 220.

Shane, S. & Stuart, T. (2002). Organizational Endowments and the Performance of University Start-Ups. Management Science, 48, 1, pp. 154 – 170.

Stinchcombe, A.L. (1965). Social Structure and organizations. In J.G. March (Ed.) Handbook of organizations: pp. 142 – 194. Chicago: Rand-McNally&Co.

Stuart, T.E., Hoang, H. & Hybels, R.C. (1999). Interorganizational Endorsements and the Performance of Entrepreneurial Ventures. Administrative Science Quarterly, 44, pp. 315 – 349.

Teece, D.J., Pisano, G. & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. Strategic Management Journal, 18 (7), pp. 509 – 533.

Tiler, C., Metcalfe, S. & Connell, D. (1993). Business Expansion through Entrepreneurship: the influence of internal and external barriers to growth. In: Dodgson, M. and Rothwell, R. (eds.). International Journal of Technology Management, Special Publication on Small Firms and Innovation, pp. 119 – 132.

Utterback, J.M., Meyer, M., Roberts, E. & Reitberger, G. (1988). Technology and Industrial Innovation in Sweden: A Study of Technology-Based Firms formed between 1965 and 1980. Research Policy, 17, pp. 15 – 26.

Utterback, J.M. & Reitberger, G. (1982). Technology and industrial innovation in Sweden: A study of new technology-based firms, Stockholm, report submitted to STU.

Utterback, J.M. & Suárez, F.F. (1993). Innovation, Competition and Industry Structure. Research Policy, 22, pp. 1 – 21.

Van de Ven, A.H., Hudson, R. & Schroder, D.M. (1984). Designing new business start-up's entrepreneurial, organizational, and ecological considerations. Journal of Management, 10, pp. 87 – 107.

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

Yoffie, D.B. & Cusumano, M.A. (1999). Building a Company on Internet Time: Lessons from Netscape. California Management Review, 41, 3, pp. 8 – 28.

Zahra, S.A. (1996). Technology Strategy and New Venture Performance: A Study of Corporate-Sponsored and Independent Biotechnology Ventures. Journal of Business Venturing, 11, pp. 289 – 321.

FIGURE 1

Type of Sample [a]

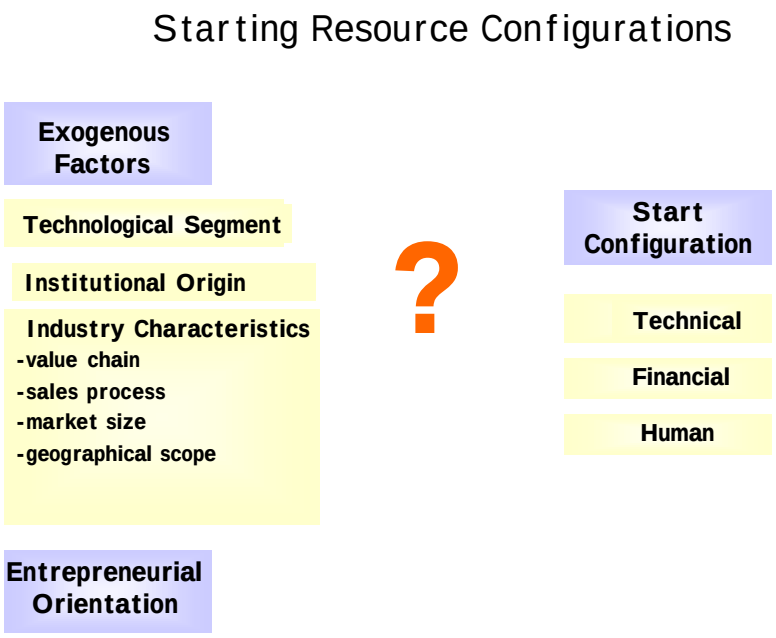

TABLE 1

Starting resource variables used to derive a resource-based taxonomy of RBSUs

Category	Description	Interpretation
Technology	Stage of development of core product (StageNPD)	Ranging from no α-prototype, over α-prototype, β-prototype to a market-ready product at founding (Scaled 0 – 3)
	Scope of product/ technology	Dummy: 1 indicating that the firm develops a platform serving as the base for several products; 0 otherwise
	Innovativeness	Dummy: 1 indicating that firm creates mainly new, proprietary knowledge (innovator); 0 firm rather uses existing knowledge and focuses on minor improvements to it or synthesizes several existing technologies (imitator)
Financial	Capital	Amount (Euro); For the cluster analysis the original capital variable is rescaled into 7 financial classes: <1k; 1k – 10k; 10k – 50k; 50k – 100k; 100k – 250k; 250k – 500k; and > 500k
	Debt Ratio	Ratio between loans plus other debts and capital (Log Amounts in Euro)
	VC	Dummy: 1 indicating that the firm raised capital from institutional risk capital investors during the first year; 0 otherwise
Human	Team size	Number of founders
	Management experience	Highest level of management experience of one of the founders ranging from low (less than 3 years); over medium (3 to 6 years) to high (more than 6 years) (Scaled 1 – 3)
	Sector experience	Highest level of sector experience of one of the founders ranging from low (less than 3 years); over medium (3 to 6 years) to high (more than 6 years) (Scaled 1 – 3)
	Hired Guns	Dummy: 1 indicating that professional managers with more than 10 years of experience were hired during the first year; 0 otherwise

