Start-ups Innovative Performance: Empirical Analysis of the main influencing factors

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Start-ups Innovative Performance: An Empirical Analysis of the main influencing factors

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Sommario

1. Introduction

The literature on start-ups has mainly centered its attention on performance characteristics and the way they influence innovation and growth path.

Start-ups constitute a remarkable instrument through which new ideas are brought to life, especially those ideas that require an alternative response to that from the already-established companies in the industry. In this context, political, economic, social, technological, (external level) influencing factors, as well as the main factors within the organizational (internal level) boundaries, are to be considered as crucial for start-up innovation and growth. Starting from these approaches, the present dissertation aims at studying the main factors affecting start-up innovative performances.

Specifically, this work focused on some relevant drivers of the innovative performance of start-up, namely the role of grants received, the presence of a highly qualified team, the geographical distance, and the relationship intensity among actors involved in innovation processes.

In fact, innovations enable start-ups to challenge the existing technological order, shape new trajectories and allow them to engage in corporate reinvention, business growth, and new business development.

Moreover, innovations may represent rare, valuable, and inimitable sources of competitive advantage for firms (Samuelsson and Davidsson 2009). However, creating successful innovations is often a function of the external knowledge that a firm can access. External knowledge may allow the firm to overcome competency traps (Levinthal and March 1993) that limit the firm's ability to access and build on new paradigms.

The work is structured in three distinct parts. Firstly there will be the presentation of the original results of a systematic literature review through the identification, classification and analysis of the current knowledge on the main factors influencing start-ups' innovative performance and then I organized them into areas of influence.

The academic literature has a long history of struggling with regard to the measurement of performance, in particular the innovative performance of start-ups (Griliches 2007; Ernst 2001a), although the results of these studies have not yet led to a common view of the typologies of indicators or to a common way to use them. While much importance has been given to the study of performance measurement, other fields remain unexplored, especially those concerning the main influencing factors. Therefore, this research is added to these previous works by conducting a systematic review of the literature (Tranfield, Denyer, and Smart 2003; Denyer and Tranfield 2009; Huisingh 2012; Mariano, Sobreiro, and Rebelatto 2015; Amui et al. 2017) about the various factors that intervene, at multiple levels, in start-up performance improvement.

The objective of this work, as anticipated, is to systematize the available knowledge on the factors affecting start-up innovative performance by:

- identifying articles about innovative performances and their main influencing factors;
- classifying and codifying the characteristics of these articles;
- discussing the results of the literature review;
- providing a framework for addressing the gaps in the current knowledge, contributing to a future research agenda.

Starting from the Web of Science database, 259 articles form 26 international journals has been analysed. I utilized co-citation software to visualize the networks that emerged from recurrent terms, which were then used to develop the categories of analysis. This study confirms that the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels of analysis. The results reveal, in fact, that the political, economic, social, technological, (macro-environment level) influencing factors, as well as the main factors within the organizational boundaries (firm-level), are to be considered as crucial for the growth path of a start-up: in most cases these factors produce a positive impact, although, in specific

cases there can be a balance with negative impacts (multiple influences), considered the coexistence of several elements.

In the second part of this work there will be an investigation about the coexistence of multiple phenomena and their influence on the innovative performance, and in particular on the R&D activities. Specifically, the focus will be on some relevant drivers of the R&D activities of start-up, namely the number of grants received, the total amount of grants received and the presence of a highly qualified team. The crucial aspect that characterizes this study is the choice of the sample, based on innovative start-ups in accordance with the Decree-Law 179/2012 on "Further urgent measures for Italy's economic growth", converted into Law 221/2012.

So, employing a sample of 405 Innovative Start-ups established in Italy and registered into the Chamber of Commerce official database, it was possible to test the effects exerted by the number and total amount of grants received and presence of a highly qualified team, both separately and jointly.

Results suggest that Grants Number and the Total Grants amount received have a positive relationship with the R&D expenses of start-ups. This data is in line with what emerged from various studies; it was noted, in this literature, that public funding induced more R&D activities (Busom 2000) and that companies that receive public funding reach on average a higher intensity (intended as the ratio between R&D expenditure and sales) than the other (Almus and Czarnitzki 2003).

Ultimately, in the last section, I deal with the Start-ups – Incubators joint innovation, focusing on the factors making some collaborations better than others. Specifically, differently from previous works that have mainly focused on identifying start-ups characteristics and relations that promote this kind of collaboration (Veugelers and Cassiman 2005; F. T. Rothaermel, Agung, and Jiang 2007), I analyze how these characteristics interact each other, investigating the role that both geographical distance and grants received compared to the innovative value of start-up. In an attempt to fill the

above gaps, I focused on industrial property, measuring the innovative value of start-up as the number of patents, licenses, property rights owned by the start-up for the achievement of innovative products/services and processes. Moreover, I focused on some relevant drivers of the innovative value of start-up (number and total amount of grants received, geographical distance, in kilometers, between the start-up headquarters and the nearest incubator and the relationship intensity). Testable hypotheses about the impact of these factors on the innovative performance of Start-ups has been developed, and it has been possible to test them on a sample of 1841 Innovative Start-ups established in Italy and listed at the Chamber of Commerce official database.

In brief, this analysis reveals that both the relationship intensity and the number of grants received by each start-up impact positively innovative value of a Start-up. Instead, the geographical distance and the total amount of Grant received, however, have a negative relationship tending towards zero.

2. Start-up innovative performances: A systematic review and research agenda

2.1 Introduction

In a knowledge-based society, innovation is the driving force of the economy on all levels and in all types of organizations. The high risk connected with the introduction of new products or services usually pushes innovations to be commercialized through new and specific entities: start-up companies (K. G. Smith, Collins, and Clark 2005). A start-up is a "young, newly emerged company which is characterized by a high rate of innovation and a fast-growing business that aims to meet a marketplace's need by developing a valuable business model around an innovative product, service, process or a platform".

Start-ups constitute an important instrument through which new ideas are brought to life, especially those ideas that require an alternative response to that from the already-established companies in the industry. Innovation is a central concept when talking about start-ups, which are innovative by nature.

