Bound for Glory or Cursed for Life? Exploring the Impact of Initial Resources on the Venture Emergence of New Technology-based Firms

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Bound for Glory or Cursed for Life? Exploring the Impact of Initial Resources on the Venture Emergence of New Technology-based Firms.

Abstract:

When studying technology-based entrepreneurial activity, researchers have found it challenging to make visible the relationship between the new venture emergence and their initial resource combinations. We propose a revision of the value of resources for new tech-based ventures to clarify the contradictory findings in prior research.

We adopt a mixed-method approach. We use the cases of 21 tech-entrepreneurs to build propositions on what factors (resources) play a role in new venture emergence. To validate our findings, we use a longitudinal dataset of 400 new technology-based firms.

The results show that resources’ influence goes beyond short-term direct impact on firm’s performance. We observe that technology and market resources have distinct influence. Interestingly, combination of such resources introduces significant, and positive, effects in the long run. The results are discussed considering insights from marketing and human capital theory to provide an explanation on the venture emergence of new technology-based firms.

Keywords: Technology Entrepreneurship, Venture Emergence, Technology Resources, Panel Data Set

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1. Introduction

The disruptive potential of new technologies in the hands of entrepreneurs attracts investors and governments alike (Lerner 2010). Technology-based firms are seen as a reliable contributor to the economic growth and innovation drivers, their role has been described as being the "spur" than helps to ignite the technology innovation in industries and regions alike (Lerner 2010). Nevertheless, there are little evidences to support that technological progress is quickly or smoothly transferred to the market by entrepreneurs (Schoonhoven et al. 1990; Brown & Mason 2014).

New technology-based ventures are seen to face a situation where they have to deal with both technology and entrepreneurship development challenges (Hsu 2008; Brem & Borchardt 2014). As a result it is often observed that promising new ventures that rely on a highly novel technology fail to exploit their opportunity, unable to move beyond the initial search for a valuable application or use of their product or service (Choi et al. 2008).

The theoretical expectations from the resource-based view (RBV) would propose that resources of the new firm explain their ability to establish a competitive advantage (Barney 1991; Wernerfelt 1995). The assumption that the competitive capacity of the new firm is a consequence of their resources does not seem to fully explain the performance of new technology-based firms - NTBFs (Newbert et al. 2008; Klyver & Schenkel 2013; Bhawe et al. 2016). Scholars have suggested that the reasons why we do not observe such relationship might be that we are missing the indirect effects of some resources, for example undervaluing the signaling effect of some resources (Bjornali et al. 2017; Connelly et al. 2011); not paying attention to the time-effects of resources, the value of the resource might be related to a specific challenge in a moment in time of the new venture evolution (Bhawe et al. 2016); or neglecting that the new venture’s market heterogeneity might be affecting such effects (Ye et al. 2011; Priem et al. 2011).

As a result, we propose to revise the effect of resources in the venture emergence process of new technology-based firms, aiming to address such research gaps. We use a mixed-method approach (Venkatesh et al. 2013) to combine both exploratory and confirmatory questions, gathering empirical evidences through a set of cases that guide theoretically-grounded hypotheses. These hypotheses are then tested using a longitudinal panel of new technology-based firms.
The article is structured as follows: first, we cover the initial theoretical background; then we describe the overall research design and the initial exploratory work. Next, we review and extend the initial theoretical framework. Finally, we describe the research design and hypotheses test using a longitudinal dataset. The overall results are discussed, identifying implications for theory and practice of technology entrepreneurship.

2. Theoretical background

Scholars identify that technology entrepreneurship opportunities come from advances in science and engineering (Beckman et al. 2012), and are linked to the technological knowledge and skills of the founder (Clarysse, Bruneel, et al. 2011). The development of technology entrepreneurship requires a technological innovation capacity (Brem & Borchardt 2014), as the new firm aims to create and capture value in a nascent market (Bailetti 2012), introducing novel products and services (Beckman et al. 2012; Clarysse, Bruneel, et al. 2011).

The combination of the usual entrepreneurial challenges and the specific challenges related to technology development process (Hsu 2008) makes technological entrepreneurship a process with multiple options at each decision point. In other words, it is a situation where the entrepreneur’s action is permanently subject to uncertainty (McMullen & Shepherd 2006). Scholars have debated on the singularity of technology entrepreneurship (Hsu 2008; Brem & Borchardt 2014), suggesting that technology-based entrepreneurs often struggle to unlock the “product-market fit” (Maurya 2012), that would put together their new technology-based product or service with a market (Teece 2010). Scholars have also identified that the degree of novelty of the new venture, unless coupled with the right market entry strategy (Zott & Amit 2008), could be negatively related to the new venture survival possibilities in competitive markets (Shepherd et al. 2000).