TABLE 2

Descriptive Statistics for the Resource Variables

Variables	N	Mean	Median	Minimum	Maximum	SD
Technology						
1. Stage NPD	80	1.062	1	0	3	1.173
2. Scope	79	0.190	0	0	1	0.395
3. Innovativeness	79	0.367	0	0	1	0.485
Financial						
4a. Capital	79	358 328	51 973	100	6 000 000	1 012 899
4b. Financial Class	80	3.95	4	1	7	1.713
5. Debt ratio	79	1.678	1.775	0	2.739	0.622
6. VC dummy	80	0.150	0	0	1	0.359
Human						
7. TeamSize	80	2.200	2	0	7	1.436
8. SectorExp	77	1.948	2	1	3	0.944
9. ManagExp	77	1.416	1	1	3	0.767
10. Hired Guns	80	0.088	0	0	1	0.284

TABLE 3

Variables measuring key contingencies and entrepreneurial orientation

Category	Description	Interpretation
Technological Domain	Technological segment in which the firm is active	Following the International Patent Classification System and aggregating firms into 4 main classes: Software, Telecom, Medical-related and Others*
Organizational Origin	Academic Spin-off, Corporate Spin-off or Independent Start-Up	Three dummies with 1 indicating that the firm is an academic or corporate spin-off of independent start-up; 0 otherwise
Industry Characteristics	Complexity of value chain	The firms dependence on other players to develop complementary products or services so that the focal firm's product or service has value for the end customer (Scaled –1 to +2; with -1 = munificent value chain; 0 = all technology and complementary assets are available in house or can be built up at a relative low cost; +1 = the company does not have all technology or complementary assets to bring a product to the market but its negotiation strength is equal to that of the other parties; +2 = the company needs to deal with several large and complicated parties such as large organizations or government firms in order to further develop and commercialize its technology)
	Complexity of buying center	Complexity of selling process to the firm's direct customer taking into account the number of decision makers and the difficulty of locating and accessing them; scored as easy, moderate and difficult (Scaled 0 – 2, with 0 = one decision maker, whom the focal firm can easily approach. +1 = different decision makers but they are rather easy to locate and approach; +2: different decision makers which are difficult to identify (e.g. because the customers organization is very complex) or approach (e.g. at a high hierarchical level or located in corporate headquarters abroad)
	Market Size	Size of the targeted market at founding ranging from niche, over temporary niche with specific intention to penetrate larger market later on, to large market (Scaled 1 – 3)
	Geographic Scope	Geographic coverage of market ranging from local focus, over European/ international to worldwide/global (Scaled 1 – 3)

Entrepreneurial Orientation	Autonomy	Importance of being self-employed (urge for autonomy) in the decision to start this company (Scaled 1 – 5, with 1 = not important at all and 5 = very important)
	Proactiveness	Importance of the anticipation of a concrete new opportunity in the decision to start this firm (Scaled 1 – 5, with 1 = not important at all and 5 = very important)
	Main motivation for starting the company	Dummy: 0 indicating that self-employment related arguments (i.e. loss of job, willingness to work independently…) were the most important reason; 1 if recognition of a concrete opportunity was more important to start the company

* A detailed description of the classification procedure can be obtained from the first author upon request.

TABLE 4

Descriptive statistics for key contingency variables and entrepreneurial orientation

Variables	N	Mean	Median	Minimum	Maximum	SD
Technology Domain						
Software	80	0.488	0	0	1	0.503
Telecom	80	0.150	0	0	1	0.359
Medical related	80	0.125	0	0	1	0.333
Other	80	0.238	0	0	1	0.428
Organizational Origin						
Academic Spin-Out	80	0.313	0	0	1	0.466
Corporate Spin-Out	80	0.313	0	0	1	0.466
Independent Start-Up	80	0.375	0	0	1	0.487
Industry Characteristics						
Value Chain	79	0.380	0	-1	2	0.756
Buying Center	79	1.013	1	0	2	0.810
Market Size	79	1.557	1	1	3	0.780
Geographic Scope	79	1.873	2	1	3	0.774
Entrepreneurial Orientation						
Autonomy	53	3.660	4	1	5	1.255
Proactiveness	53	3.755	4	1	5	1.191
Main Motivation dummy	80	0.466	0	0	1	0.502