Innovation has been studied in the literature with rather contrasting results. Several studies have suggested a positive link between innovation and start-up growth. Innovation can enhance market power (Schumpeter 1982), improve the ability to escape competition(Porter 1990), reduce production costs (W. M. Cohen and Klepper 1996a; 1996b), support dynamic capabilities (Teece, Pisano, and Shuen 1997)and lead to enhanced absorptive capacity (Zahra and George 2002). In other cases, it can lead to less linear start-up processes (Samuelsson and Davidsson 2009) or more skewed returns (Scherer and Harhoff 2000).

The connection between start-ups and innovation extends further; in fact, due to their smallness, start-ups suffer from a structural lack of tangible and intangible resources. For this reason, the utilization of open innovation (OI) becomes necessary for this kind of company. The term “open innovation” was originally defined as “a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology” (H. W. Chesbrough 2003). In a world where knowledge is highly distributed, it is quite unlikely that start-ups will be able to rely entirely on their own knowledge; instead, they should integrate it with external sources of innovative opportunities to achieve successful growth. The growth of a start-up is closely linked to the improvement of its performance (Damanpour 1991; K. G. Smith, Collins, and Clark 2005). The academic literature has a long history of struggling with regard to the measurement of performance, in particular the innovative performance of start-ups (Freeman and Soete 1997; Griliches 2007; Ernst 2001b), although the results of these studies have not yet led to a common view of the typologies of indicators or to a common way to use them. While much importance has

been given to the study of performance measurement, unexplored fields remain, especially those concerning the main influencing factors. Therefore, our research adds to these previous works by conducting a systematic review of the literature (Tranfield, Denyer, and Smart 2003; Denyer and Tranfield 2009; Huisingh 2012; Mariano, Sobreiro, and Rebelatto 2015; Amui et al. 2017) on the various factors that intervene, at multiple levels, in start-up performance improvement; in particular, we focus our attention on the innovative performances of start-ups. The objective of this paper is to systematize the available knowledge on the factors affecting start-up innovative performance by:

- identifying articles on innovative performance and the main influencing factors;
- classifying and codifying the characteristics of these articles;
- discussing the results of the literature review; and
- providing a framework for addressing the gaps in the current knowledge, contributing to a future research agenda.

Starting from the Web of Science database, the authors utilized co-citation software to visualize the networks that emerged from recurrent terms, which were then used to develop the categories of analysis. This study confirms that the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels of analysis. The results reveal that the political, economic, social, technological, (macro-environment level) influencing factors, as well as the main factors within the organizational boundaries (firm level), are to be considered as crucial for the growth path of a start-up, because in most cases these factors produce a positive impact, although, in specific cases involving the coexistence of several elements, there can be a balance with negative impacts (multiple influences). The paper is structured as follows. In the next section, we present the theoretical background, introducing the role of performance in start-ups' growth and the influence of several factors operating at multiple levels. Then, step by step, we present the methodological approach used in this work. Finally, we provide an overview of the key evidence:

We present original results of a systematic literature review through the identification, classification and analysis of the current knowledge concerning the main factors influencing start-ups' innovative performance and organize them into areas of influence. We develop an original research agenda for progressing the still-scarce discussion on the potential impact generated on start-ups' performance.

2.2 Theoretical Background

Analysing the academic literature on innovation, it is possible to observe that start-ups play a key role in the generation of radical innovations. This is due to their small size and the absence of established market positions (Jaffe, Trajtenberg, and Henderson 1993; Utterback, n.d.; Chandy and Tellis 2000) and to the necessity to create something new, starting from what already exists (Hargadon 2002; lo Storto 2006; Weiss and Gangadharan 2009). Nonetheless, it is understood that start-ups, due to their lack of skills, are often not able to assemble, organize and monitor their resources (Katila and Shane 2005) or to manage their main assets to generate profits (Teece 1994) and consequently sufficient capital to finance innovation.

The prevailing view in the literature suggests a positive link between start-up performance and innovativeness. According to (Rosenbusch, Brinckmann, and Bausch 2011), innovation is positively associated with performance, and this was explained through a detailed meta-analysis of the innovation–performance relationship among small and medium-sized enterprises (SMEs). (Song et al. 2007) also reported that a positive innovativeness–performance link could be found in over two-thirds of the empirical studies that they reviewed. Both of these meta-analyses also concluded that the results may be context dependent and heterogeneous and often related to technology improvement; for this reason, it is crucial for start-ups to pursue radical innovation, and

scholars have started examining and categorizing their performance in relation to their level of innovation.

Innovative performance has been defined as the results that companies achieve in terms of the degree to which they actually introduce inventions into the market, that is, their rate of introduction of new products, new process systems or new devices (Freeman and Soete 1997). Several research studies have therefore shown that the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels of analysis: first within the organizational boundaries and then in relation to the external environment. This environment refers to a set of values, rules, norms, connections and relations (Edquist and Johnson 1996) and to differences in institutional endowments (Hart 2009) that can affect the growth of a start-up separately or in combination. Analysing organizational boundaries, we can see that corporate strategies represent a key influencing factor that affects performance outcomes (profitability, growth or return on assets) contingent on the industry conditions (Robinson and Pearce 1988; Carter et al. 1994; P. P. McDougall et al. 1994), the environmental characteristics (Covin and Slevin 1989; Covin, Slevin, and Covin 1990) and the entrepreneur's background (Sandberg 1986; R. W. Stuart and Abetti 1990; Feeser and Willard 1990). The results show that particular types of strategies affect a variety of performance outcomes – profitability (P. McDougall and Robinson 1990), survival (A. C. Cooper, Dunkelberg, and Woo 1988), growth (P. McDougall and Robinson 1990) and non-financial measures (R. W. Stuart and Abetti 1990). Collectively, this research provides a solid base for understanding differences in firms' performance depending on the strategy, the industry and the entrepreneur(s).