Consistent with this paradox, scholars have proposed to use “venture emergence” as an outcome construct that can reflect the different evolutionary paths of new ventures (Tornikoski & Newbert 2007). The venture emergence perspective helps to describe the progress of the entrepreneur in bringing to market its technology-based idea or opportunity (Dimov 2010).
The Venture Emergence perspective for technology entrepreneurship

The development of venture emergence as a research concept responds to the necessity to understand the question of how organizations come to exist (Katz & Gartner 1988), the relevance of this question is still considered to be one of the most complex organizational areas of research (Lichtenstein 2014). The seminal work of Katz & Gartner (1988) describes that there are different elements that can help to identify the evolution in the process of an organization that is coming to exist: intention, resources, boundary, and exchange. The first element is intention, it is used to describe that organizations are led by an individual actor that has the goal of creating a new organization. The second element is resources, it is used to characterize the human, financial capital and other endowments that are the building blocks an emerging organization uses, combines and organizes production activities with (Brush et al. 2008). The third element of boundary is used to portray how emerging organizations also build boundaries, for example through contracts, or physical spaces; they are also established with the information and material transactions between the emerging firm and its environment. Last, the exchange element illustrates the activation of transactions in the organization, it involves combining internal inputs that are transformed into valuable outputs.

These four elements, were later used as reference for an empirical work on how would new ventures emerge (Brush et al. 2008). There have also been further efforts to establish measures for the “emergence events” (such as achieving the first commercial transaction or hiring the first employee) that can fit with an evolutionary perspective of the venture emergence. As a result, different venture emergence levels are described depending on how many of those events the venture has gone through (Dimov 2010; Tornikoski & Newbert 2007). The use of venture emergence as an outcome construct for the technology entrepreneurship process offers a better fit with the expectation that this is a complex process and that might need to take into account changes across time (Clarysse, Wright, et al. 2011).

Two elements motivate this study: absence of a clear relationship between the possession of resources, entrepreneur’s actions, and entrepreneurial performance (Newbert et al. 2008); and the limited understanding of the particularities of high-growth technology-based start-ups (Hsu 2008; Brown 2013; Paleari et al. 2017). Thus, we propose to start this study with an exploratory approach of the phenomenon
that allows for further theoretical development, using the following research questions: are there specific factors and/or actions that influence on the technology-based entrepreneurship process?

3. Research design: a mixed-method approach

The research need to uncover the function and use of resources in technology entrepreneurship suggests an interpretative inductive method; while the ambition to establish a relationship between initial resource configurations and emergence of new ventures suggests a deductive quantitative approach. The mixed-method approach offers a two-step research structure (Cameron 2011). It is an alternative to the exclusive and isolated use of a qualitative or quantitative research method. We propose to follow a mixed-method sequential approach (QUAL-> QUANT); first a qualitative inductive study, then a quantitative deductive study to, within the research limitations, validate the theory insights (Molina-Azorin 2010).

The purpose of adopting mixed-method in this research is to benefit from the “developmental” powers of this approximation Venkatesh et al. (2013). The “developmental” purpose is described as: “questions for one strand emerge from the inferences of a previous one, or one strand provides hypotheses to be tested in the next one” (Venkatesh et al. 2013, p.6); for example, completing a qualitative study to identify constructs and propositions, and then a quantitative study to test the hypotheses.

The use of a mixed-method introduces “meta-inferences” as an additional requirement (Molina-Azorin 2010). Meta-inferences should integrate the findings from the qualitative and quantitative parts of the research (Venkatesh et al. 2013); are also described as "bridging" (Venkatesh et al. 2013) between the findings of each research section. These, are discussed in the last section of this study.

4. Exploratory work on resources and venture emergence

The exploratory qualitative approach was implemented with an approximation that followed the grounded theory method guidelines (Glaser & Strauss 1967; Glaser 2002). We kept regular reviews on the data collected and contrasted it with literature on entrepreneurship, aiming to establish the elements that could be explained and the emerging themes (Wagner et al. 2010). The regular revision cycles of data and emerging concepts, brought us to a saturation point after interviewing 21 new venture’s entrepreneurs (see Table 1).
The sample of NTBFs came from different innovation parks and incubators in Barcelona (Spain). A selection criterion was that they should be developing a new technology and have a global market ambition. This was done with the intention to capture the profile of the emerging global NTBFs (Tanev 2012). An additional criterion was that they should be in their early-stage (between 0-3 years since inception) to ensure that we could capture part of the venture emergence process. The data collection process began with an interview (with length varying from 45 to 80 minutes) and was complemented with secondary information on each venture (publicly available information such as investor’s presentations and venture press releases). All interviews were performed between 2009 and 2011, they were recorded, transcribed, and coded with to identify significant actions and resources that would influence the technology-based entrepreneurship development. The codes were checked and validated with the help of another researcher in the field of entrepreneurship. The first cases analyzed were used to map out codes and emerging concepts, this initial coding was used as a reference for the following cases coding.

