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Exploring the Impact of Initial Resources on the Venture Emergence of New Technology-based Firms. 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.

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.

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?

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.

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.

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).

Concepts Illustrative quotes Entrepreneurial Venture

Prior entrepreneurial experience influences decision-making and technology opportunity identification “ If I hadn't had experience in this industry, I wouldn't have (created) this company” P19-DataSecure. Technology intensity of the product/service introduces market uncertainty “ our product is highly technological, it needs a lot of time to actually become a marketable product” P01-Electonix “ 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” P11-LaserPower “ we still haven't found it (value proposition) yet, different customers see it in different ways, so we want to spend time in that” P18-ElectroComputer. Technology intensity also impacts on the resource access and management “ it is very difficult to talk in technical terms to investors” P01-Electonix. “ 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” P-14 – Creativity.

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).

Descriptive Variables

Entrepreneurial Venture Product Technology Key Resources

P08- TDTBox Value-added services to digital television broadcasters

Software to broadcast digital television and middleware for set-top boxes A strong network including technology and institutional partners.

P01- Electonix Low-consumption integrated circuits Designs for elastic clocks in integrated circuits A leading international research group on electronics.

P13- Security Systems Software to prevent data leakage SaaS solutions for data analysis using new proprietary algorithms Prior knowledge of market and technology and a strong software development team.

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

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 & Rijdsdijk 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.