Other research studies have considered innovation as an effective strategy to boost organizational performance (Drucker 1985; Butler 1988) and an important mechanism for a business to keep itself informed of the external competitive environment. Moreover, (Bala Subrahmanya 2005) defined innovation as a company

applying new knowledge or key techniques to development, manufacturing or services. Besides, according to the literature review on organizational innovation and organizational performance, there is a positive and significant correlation between the two (Yam et al. 2004; Bala Subrahmanya 2005; M.-Y. Chen and Chen 2006; Eddleston, Kellermanns, and Sarathy 2007; Damanpour, Walker, and Avellaneda 2009; Naranjo-Gil 2009; T.-S. Liao and Rice 2010).

Considering the external environment, a more varied analysis emerges. Some studies have focused on aspects related to the network, others on the competitive environment in which the start-up operates and others on indirect variables, such as political, economic or social variables. For example, an important aspect is the role of venture capital. Some studies have examined the effects of venture capital financing and strategic alliance networks on start-ups' performance, highlighting that the lack of financial resources is the most limiting factor for the growth of start-ups (Lewis and Churchill 1983; Boeker 1989).

Inter-firm alliances also represent a key factor for the growth of innovative performance; although it has already been shown that the innovation impact of alliances is contingent on a series of factors, such as the organizational form of the alliance and the characteristics of the partner firms and of the networks into which the partner firms are embedded (T. E. Stuart 2000; Sampson 2007; Schilling and Phelps 2007), research on the drivers of alliance innovation performance is far from being exhausted.

Strictly related to inter-firm alliances is the concept of geographical proximity, a factor that tends to facilitate knowledge exchange, particularly when the knowledge is complex and has a strong tacit component (DiMaggio 1988). Several studies have argued that the relevance of geographical proximity lies mainly in the fact that co-location favours the development of other types of proximity – social, cognitive and organizational – that may generate a significant impact on firm performance (Breschi 2001; Boschma 2005; Torre and Rallet 2005).

Specific studies have also focused on the importance of intermediary actors and the relative impact of firm performance. They have argued that, for medium to low innovative firms, there is a positive correlation between access to tangible and intangible resources at the STFC and performance, while, with regard to highly innovative firms, having a business partnership with incubators or universities appears to be positively correlated with firm performance. Other studies in this field, instead, have realized that the creation of an incubator or the presence of a university, per se, is not sufficient for improving performance (Patton, Warren, and Bream 2009) and that new firms need specialized support, especially in soft-skill areas (Hindle and Yencken 2004; Colombo and Grilli 2005).

The above discussion indicates that performance measurement represents a key element for start-up growth and improvement. The literature has mainly focused on performance analysis and description (Freeman and Soete 1997; Griliches 2007; Ernst 2001b) and on understanding specific dynamics that lead to possible improvements. Nevertheless, an understanding of the main factors influencing start-up performance is still lacking. Our research adds to these previous works by conducting a systematic review of the literature, analysing the various factors that intervene, at multiple levels, to improve or reduce start-up performance and identifying the key research element.

2.3 Methodology

The research, based on a systematic literature review, used an extraction process involving two rounds of analysis. After the first step – individual analysis conducted by different researchers – the findings were compared and reconciled when necessary, as suggested by Tranfield et al. (Tranfield, Denyer, and Smart 2003). The database used was the ISI Web of Knowledge (Web of Science) because of its importance as an online subscription-based scientific citation indexing service.

The procedure was systematic, transparent and replicable; in fact, it consisted of a series of steps that helped the authors define the research objective and plan the way in which articles were retrieved and reported (see also Thorpe et al. 2005; Meier 2011; Greer and Lei 2012; Christoffersen 2013).

The term [start-up] and similar concepts[1] were used as the base of the research; then, a list of keywords[2] based on our prior experience was discussed with a review panel of three experienced academics in the field of innovation management.

We conducted Boolean searches using several combinations of the keywords identified in step 1 and discussed them with the review panel. These searches included: [start-up* OR startup* AND innovat*], [start-up* OR startup* AND performance*], [start-up* OR startup* AND endogenous variable*], [start-up* OR startup* AND exogenous variable*], [High tech Company* AND innovat*], [High tech Company* AND performance*], [High tech Company* AND endogenous variable*], [High tech Company* AND exogenous variable*], [Spin-off * AND innovat*], [Spin-off * AND performance*], [Spin-off* AND endogenous variable*], [Spin-off* AND exogenous variable*], [young firm* AND innovat*], [young firm* AND performance*], [young firm* AND endogenous variable*] and [young firm* AND exogenous variable*].

The review was limited to non-invited peer-reviewed journal articles published up to January 2019 (inclusive), excluding working papers, editorials, research notes and commentaries, interviews, dissertation abstracts, books, book chapters and conference proceedings (Keupp, Palmié, and Gassmann 2012). Journal articles are widely considered to be repositories of valid knowledge (e.g. Podsakoff et al. 2005; Ordanini, Rubera, and DeFillippi 2008).

Furthermore, the review was confined to high-quality management journals (Armstrong and Wilkinson 2007). As suggested by prior studies (e.g. Armstrong and

[1] "High tech company", "spin-off" and "young firm".
[2] "Innovation", "innovative", "performance", "endogenous variable" and "exogenous variable".

Wilkinson 2007; Meier 2011; Keupp, Palmié, and Gassmann 2012; Christoffersen 2013), within the Social Science Citation Index (SSCI), we included journals listed in the "management" and "business" subject categories of the ISI Web of Knowledge.

Then we took into consideration only journals with a five-year impact factor (or the current impact for journals established later than 2014) greater than the "aggregate impact factor" value,[3] ensuring the inclusion of articles that have been significantly influential in the academic debate. This choice reduced the number of journals to 36, with a total of 259 articles.

This large number was produced by the general nature of some of the keywords developed in stage (1). However, the generation of many references in the first round of searching is not uncommon in systematic literature reviews (see Pittaway et al. 2004; Provan, Fish, and Sydow 2007; Bakker 2010; Keupp, Palmié, and Gassmann 2012). In subsequent stages of analysis, this number was systematically reduced.