Table 1. List of the sampled ventures of technology entrepreneurs

<table>
<thead>
<tr>
<th>Nascent venture name</th>
<th>Industry</th>
<th>Entrepreneur Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>P01 - Electronix</td>
<td>Electronics</td>
<td>Novice</td>
</tr>
<tr>
<td>P02 - Usability</td>
<td>Internet</td>
<td>Novice</td>
</tr>
<tr>
<td>P03 - HHRR Software</td>
<td>Software</td>
<td>Novice</td>
</tr>
<tr>
<td>P04 - Medical Coding</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P05 - Innovation Services 1</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P06 - Venturing</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P07 - eRecovery</td>
<td>eHealth</td>
<td>Novice</td>
</tr>
<tr>
<td>P08 - TDTBox</td>
<td>Digital TV</td>
<td>Experienced</td>
</tr>
<tr>
<td>P09 - WaterPower</td>
<td>Renewable Energy</td>
<td>Novice</td>
</tr>
<tr>
<td>P10 - ChinaTravel</td>
<td>eTravel</td>
<td>Novice</td>
</tr>
<tr>
<td>P11 - Laserpower</td>
<td>Optic devices</td>
<td>Novice</td>
</tr>
<tr>
<td>P12 - Contengia</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P13 - Security Systems</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P14 - Creativity</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P15 - UbiquousWifi</td>
<td>Telecom devices</td>
<td>Novice</td>
</tr>
<tr>
<td>P16 - Outsourcing</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P17 - Innovation Services 2</td>
<td>IT services</td>
<td>Novice</td>
</tr>
<tr>
<td>P18 - ElectroComputer</td>
<td>Electronics</td>
<td>Experienced</td>
</tr>
<tr>
<td>P19 - Data Secure</td>
<td>Software</td>
<td>Novice</td>
</tr>
<tr>
<td>P20 - Ebusiness</td>
<td>IT services</td>
<td>Experienced</td>
</tr>
<tr>
<td>P21 - DigitalDevices</td>
<td>IT services</td>
<td>Novice</td>
</tr>
</tbody>
</table>

Descriptive findings and further refinement of the exploratory work

The coding process of the data gathered lead to the identification of first layer of concepts that were observed to have an impact on the technology entrepreneurship process. In this initial iteration elements
known to influence on the new venture’s emergence appeared. Aspects that described the influence of the technology in their venture emergence were also noticed (see table 2).

Table 2. Analysis of qualitative data with examples of quotes

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Illustrative quotes</th>
<th>Entrepreneurial Venture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior entrepreneurial experience influences decision-making and technology opportunity identification</td>
<td>“If I hadn’t had experience in this industry, I wouldn't have (created) this company”</td>
<td>P19-DataSecure</td>
</tr>
<tr>
<td>Technology intensity of the product/service introduces market uncertainty</td>
<td>“our product is highly technological, it needs a lot of time to actually become a marketable product”</td>
<td>P01-Eletonix</td>
</tr>
<tr>
<td></td>
<td>“You are reaching the end of a phase, so that particular uncertainty disappears, but new ones come in. When you are reaching the horizon, there is a new horizon further ahead”</td>
<td>P11-laserpower</td>
</tr>
<tr>
<td></td>
<td>“we still haven't found it (value proposition) yet, different customers see it in different ways, so we want to spend time in that”</td>
<td>P18-Electrocomputer</td>
</tr>
<tr>
<td>Technology intensity also impacts on the resource access and management</td>
<td>“it is very difficult to talk in technical terms to investors”</td>
<td>P01-Eletonix</td>
</tr>
<tr>
<td></td>
<td>“It is very difficult to put some things in the business plan, for example if the business depends on this or not...the inputs you receive shape a new path too frequently”</td>
<td>P-14 - Creativity</td>
</tr>
</tbody>
</table>

This initial exploration provided clues to further investigate the influence of initial resource configurations in the development of new ventures. We studied in more detail three cases that provided examples of three different combinations of product, technologies and resources (see Table 3).

Table 3. Description of the new technology-based ventures in the study

<table>
<thead>
<tr>
<th>Entrepreneurial Venture</th>
<th>Product</th>
<th>Technology</th>
<th>Key Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>P08-TDTBox</td>
<td>Value-added services to digital television broadcasters</td>
<td>Software to broadcast digital television and middleware for set-top boxes</td>
<td>A strong network including technology and institutional partners</td>
</tr>
<tr>
<td>P01-Eletonix</td>
<td>Low-consumption integrated circuits</td>
<td>Designs for elastic clocks in integrated circuits</td>
<td>A leading international research group on electronics</td>
</tr>
<tr>
<td>P13-Security Systems</td>
<td>Software to prevent data leakage</td>
<td>SaaS solutions for data analysis using new proprietary algorithms</td>
<td>Prior knowledge of market and technology and a strong software development team</td>
</tr>
</tbody>
</table>

In these three cases, technological resources were perceived to have a substantial value when used to build legitimacy and signal the technical capacity of the new venture. Likewise, actions that build upon the industry experience and connections of the entrepreneur came out as valuable signals to convince investors
and uncertain customers (see table 4). Finally, and despite being in a technological context, actions related on building a market presence such as branding or building credibility by engaging with reputed beta customers also came out as strategies to overcome the challenge of advancing towards venture emergence.