TABLE 5

Profile of Starting Resource Clusters (Means and Standard Deviations): Results of Cluster Analysis

Dimension	VC-backed start-ups	Prospectors	Product start-ups	Transitional start-ups	F (sig.)
Technology					
Stage NPD	0.714	0.733	2.667	0.345	40.398****
	(0.914)	(0.961)	(0.594)	(0.553)	(<0.001)
Scope	0.500	0.067	0.278	0.069	5.167***
	(0.519)	(0.258)	(0.461)	(0.258)	(0.002)
Innovativeness	0.786	0.200	0.444	0.172	7.320****
	(0.426)	(0.414)	(0.511)	(0.384)	(<0.001)
Financial					
Financial class	6.714	3.133	4.111	2.862	53.689****
	(0.469)	(1.061)	(1.231)	(0.915)	(<0.001)
Debt ratio	1.284	1.577	1.614	1.918	3.809**
	(0.570)	(0.675)	(0.561)	(0.585)	(0.014)
VC dummy	0.786	0.000	0.056	0.000	49.457****
	(0.426)	(0.000)	(0.236)	(0.000)	(<0.001)
Human					
Team Size	3.143	3.867	1.556	1.379	27.495****
	(1.791)	(0.915)	(0.784)	(0.494)	(<0.001)
Sector Exp	1.571	1.533	2.278	2.138	3.016**
	(0.937)	(0.743)	(0.958)	(0.953)	(0.035)
Management	2.000	1.133	1.222	1.414	4.212***
Exp	(1.038)	(0.516)	(0.548)	(0.733)	(0.008)
Hired Guns	0.357	0.000	0.111	0.000	6.554****
	(0.497)	(0.000)	(0.323)	(0.000)	(0.001)
Cluster Size	14	15	18	29	76

Levels of significance: ** = .05 ; *** = .01 ; **** = .001

TABLE 6

Heterogeneity in technological domain in the different clusters: Observed minus expected frequencies and Pearson Chi-square test of significance

Technological domain	VC-backed start-ups	Prospectors	Product start-ups	Transitional start-ups	Pearson Chi-square (sig)
Software	-1.816	0.697	-2.763	3.882	4.850 (0.183)
Telecom	0.789	-1.368	0.158	0.421	1.330 (0.722)
Medical related	0.342	-0.776	3.868	-3.434	12.324*** (0.006)
Other	0.684	1.447	-1.263	-0.868	1.592 (0.661)

Levels of significance: ** = .05 ; *** = .01 ; **** = .001

TABLE 7

Heterogeneity in organizational origin in the different clusters: Observed minus expected frequencies and Pearson Chi-square test of significance

Origin	VC-backed start-ups	Prospectors	Product start-ups	Transitional start-ups	Pearson Chi-square (sig)
Academic spin-out	2.579	1.263	2.579	-6.157	10.128** (0.018)
Independent start-up	0.947	-0.342	-1.21	0.605	0.807 (0.847)
Corporate spin-out	-3.52	-0.921	-1.105	5.552	8.689** (0.033)

Levels of significance: ** = .05 ; *** = .01 ; **** = .001

TABLE 8

Means and standard deviations for the business environment variables in each cluster and the Kruskal-Wallis test of significance

Variables	VC-backed start-ups	Prospectors	Product start-ups	Transitional start-ups	Kruskal-Wallis (sig)
Value Chain	1.07 (0.497)	0.20 (0.774)	0.17 (0.514)	0.27 (0.648)	15.321*** (0.002)
Buying Center	1.42 (0.646)	0.80 (0.774)	1.05 (0.872)	1.10 (0.859)	4.241 (0.237)
Market Size	2.29 (0.726)	1.33 (0.617)	1.38 (0.777)	1.38 (0.676)	17.300**** (<0.001)
Geographic Scope	2.64 (0.497)	1.80 (0.774)	1.94 (0.725)	1.52 (0.687)	19.677 **** (<0.001)

Levels of significance: ** = .05 ; *** = .01 ; **** = .001

TABLE 9

Means and standard deviations for two measures of the entrepreneurial orientation at start-up – autonomy and proactiveness – in each cluster and the Kruskal-Wallis test of significance

Variables	VC-backed start-ups	Prospectors	Product start-ups	Transitional start-ups	Kruskal-Wallis (sig)
Autonomy	3.64 (1.03)	3.15 (1.28)	3.75 (1.35)	3.94 (1.34)	3.569 (0.312)
Proactiveness	4.09 (0.83)	4.54 (0.87)	3.67 (1.07)	2.94 (1.34)	13.466*** (0.004)

Levels of significance: ** = .05 ; *** = .01 ; **** = .001