The titles, abstracts and keywords of the 259 initial articles were reviewed following a path based on the relevance of the articles to the object of our analysis, and therefore we defined specific exclusion criteria (Pittaway et al. 2004; Rashman, Withers, and Hartley 2009; Meier 2011; C. L. Wang and Chugh 2014).

In detail, of the 259 papers reviewed, 105 papers were excluded because they did not match the aim of our research and did not treat the influencing factors on start-up performance as a central theme or as a peripheral issue for another analysis. In particular, 19 articles concerning "technology transfer" through the use of models and theories, 23 articles concerning the conceptualization of an entrepreneurial ecosystem, 23 articles concerning venture capital, 21 articles concerning organizational management and 19 articles concerning team entrepreneurial characteristics were excluded.

[3] The aggregate impact factor is calculated by the ISI Web of Knowledge for each scientific category and takes into account the number of citations for and the number of articles of all the journals in the category. The value of the aggregate impact factor for the business category was 2,702 and for management it was 2,631 in 2017.

Systematic reviews use a set of explicit selection criteria to assess the relevance of each study identified (Denyer and Tranfield 2009). Before the careful codification of the papers, the 154 remaining papers were analysed using the VOSviewer software (version 1.6.9), a tool for constructing and visualizing bibliometric networks. These networks, enabled by the text-mining functionality, were used to construct and visualize co-occurrence networks of the important terms that appeared in the literature, representing a way of highlighting the main topics studied and the opportunities for future research.

In particular, the terms from keywords that appeared in the networks as the most recurrent were used initially for the development of categories of analysis. We considered the minimum number of occurrences of a keyword (=10); of the 942 keywords analysed, 26 reached the threshold. For each of the 26 keywords, the total strength of the co-occurrence links with other keywords was calculated. The keywords with the greatest total link strength were selected. The analysis shows that the core keywords are "performance", "innovation" and "start-ups" (see Table 1).

Keyword	Occurrence	Total link strength
Performance	83	209
Innovation	76	199
Start-ups	41	139

Table 1: Co-occurrence network of keywords

This preliminary result confirmed the approach followed with the Web of Science platform and the sample used. Starting from these three main keywords, we found strong ramifications with some topics, like "policy", "economic development", "technological innovation", "market", "industry", "product development", "network", "alliances", "venture capital", "capabilities", "social capital", "innovation" and "strategy". We used these occurrences and aggregated them according to two classification dimensions: "level of influence" and "type of influence". Together with these categories, other general and

specific information, such as the method and research technique, were used as categories to analyse the existing articles.

A classification framework was developed using the number and letter codes to classify the articles. The classification dimensions were:

- Emphasis (1), coded on a scale from A to B: This category determines whether the paper treated the influencing factors on start-up performance as a central theme or used it as a peripheral issue for another analysis.
- Aspects (2), coded on a scale from A to C: This category considers the sorting of the papers into technical, human or managerial aspects.
- Research method (3), coded on a scale from A to C: This category aims to check the methods used in the analysed articles: qualitative, quantitative or mixed.
- Research design or technique (4), coded on a scale from A to F: This category aims to verify which research techniques are used in the analysed papers: case study, interviews, survey, literature reviews, mixed method or simulation/programming/others
- Approach, coded on a scale from A to B: This category aims to verify if the article used theoretical/conceptual or empirical approaches.
- Focus, coded on a scale from A to C: The objective in this category is to identify the principal geographic region of the paper: emerging economies, developed economies or not applicable.
- Level of influence, coded on a scale from A to D: The objective in this category is to find the main determinants operating at different levels of analysis (firm , network, competitive, macro);
- Type of influence, coded on a scale from A to C: The objective in this category is to find out whether the start-ups' performance is positively or negatively affected.

After creating the above codes and categories, with regard to the "level of influence" and "type of influence", a second co-occurrence network was elaborated based on the

abstracts of the analysed articles. We considered the minimum number of occurrences of a keyword (=10); of the 3552 keywords analysed, 101 reached the threshold. For each of the 101 terms, a relevance score was calculated. Based on this score, the most relevant terms were selected. The default choice was to select the 60 per cent most relevant terms, which led to the selection of 63 terms for the analysis (we eliminated generic terms like articles, sample, year, etc.). Four main categories are set according to the co-occurrence network of keywords analysis. The first level explores the main factors affecting performance within the organizational boundaries (firm level), the second level explores all the influencing factors of incubators, alliances and collaborations (network level), the third explores the influencing factors of barriers, competitors and economy of scale/scope (competitive environment level) and the fourth level explores the political, economic, social, technological, environmental and legal influencing factors (macro-environment level).

The results show that the influence at the firm and macro-environment level represent more than 70 per cent of the total data analysed. In addition, the results show that the majority of papers presented a positive impact, while 60 of 154 considered multiple effects (positive or negative) due to the presence of several factors in the analysis and the complexity of the phenomenon analysed.