Table 4. Actions as signals in the new technology-based firms in the study

<table>
<thead>
<tr>
<th>Entrepreneurial Venture</th>
<th>Resource used as signals in Technology Entrepreneurship</th>
<th>Examples of identified actions using resources as signals and quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P08- TDTBox</td>
<td>Market signals: brand building actions</td>
<td><em>(the institutional endorsement) worked as a public certification that we had the technological and financial resources to complete our technological development)</em></td>
</tr>
<tr>
<td></td>
<td>Social Capital signals: pilot experiments with endorsers, networking</td>
<td><em>(technological resources as) elements that help the market to discern you from the others)</em></td>
</tr>
<tr>
<td>P01- Electonix</td>
<td>Social capital signals: Endorsements from investors (VC)</td>
<td><em>(Investors evaluate their decision based on whether there is (already) another investor with good reputation (that has already invested) in the company)</em></td>
</tr>
<tr>
<td></td>
<td>Market signals: patenting</td>
<td><em>(patenting and other actions to give visibility to R&amp;D activity)</em></td>
</tr>
<tr>
<td>P13- Security Systems</td>
<td>Market signals: brand development and beta customer actions</td>
<td><em>(regarding technology development) for the venture to survive we needed to achieve clear goals)</em></td>
</tr>
</tbody>
</table>

The results from the exploration approach provided the needed insights to guide the hypotheses development.

5. Hypotheses development

**Entrepreneur's experience and knowledge as new venture's human capital**

Entrepreneurs that lead new technology-based firms (NTBFs) are often endowed with limited resources, the knowledge and skills of the entrepreneur and its team members are sometimes the only visible resources in a new firm. The combination of individual’s knowledge and skills, entrepreneur’s human capital (Davidsson & Honig 2003), has received much attention in the entrepreneurship literature (Rauch & Rijsdijk 2013). Prior studies showed that exposure to situations related to the exploration and exploitation of opportunities would result in learning outcomes that generated valuable knowledge for the new firm (Politis 2005). There could be different types of experiences that constitute the human capital of the new firm, it could be prior work experiences or prior attempts (successful or not) to run a start-up, we detail the expected effect of each of those.
There is though, limited evidence on its specific impact on venture survival or performance in the market (Dimov 2010; West & Noel 2009). Work experience would be a potential contributor to the human capital of the entrepreneur; more years of work experience should render additional learnings from challenging situations. Work experience might also include a broader network of valuable contacts and potential references (social capital), that could be quite valuable in the context of entrepreneurship (Carolis et al. 2009). Thus, we expect that work experience of the entrepreneur should translate into human capital and positively influence the venture emergence of the NTBF. Therefore, we propose that:

\*H1a: Founder’s human capital (in years of work experience) has a positive influence on the new technology-based venture emergence.\*

A different dimension of human capital that has particular importance in the entrepreneurial context is being an “experienced entrepreneur” (Hsu 2007). The exposure to situations that include activities related to opportunity recognition and exploitation are seen as potential generators of the specific knowledge reservoir of entrepreneurial knowledge (Politis 2005; Widding 2005). Prior research has proposed that experienced entrepreneurs, those that have had the opportunity to develop the entrepreneurial knowledge reservoir, actually follow different decision-making processes when assessing entrepreneurial opportunities and their exploitation (Dew et al. 2009). Therefore, it is argued that the learning outcomes from prior entrepreneurial experience will make the entrepreneur more prepared to cope with the liabilities of newness (Stinchcombe 2002), thus we hypothesize that she would have developed the capability to adjust their mechanisms and decision-making structures to the uncertainty and dynamism of technology intense markets (Read et al. 2009). Therefore, we suggest that:

\*H1b: Founder's human capital (as entrepreneurial experience) has a positive influence on the new technology-based venture emergence\*

Additionally, prior research has observed that there was a positive association between business performance and the similarity of customers and suppliers with prior experiences of the entrepreneur (Gimeno et al. 1997). We expect to see similar effects to the observation of Colombo & Grilli (2005) on the positive influence on firm performance of industry-specific work experience in the Italian high-tech firms’ context. Therefore, we would suggest the following:
H1c: Founder's experience (as prior startup experience in the same industry) has a positive influence on the new technology-based venture emergence.

Technological resources and venture emergence

Using a resource-based view perspective, we would expect that firms with larger portfolios of technological resources would be more likely to generate and capture value and emerge. Nevertheless, scholars also suggest that actually the novelty of the products and services offered by technology-based ventures could actually be hurdle for their future (Shepherd et al. 2000). In most of the NTBFs "the main problem is not so much invention but commercialization" (Gans & Stern 2003). Even if technological resources (such as patents) are seen as one of the key assets that these type of firms can leverage to build their competitive advantage (Hsu & Ziedonis 2013), it is not obvious how to do it (Brem & Voigt 2009). In technology markets, new entrants are in a weaker position compared to established players, the limited information available on the product, team, and past performance, makes them a riskier choice for a potential customer (Godley 2013).

In order to capture the different effects related to technology, we separate technology outputs (as visible factors, such as patents) from technology capacity inputs (as technology intensity or orientation) as suggested by Hsu & Ziedonis (2013)' findings. It could be, that some firms have low levels of visible technology outputs (low number of patents) but sustain a strong R&D intensity that favors the development of non-patented technological innovations in their market. As a result, we build on the perspective of the resource-based view to propose that technological knowledge resources (such as patents) will positively influence on the venture emergence. Not only because they are sources of knowledge for internal use, but also because they provide clues (visible signals) to potential stakeholders and customers on the quality of the new venture. Thus, we suggest that:

H2: Technology factors would positively influence venture emergence.

Market factors and venture emergence

Using as a reference point the observation from the exploratory field work on the value of building an early a market presence for the NTBF, we review the marketing literature for further clues on what factors and actions could influence on the venture emergence of new technology-based firms.
The marketing literature suggests that an active management of the marketing mix would favor a reduction of information asymmetry between the producer and the buyer (Kirmani & Rao 2000). Studies have observed that product, promotion, place and pricing decisions would have an impact on the perception that the buyer or consumer have of the product or service (Kirmani & Rao 2000). Furthermore, investment in brand development or active communication of the expected benefits or uses of the product would reduce the consumer uncertainty and favor the activation of first transactions (Mudambi et al. 1997; Erdem & Swait 1998). Therefore we expect that the development of marketing capacities in the NTBF influences on the venture emergence, in line with the observation that building marketing assets impacts positively on the introduction and commercialization of new products (Ramaswami et al. 2008). Marketing and innovation management theory explain how organizations that have the ability to sustain their innovation capabilities meanwhile staying tuned with market demands, and achieve a better performance (Ramaswami et al. 2008; Becker et al. 2015). Thus, the marketing theory offers support to expect that NTBFs that activate market factors (for example developing a brand, or investing in a marketing campaign), or that develop a marketing capacity (for example allocating some of their employees to the sales or business development functions), are more likely to advance in their venture emergence. As a result, we propose that:

H3: Market factors would positively influence venture emergence.

The resulting research model (see figure 1) provides a visualization of the different constructs and theories being used in this coming section.
6. Validating the hypotheses on NTBF’s venture emergence

Using as reference the research framework and hypotheses (see figure 1), we advance to the second part of the mixed-method overall research design where we adopt a quantitative approach to explore the validity of the proposed hypotheses.

**Data and measures**

We use a data sample of 447 firms from the Kauffman Firm Survey (KFS) to test the hypotheses. The KFS is a longitudinal survey of new businesses in the USA sponsored by the Ewing Marion Kauffman Foundation. The KFS panel study contains data from 4,982 business started in 2004 that were surveyed annually from 2004 to 2011, (see Coleman & Robb 2009; Robb 2012). We select technology-based firms from the larger sample of the Kauffman Firm Survey, and follow them through their early-stage (0-3 years – between 2004-2007), identifying as technology-based firms the new ventures in industries that are either “technology employers” or “technology generators” (Coleman & Robb 2009).

The resulting sample captures new firms in industries such as information technologies, equipment manufacturing, chemical, and other sub-industries, providing a fit with the initial sample of industries observed in the exploratory analysis.
Dependent variable: venture emergence

We use a multidimensional scale to assess the changes in the new firm’s emergence, it is an adaptation of the scale used by Tornikoski (2007), and Tornikoski & Newbert (2007). It allows to develop an aggregated scale to measure the overall venture emergence of the NTBF, and at the same time it can provide information on the different dimensions that constitute venture emergence. It is important to highlight our ambition to conceptualize venture emergence as a process, meaning that the measurement of the variable can change across time (Lichtenstein 2015).

We use four indicator statuses: does the NTBF have sales? (Yes=1 or No=0), does the NTBF have employees? (Yes=1 or No=0), has the NTBF received external funding? (Yes=1 or No=0), does the NTBF have profits? (Yes=1 or No=0). As a result, for each year measurement the sum of the different indicators generates a status level from 0 to 4. Those that achieve higher values (3 or 4) can be considered firms that have high levels of venture emergence and that have become visible and operating organizations.

Independent variables

The three independent variables of the human capital are measured to capture the information on the characteristics of the entrepreneur. We distinguish between overall work experience (years of work experience), entrepreneurial experience (number many businesses started), entrepreneurial experience in the same industry (business started in the same industry). The measure of work experience in years is like the measurement used by Colombo & Grilli (2005), the use of number of businesses that they have started is measured as in Dimov’s (2010) study. Lastly, we use of a binary measure to select whether the prior experience is in the same industry or not.

We measure two variables for the Technology factors, the technology assets and the capacity. We measure patents as a technology asset, the number of patents are a proxy for technology knowledge (Lin et al. 2006). The number of patents is also used as an indicator of the intentions of the firm to exploit an innovation, and an indication of the potential value of its technological innovations (Hsu & Ziedonis 2013). We measure the technology capacity using the well-established measure of R&D Intensity (Lin et al. 2006). Nevertheless, instead of using R&D expenditure, we use the alternative measurement of the percentage of
employees in the function of R&D (Caloghirou et al. 2004). We calculated the average value of each firm across the period of observation (2004-2007).