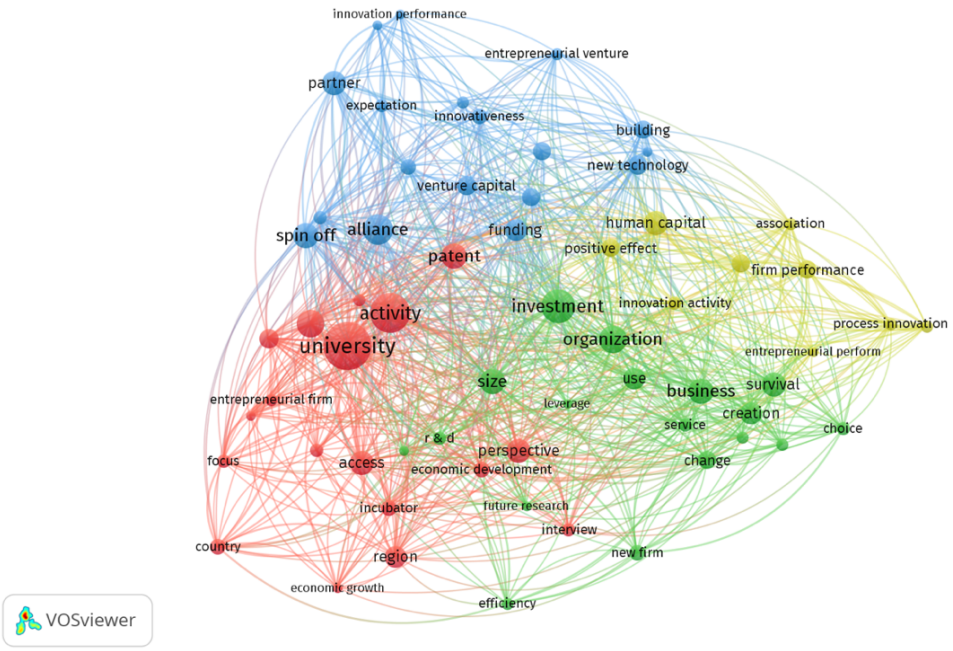

Figure 1 Co-occurrence network from abstract terms

The papers selected to be analysed and codified were sent to three researchers from our research group (Department of Mechanics, Mathematics and Management "DMMM" - Polytechnic of Bari). Their objective was to read the papers, validate our categorization method and codify the articles. Many systematic reviews in fact use two or more independent reviewers to extract data from studies (Denyer and Tranfield 2009).

The classification framework and the descriptions of the 154 papers selected for this analysis are available in Appendix 1 and 2.

Mostly of the papers are published between 2012 and 2019, with 20 publications in 2018 and 2 publications already in 2019 In this context, the subject can be seen as recent and so far largely unexplored in the literature, but it has been rising during the last few years (Figure 2).

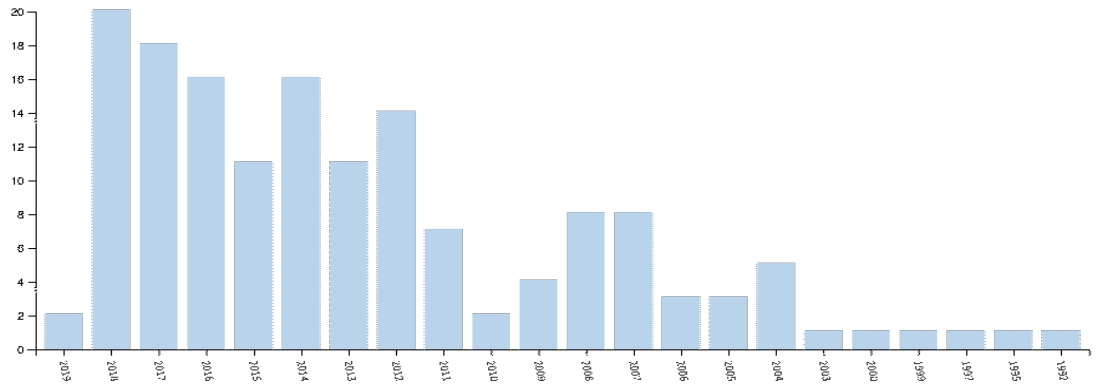

Figure 2 – Number of Articles per year

Interestingly, examining the journals in which the sample articles were published reveals how widespread this topic is in the innovation management literature. Indeed, these articles appear in 17 different journals, mostly top-quality outlets such as Small Business Economy, Research Policy, Strategic Management Journal, Journal of Product Innovation Management and Technovation (as reported in Figure 3).

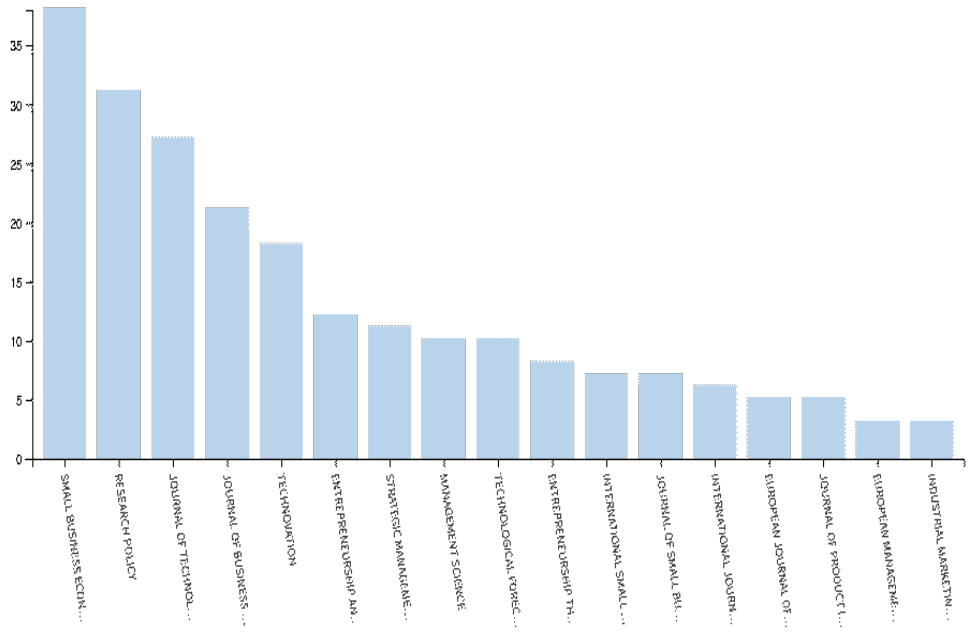

Figure 3 – Number of Articles per Journal

Below, the four dimensions (firm, network, competitive environment, macro environment) are used to group the discussion of the review results. First, the sub-sections are used to analyse and synthesize the key findings. Then, this analysis is used to derive promising directions for future research in this line of inquiry.

2.4 Finding on the factors influencing of Start-Up innovative performances

In this analysis, four main clusters were generated. The results demonstrate that there is no centrality of a specific concept but that some of them appear to be relevant. We used these concepts to extrapolate from each of the 154 articles the main factors affecting the innovative performance of start-ups. The foregoing discussion pointed out that the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels of analysis: the first level explores the main factors affecting the performance within the organizational boundaries (firm level), and the other three levels argued that the external environment can positively or negatively affect companies' innovativeness. In particular, the second level explores all the incubators, alliances and collaborations influencing factors (network level), the third explores the barriers, competitors and economy of scale/scope influencing factors (competitive environment level) and the fourth explores the political, economic, social, technological, environmental and legal influencing factors (macro-environment level).