We measure Market factors using the asset and capacity likewise. To measure the market assets in the NTBF we use the number of trademarks. The use of trademarks by new firms captures the decision of the managers (the entrepreneur/s) to establish a position in the market and distinguish themselves from the potential established competitors or new entrants (Mendonça et al. 2004); additionally the use of trademarks also is seen to provide information on the marketing capabilities and complementary information on the innovation capabilities of the firm (Mendonça et al. 2004). We measure the market capacity using the percentage of sales, marketing and general administration employees. This variable has been generated subtracting employees in other functions to identify the group that is related to marketing and business development support. This measure has been used as a good indicator of the commercialization intention of the NTBF (Lin et al. 2006), and it provides a comparison reference to establish differences on market orientation among different firms (Morgan et al. 2009). For both variables, we calculated the average value of each firm across the period of observation (2004-2007).

Control variables

We have controlled for the number of years that the firm manage to survive including the year coefficients in the model (see later in table 6). This is in line with the recommendation on using panel data sets for entrepreneurship research and controlling for the unexpected time-effects (Delmar & Johnson 2015). Although all firms start the same year, we have introduced a firm size measure (number of employees (Deeds 2001)) to be able to observe whether firms that start with a larger size would exhibit a significantly different behavior in any of the analyses we perform.

Data analysis and results from the quantitative testing

The descriptive statistics of the variables (see Table 5) includes the mean, standard deviation (SD) and the correlations between the dependent and the independent variables. We have included in the table a group of variables not used in the hypotheses formulation: revenues, profits, and employees; the reason to include them in the correlation table is to be able to also identify any a-priori correlations that might be important in the interpretation of the results.
Please see the final version at: https://www.inderscience.com/jhome.php?jcode=ijev

Table 5. Descriptive statistics and correlations

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Venture emergence</td>
<td>2.71</td>
<td>0.99</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Work Experience</td>
<td>15.45</td>
<td>11.17</td>
<td>0.06</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Entrep. Experience</td>
<td>1.28</td>
<td>1.56</td>
<td>-0.07</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Entrep. Experience (in industry)</td>
<td>0.49</td>
<td>0.50</td>
<td>0.11</td>
<td>0.46</td>
<td>0.05</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Patents (avg)</td>
<td>0.68</td>
<td>1.83</td>
<td>-0.12</td>
<td>0.23</td>
<td>0.19</td>
<td>0.07</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>% R&amp;D Employees (avg)</td>
<td>0.35</td>
<td>0.28</td>
<td>-0.13</td>
<td>0.10</td>
<td>0.01</td>
<td>0.07</td>
<td>0.11</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Trademarks (avg)</td>
<td>0.79</td>
<td>1.66</td>
<td>0.09</td>
<td>0.00</td>
<td>0.17</td>
<td>0.07</td>
<td>0.31</td>
<td>-0.13</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>% Market employees (avg)</td>
<td>0.47</td>
<td>1.64</td>
<td>0.15</td>
<td>0.00</td>
<td>0.05</td>
<td>0.10</td>
<td>-0.02</td>
<td>-0.04</td>
<td>-0.06</td>
<td>1.00</td>
</tr>
<tr>
<td>9</td>
<td>Employees</td>
<td>4.63</td>
<td>8.84</td>
<td>0.02</td>
<td>0.05</td>
<td>-0.05</td>
<td>0.22</td>
<td>0.09</td>
<td>-0.24</td>
<td>0.17</td>
<td>-0.07</td>
</tr>
</tbody>
</table>

Data analysis results

In order to test the hypotheses we used an ordinal logit model (Wooldridge 2002), as the dependent variable, venture emergence, is codified as different status levels of the new venture. Due to the nature of the hypotheses we adopted a random effects model specification (Schunck 2013; Andreß et al. 2013).

In the analysis of the different models we use the McFadden pseudo-$R^2$ as a measure for the variance explained (see Hoetker (2007) for further discussion on pseudo-$R^2$ measures). The results offer the possibility to develop a comparative analysis with the contributions and effects of the previous partial models (see table 6). The results for the complete model show an increase of the pseudo-$R^2$ explained, suggesting that the introduction of technology and market factors’ hypotheses has enriched our initial understanding (Model 1) based only on the influence of human capital factors.
Regarding the first group of hypotheses (H1a, H1b, H1c) on the influence of human capital, across all the models we see that although work experience (H1a) has no significant effect, entrepreneurial experience does. The number of prior startups run by the entrepreneur (H1b) have a negative weak significant effect (-.09, p<0.01) as seen in the complete model (see Model 4 in Table 6). While the fact that the prior start-up was in the same industry (H1c) has a stronger and positive effect (.41, p<0.01) on the venture emergence of the NTBF. Thus, while we cannot validate H1a, we actually get support for H1b in the opposite direction than we expected, and strong support for H1c. Suggesting that not all types of human capital have the same effect.

The hypothesis to study the effects of technology factors (H2) shows surprising results. The technology assets (patents) and the capacity (% of R&D employees) show negative effects, weak for the patents (-.03, p<0.01), but strong for the technological capacity measure (-.67, p<0.01). In both cases with significant statistical support.

Finally, the hypothesis to explore the effects of market factors (H3) offers mixed results. While market assets (trademarks) show a weak but negative influence (-.04, p<0.05), the market capacity (% employees in market related functions) shows a positive and significant effect (.13, p<0.01).