Influence at the firm level

Analysing the firm level, several authors have considered the development of innovative entrepreneurship to be a significant factor for the success of a start-up (Li, Qu, and Huang 2018) and asserted that innovation orientation positively affects managers' tendency to rely on interpersonal ties to gather knowledge (Schierjott, Brennecke, and Rank 2018).

Moreover, the survival of an innovative company is linked to personal criteria – such as age, gender, belonging to a minority, professional experience and financing sources (Boyer and Blazy 2014) – and to the combined use of internal resources.

In particular, when the combination of intellectual resources and product innovation capability, in addition to the combination of reputational resources and marketing capability, is high, the company growth is enhanced (O'Cass and Sok 2014). Different forms of capital (financial, human, social, etc.) play a significant role in the innovation and performance of start-ups. Companies launched by a team of founders are more likely to succeed than companies launched by individuals in terms of organizational innovation and organizational performance, capital impacts on firm survival, the "quality" of new business start-ups and investment returns (Robson et al. 2012). This is due to the ability of the team to merge and share experiences and skills through common learning and the ability to accumulate knowledge (Santarelli and Tran 2013; Agarwal and Shah 2014). Knowledge is recognized as a key factor for economic growth, especially if it is transformed into products and services. Firms that seek to exploit opportunities based on existing market knowledge are more likely to attain substantial growth (Saemundsson and Dahlstrand 2005). Having a diversified and qualified team of employees (Moser and Kalton 2017), with different skills or abilities to produce, identify and exploit knowledge (Ben-Hafaïedh, Micozzi, and Pattitoni 2018) as well as heterogeneous and complementary experiences (Moeen and Agarwal 2017) contributes to increasing the effectiveness of most start-ups in achieving successful economic growth (Aspelund, Berg-Utby, and Skjevdal 2005).

In particular, outside board-specific experience, diversity and tenure are important determinants of firm performance (Calcagnini et al. 2016), helping to acquire diversified knowledge with technological and market benefits (Stern and Henderson 2004; Matusik and Fitza 2012). In the field of the workforce, a U-shaped relationship exists between the external labour turnover of regular employees and the probability of product innovation

(Kato and Zhou 2018). The role of initial worker and job characteristics (e.g., qualification, age, number of employees and marginal employment) of start-ups can determine the variation in their performance (Koch, Späth, and Strotmann 2013; Held, Herrmann, and van Mossel 2018). Operating under high levels of uncertainty and limited public recognition, one of the most significant challenges for new ventures is attracting qualified employees (Moser and Kalton 2017). Among the challenges of a team, such as creating a new venture or solving a start-up problem, entrepreneurship education has great importance (Backes-Gellner and Werner 2007; Dutta and Folta 2016). In particular, ventures cannot ignore the founding team composition and expect to professionalize their top management teams later to align with their strategy and environment (Lee and Eesley 2018). New innovative ventures enable economic development, particularly when start-ups are created by employee, academic and user innovators (Agarwal and Shah 2014). In addition, the former employers' characteristics can influence the creation of these entrepreneurial ventures (Vivarelli 2004; Chatterji 2009; Rubin, Aas, and Stead 2015). These characteristics and others, such as observable resources, particularly patents, alliances and team experience, are known to affect a start-up's ability to attract venture capital financing (J. A. C. Baum and Silverman 2004; Coad, Nielsen, and Timmermans 2017). Each strategic dimension (networks of alliances, control of internal resources and participation) produces distinct strategies (e.g. cost, quality, differentiation, etc.) that lead to the success of a start-up (Brush and Chaganti 1999; Robson et al. 2012). However, concrete business strategic choices in addition to the development of high-tech products (Bayus and Agarwal 2007) are essential to increase the financing opportunities. To be sustainable, a start-up has to implement goal attainment, pattern maintenance, social networking, economic optimization and the balancing of the related types of capital (Groen, Wakkee, and De Weerd-Nederhof 2008).

In the management of an innovative company, in addition to strategic choices, prejudices and heuristics are an effective and efficient guide to decision making in conditions of

uncertainty and environmental complexity (Manimala 1992; Busenitz and Barney 1997). An essential condition for growth is cooperation; in particular, the variation in the composition of the alliance network enhances the early performance of a start-up (J. A. Baum, Calabrese, and Silverman 2000).

Influence at the network level

Several authors have considered a business incubator and its resources as a key asset to support the commercialization of laboratory research results for innovative new science and technology-based firms (NSTBF) (M'Chirgui et al. 2018), creating an environment that protects start-ups from unfavourable institutions (van Weele et al. 2018). However, the technical–financial support of an incubator has a positive influence on all levels of innovation activity in all regions (Xiao and North 2018), but the effects of incubation services on the initial growth of new technology-based businesses vary according to the local context (Xiao and North 2017). TBI mechanisms and policies are important tools for supporting innovation and technology-oriented entrepreneurial growth (S. Mian, Lamine, and Fayolle 2016), and their support is important to enhance the effect of strategy on performance (Soetanto and Jack 2016). The incubates in some types of incubators are more prone to generate product and technological process innovations than those hosted in other types (Barbero et al. 2014). Moreover, the collaboration between incubates and incubator management increases incubates' financial knowledge and their likelihood of raising capital (Rubin, Aas, and Stead 2015).

Some authors have considered the alliance of spin-offs with other firms to be strategic (Hagedoorn, Lokshin, and Malo 2018) to improve resources, knowledge and competence (Parida et al. 2017). In addition, hybrid alliances, which combine exploration and exploitation activities, can lead to synergies to improve alliance innovation performance (Colombo and Grilli 2005). Therefore, high-technology start-ups' innovative capability and inter-firm network (Zheng, Liu, and George 2010) bring about a competitive advantage,

innovations (Littunen and Tohmo 2003) and employment growth during their early life course (Stam and Wennberg 2009) and consequently a growing complementary effect of innovative capability and network heterogeneity on firm valuation (Zheng, Liu, and George 2010). However, not only the networks (Hayter 2013) but also the characteristics of the firm, the entrepreneurs and the market environment are important, leading to improved entrepreneurial performance and participation in collaborative agreements (Y. Kim and Vonortas 2014).

Other authors have considered the role of universities as generators and disseminators of valuable knowledge (Fischer et al. 2018) and university–industry collaboration (S.-H. Chang 2017) as a key asset to enhance the capabilities/efficiencies of innovation systems and the access to financial capital (Partanen, Chetty, and Rajala 2014; Soetanto and van Geenhuizen 2015). Therefore, the social identification with the network acts as a key moderation mechanism (Bond, Houston, and Tang 2008). However, the inter-partner dissimilarities in industry–university (IU) alliances can trigger particular coordination and cooperation patterns (Estrada et al. 2016), supporting the internationalization of new ventures (Murmann, Ozdemir, and Sardana 2015).

Influence at the competitive environment level

At the competitive environment level, several authors have considered as influencing factors marketing skills, through design and product innovations (S.-H. Chen 2016), the combination of different knowledge and the use of entrepreneurial strategies (D. Miller and Le Breton-Miller 2017), as well as the presence of corporate structural elements (Protogerou, Caloghirou, and Vonortas 2017). The use and implementation of information and communication technologies (ICTs) in business management have become crucial for the growth of a competitive advantage in the market (Steinfield, Scupola, and Lopez-Nicolas 2010). The growth prospects of a company also depend on its ability to maintain a competitive advantage by exploiting the opportunities available on the market (Gruber,

MacMillan, and Thompson 2008). Moreover, the acquisition of innovative and entrepreneurial firms is considered to be an important issue in gaining competitive advantages (Lehmann and Schwerdtfeger 2016).

Influence at the macro-environment level

At the macro-environment level, several authors have considered venture capital and its programmes as important tools to finance knowledge-intensive enterprises (Rossi et al. 2017), creating value for the investing firms in terms of growth (S. J. Chang 2004; Bertoni, Colombo, and Grilli 2011). There are different types of private investors operating in the field of start-ups, such as "venture capital" and "business angels", which contribute equally to innovation rates, but these effects are non-additive (Dutta and Folta 2016). Investors have realized that the economy of culture exists and is a field of innovation, which allows start-ups to develop a certain ability to innovate their business and management processes, making them attractive to investors (Wolfe 2012). An important step for a start-up that operates in the innovation ecosystem is to be listed on the stock exchange (Parhankangas 2012). In the field of external funding, some authors have pointed out that governmental venture capital investors (GVCs) stimulate invention and innovation and are an ineffective substitute, but an effective complement, of IVCs. Moreover, the social capital of venture capitalists (VCs) has a positive effect on the funding of start-ups, allowing superior access to information about investment objects and opportunities to leverage them in the future (Alexy et al. 2012). However, GVCs boost the impact of independent venture capital investors (IVCs) on both invention and innovation (Bertoni and Tykvová 2015). Among venture capital programmes, there are innovation investment funds that support new innovation funds and fund managers with expertise in early-stage venture capital investing (Cumming 2007); moreover, the financing of companies' growth could be solved by encouraging open innovation for large groups (Ferrary 2011). Nevertheless, start-ups that have participated in an open

standards community (the Internet Engineering Task Force (IETF)) have a greater likelihood of achieving an initial public offering or acquisition (Waguespack and Fleming 2009). Other initiatives that have contributed to the growth of an enterprise in terms of profit, survival and reputation are so-called M&A transactions, allowing the company to expand not only locally but also internationally (Yim 2008), but the key to economic development is new technology ventures, which could rejuvenate industries with disruptive technologies (Song et al. 2007). Therefore, investing in an equity fund involves implicit risks, and, for these reasons, some authors have considered investment in an arbitrage strategy for M&A transactions as a strategic alternative. Other authors have examined the economic impact of venture capital on the commercialization direction of technology-based start-ups (Hsu 2007), with substantial boosts in both cooperative activity associated with VC-backed firms and in the likelihood of an initial public offering, as well as the importance of business evaluation, in terms of intangible assets (trademark registration, patent protection, etc.) and of tangible assets (starting capital and the stage of product development) in their financing by venture capitalists (Heirman and Clarysse 2007). Patents and trademarks, in fact, have the function of facilitating relations with external partners to acquire financing, ensuring an increase in attractiveness to investors (Block and Wagner 2014; Maresch et al. 2016). To support the development of innovative products in addition to venture capital, there are other forms of alternative finance for start-ups, in particular reward-based crowdfunding, which ignites professional investors' interest, helping to secure subsequent funding (Roma, Messeni Petruzzelli, and Perrone 2017). The new industrial policies of governments encourage companies to invest resources in production inventions through subsidies, which include access to non-financial resources (networks and business knowledge) and the reduction of administrative burdens (Patzelt and Shepherd 2009), improving the competitiveness of the country's system.

Among the public initiatives to support the competitiveness and success of start-ups, some authors have considered programmes for technological innovation to provide indirect support, improving the investment efficiency in R&D (Söderblom et al. 2015) as well as international research joint ventures and their positive impact on the technological assets of participants (Barajas, Huergo, and Moreno 2016). In the field of academic research, spin-offs enterprises (RSOs) originating from a university or research institute appear to have greater innovative potential and capabilities than other start-ups, pursuing several business models (Clausen and Rasmussen 2013; Lejpras 2014). Moreover, the presence of academic and non-academic profiles in the entrepreneurial/management team (Visintin and Pittino 2014), as well as specific characteristics of the regional environment of the spin-off founder (Sternberg 2014) and the knowledge and technology intensity of the industry matter, have a high impact on start-ups in terms of growth (Lööf and Nabavi 2014)). Moreover, the introduction of PRFS leads to an increase in research productivity (Cattaneo, Meoli, and Signori 2016).