Table 6. Results from the ordinal estimation of the hypothesized effects on the Venture Emergence

<table>
<thead>
<tr>
<th>Ordinal Logit Estimation</th>
<th>Venture Emergence</th>
<th>Coef.</th>
<th>S.E.</th>
<th>Coef.</th>
<th>S.E.</th>
<th>Coef.</th>
<th>S.E.</th>
<th>Coef.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Experience</td>
<td>-0.00</td>
<td>0.00</td>
<td></td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Entrep. Experience</td>
<td>-0.09***</td>
<td>0.08</td>
<td></td>
<td>-0.08***</td>
<td>0.03</td>
<td>-1.0***</td>
<td>0.03</td>
<td>-0.09***</td>
<td>0.03</td>
</tr>
<tr>
<td>Entrep. Exp. (same industry)</td>
<td>0.31***</td>
<td>0.04</td>
<td></td>
<td>0.35***</td>
<td>0.09</td>
<td>0.35***</td>
<td>0.09</td>
<td>0.41***</td>
<td>0.10</td>
</tr>
<tr>
<td>Patents (avg)</td>
<td>-0.04**</td>
<td>0.02</td>
<td></td>
<td>-0.03**</td>
<td>0.02</td>
<td>-0.03**</td>
<td>0.02</td>
<td>-0.03**</td>
<td>0.02</td>
</tr>
<tr>
<td>% R&amp;D Employees (avg)</td>
<td>-0.70***</td>
<td>0.14</td>
<td></td>
<td>-0.67***</td>
<td>0.14</td>
<td>-0.67***</td>
<td>0.14</td>
<td>-0.67***</td>
<td>0.14</td>
</tr>
<tr>
<td>Trademarks (avg)</td>
<td>-0.05**</td>
<td>0.02</td>
<td></td>
<td>-0.04**</td>
<td>0.02</td>
<td>-0.04**</td>
<td>0.02</td>
<td>-0.04**</td>
<td>0.02</td>
</tr>
<tr>
<td>% Market employees (avg)</td>
<td>-0.14***</td>
<td>0.02</td>
<td></td>
<td>-0.13***</td>
<td>0.02</td>
<td>-0.13***</td>
<td>0.02</td>
<td>-0.13***</td>
<td>0.02</td>
</tr>
<tr>
<td>Firm Size (avg log)</td>
<td>-0.03</td>
<td>0.04</td>
<td></td>
<td>-0.10***</td>
<td>0.05</td>
<td>-0.10***</td>
<td>0.05</td>
<td>-0.10***</td>
<td>0.05</td>
</tr>
<tr>
<td>2005</td>
<td>0.2***</td>
<td>0.10</td>
<td></td>
<td>0.81***</td>
<td>0.10</td>
<td>0.85***</td>
<td>0.10</td>
<td>0.83***</td>
<td>0.10</td>
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<tr>
<td>2006</td>
<td>1.07***</td>
<td>0.11</td>
<td></td>
<td>1.06***</td>
<td>0.11</td>
<td>1.10***</td>
<td>0.11</td>
<td>1.08***</td>
<td>0.11</td>
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<tr>
<td>2007</td>
<td>0.89***</td>
<td>0.11</td>
<td></td>
<td>0.92***</td>
<td>0.11</td>
<td>0.94***</td>
<td>0.11</td>
<td>0.94***</td>
<td>0.11</td>
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<tr>
<td>cons</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/cut 1</td>
<td>-3.34</td>
<td>0.16</td>
<td></td>
<td>-3.63</td>
<td>0.18</td>
<td>-3.18</td>
<td>0.17</td>
<td>-3.52</td>
<td>0.18</td>
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<tr>
<td>/cut 2</td>
<td>-1.82</td>
<td>0.12</td>
<td></td>
<td>-2.16</td>
<td>0.15</td>
<td>-1.71</td>
<td>0.13</td>
<td>-2.04</td>
<td>0.15</td>
</tr>
<tr>
<td>/cut 3</td>
<td>-2.9</td>
<td>0.11</td>
<td></td>
<td>-3.8</td>
<td>0.14</td>
<td>-3.4</td>
<td>0.12</td>
<td>-4.5</td>
<td>0.14</td>
</tr>
<tr>
<td>/cut 4</td>
<td>1.76</td>
<td>0.12</td>
<td></td>
<td>1.50</td>
<td>0.14</td>
<td>1.95</td>
<td>0.13</td>
<td>1.65</td>
<td>0.14</td>
</tr>
<tr>
<td>Log Likelihood (LL)</td>
<td>-3,217.86</td>
<td></td>
<td></td>
<td>-3,082.69</td>
<td></td>
<td>-3,071.54</td>
<td></td>
<td>-3057.50</td>
<td></td>
</tr>
<tr>
<td>LR ch2 / Wald Ch2 =</td>
<td>154.020.00</td>
<td></td>
<td></td>
<td>189.04</td>
<td>211.33</td>
<td>239.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob &gt; ch2 =</td>
<td>0.00</td>
<td></td>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Pseudo) R2</td>
<td>0.02</td>
<td></td>
<td></td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td></td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

Notes: *p < 0.1, **p < 0.05, ***p < 0.01
As part of the results of the complete model, we confirm that the year controls point that in all the specifications the effect of time is positive. As it would be expected, firms that survive are also more likely to have a higher level of venture emergence.

Building on the qualitative insights and the hypotheses tests results we organize the meta-inferences as described by Venkatesh et al. (2013).

7. Integrating the results in meta-inferences

The development of technology-based opportunities often follows a lengthy and complex development project (Clarysse, Wright, et al. 2011). The measurement of venture emergence (VE) in the quantitative analysis of the study confirms two insights that we captured in the qualitative work: (1) VE is a lengthy process, as described by the entrepreneurs in the case studies and as observed in the measurement of VE; (2) there can be different paths towards VE, as there is not a clear sequence of activities that explains how successful ventures emerge, supporting the idea that it is a complex and uncertain process (Lichtenstein et al. 2007).

The entrepreneurs experience as a positive influence for the Venture Emergence of NTBFs:

Moving beyond the generic resource-based view, and adopting a human capital perspective on entrepreneurship, the quantitative analysis has provided further information on the qualitative insights: (1) It has confirmed that not all types of work experience generate the skills and abilities needed for the technology entrepreneurship process, as years of work experience was seen to have no impact on the new firm development; (2) entrepreneurial experience is valuable if it is in the same industry; suggesting that for venture emergence it is not enough to have prior entrepreneurial experience, the entrepreneur also needs to understand the dynamics of a specific high-technology market. This finding provides evidence on the influence of the combination of the two sources of human capital: industry knowledge and entrepreneurial experience.
The value of resources as quality signals and the impact of technology orientation in NTBF’s Venture Emergence

In the exploratory work we observed that the resources of the entrepreneur (for example technology related assets) did not always impact directly in the market performance of the venture in the short term. Nevertheless, we identified that resources were used to signal the firm capabilities and their quality. These findings extended the current understanding of resources as quality signals for investors (Hsu & Ziedonis 2013), as we identified that signaling strategies were also used to gain legitimacy and reduce uncertainty with customers, following a more market-oriented perspective (Im & Workman 2004).

These findings were then contrasted with the results from the quantitative study. The results showed that technological resources, such as patents, where not reliable predictors of NTBF’s venture emergence. Instead, we observed that firms with higher number of patents showed lower levels of venture emergence. The results also showed that there are firms that manage to stay active (survive) despite having low levels of venture emergence; this might be the case of firms that stay focused on developing their technological resources or that struggle to generate revenues.

The orientation towards market in technology-based firms as a construction strategy for technology entrepreneurship

In our qualitative work, we found that marketing or market-orientation capabilities should help to understand how entrepreneurs mitigate the uncertainty of their first-time buyers in a dynamic and uncertain technological market. The quantitative findings showed that our hypotheses on market-oriented factors such as registering trademarks (as a proxy for marketing development in the new venture) were not having a direct impacting on venture emergence; on the other hand, the results suggest that there is a significant impact of increasing the market capacity of the new venture, showing how venture emergence is related to marketing capacity development.

8. Implications

This research has benefited from using a mixed-method design, exploring the venture emergence in the technology entrepreneurship process using a longitudinal perspective. This work helps to further define the concept of venture emergence for new technology-based firms (NTBFs).
The human capital view has helped to clarify that entrepreneurial experience has a stronger influence if it is in the same industry. Previous research in high-tech contexts was not able to explore the longitudinal effects of the initial human capital endowments of the new firm, therefore the results complement prior research in this area and confirm findings on the positive influence of specific entrepreneurial experience (Unger et al. 2011; Tegtmeier & Heimann Roppelt 2016).

We also contribute to the open call to establish bridges between entrepreneurship and marketing theory (Webb et al. 2010). In particular the qualitative and quantitative findings support the marketing theory insights on the positive influence on venture performance of building market-oriented resources (Mendonça et al. 2004; Im & Workman 2004); the results suggest that these type of actions have a positive effect on the venture emergence of new technology-based firms, therefore they extend the areas of application of these theories to the technology entrepreneurship context.

From a broader perspective, the findings also contribute to the emerging research stream of entrepreneurial marketing (Miles et al. 2015) suggesting that the development of market-oriented capacities might play a role in the successful transformation of technological developments into valuable market innovations. We have been able to gather evidence to describe how technology entrepreneurs might have to go through a process of market creation (building legitimacy and trust with their potential customers), in particular if they are holding high potential but still incipient technological resources (Godley 2013).

A practical implication for policy makers is related to the evidences of different NTBFs profiles depending on their market or technology assets. As suggested in Gans & Stern (2003) different profiles of NTBFs might be the reason why we observe that some of the firms do not evolve in the status indicators of venture emergence. The entrepreneurial choice of market or technology performance has consequences on the types of value creation actions of the new firm, supporting the idea that the resource and the demand perspective would have complementary value when it comes to build a sustainable organization.
References


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