Other authors have asserted that the mere local availability of a university may not per se guarantee access to knowledge and resources; social ties and social–spatial strategies are additionally required (Lange 2011; Heblich and Slavtchev 2014), underscoring the need to reconsider assumptions regarding the importance of the social and cognitive dimensions of proximity in the acquisition of knowledge from their customers (Presutti, Boari, and Majocchi 2011). Other important aspects are functional integration and spatial proximity, which are particularly decisive for a start-up's development (Koch, Späth, and Strotmann 2013).

In modern industrial economies, investment in innovation is a fundamental driver of growth in all local economic systems. Another innovative factor for the economic growth of an innovative company is the use of mobile applications and collaborations with the open source software (OSS) community, which have enabled software entrepreneurial ventures to achieve superior innovation performance (Piva, Rentocchini, and

Rossi-Lamastra 2012) and to coordinate the activities of geographically distant subjects (Ehrenhard et al. 2017). The success of an innovative start-up will be realized through the innovation of products and processes, but, while the latter can generate added value in the long term, at the product level, the result will take place immediately, and the same generated product should be implemented to avoid running out in the long term (Santi and Santoleri 2017). Some authors have asserted that start-ups that are engaged in both product innovation and process innovation, with a key role of the latter, are more likely to succeed (Colombelli, Krafft, and Quatraro 2013). Another important aspect to consider is speed as a strategic factor within the concept of innovation for growth, profitability and financial independence (Heirman and Clarysse 2007). However, at the basis of a robust innovation system of an innovative company are the organizational changes, in which multiple organizational dimensions can be aligned to produce a synergistic effect while taking into account the specific characteristics and challenges of interindustry architectural innovations (Jaspers, Prencipe, and van den Ende 2012).

Innovation also concerns commercializing through UTTOs (university technology transfer offices), which commercialize patent-protected technologies; the greater revenues the streams, the more new ventures they create (Markman et al. 2005; Slavtchev and Göktepe-Hultén 2016). Some authors have considered the availability of university-related proof of concept centres (PoCCs) as a possible key factor for the creation of a national innovation system (Bradley, Hayter, and Link 2013) as well as the use of a "scientific–economic" approach by the university or higher education institution (HEI) to protect and commercialize its knowledge (Huggins 2008). In this context, universities that produce innovation in scientific knowledge play an important role in the commercialization of technologies and knowledge spillovers, encouraging the establishment of channels for the exchange of information and skills and contributing to the development of new ideas and new applications (J. Wang and Shapira 2012). Some authors have asserted that the strategic priorities for knowledge transfer are reflected in

activity in terms of the dominance of specific knowledge transfer channels, the partners with which universities engage and the geography of business engagement (Hewitt-Dundas 2012). Moreover, researchers working in an intra-organizational climate that supports commercialization and encourages intra-organizational boundary spanning will be more likely to produce invention disclosures and patents (Helmers and Rogers 2011).

2.5 Discussion, future directions and conclusion

The multi-level analyses reveal different typologies of influence and multiple impacts due to the complexity of the phenomenon analysed. Building on this framework review, we identified the central issues and the key research gaps. The results reveal that the existing papers are mostly conceptual and that quantitative methods are still lacking, although there is a good balance between theoretical studies and empirical ones. Developed countries, especially the Central European region, figure as the centre of the research production, while Latin America and Asia appear only in a few papers on the list. The literature analysis also shows that the majority of the studies have focused on the analysis of indicators: some have analysed a single indicator, while others have used two or more indicators to generate a more complex construct. These studies confirm that the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels of analysis. Figure 4 summarizes the theoretical contributions of this research corpus.

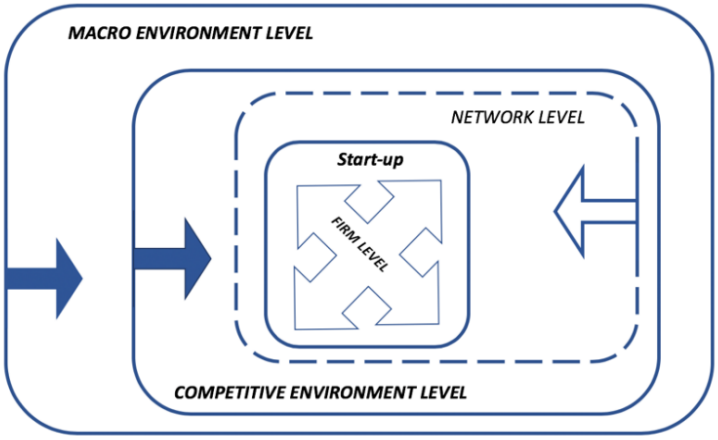

Figure 4: A theoretical framework of the actual knowledge corpus

Influence at Firm Level

The analysis carried out on the main influencing factors operating at firm level show positive or multiple impacts. Literature, at this level, stressed the importance of combination of intellectual resources and product innovation capability (Schierjott, Brennecke, and Rank 2018; Boyer and Blazy 2014; O'Cass and Sok 2014) highlighting the importance of human capital for the performances improvement. Hence we suggest more structured research on how start-ups leverage on high skilled workforces. That's why being able to recruit the best possible candidates can give a startup a great value added. Consolidated companies can afford to hire people based on their culture fit and this makes sense for them to take a chance on someone who is inexperienced as long as they are willing to learn and mesh well with the existing team. But most startups in their first few years of business don't have time to train and invest into these high-risk, high-reward candidates. They need someone who is high-reward from the first day of work (Backes-Gellner and Werner 2007; Dutta and Folta 2016).

Another crucial area of investigation regards founders and CEO experience. Some authors consider age—and by extension, experience—as a negative signal (Koch, Späth, and Strotmann 2013; Held, Herrmann, and van Mossel 2018). This view has been expressed

explicitly by some, and appears implicitly endorsed by several prominent investors. Others believe that experience greatly improves a startup's chances of success due to the ability to manage internal resources in the commercialization process, the ability to access to new market knowledge and new business opportunities (Huang, Lai, and Lo 2012).

Influences at Network Level

At the network level, literature focused on the key role played by incubators for new firm generation and the constant support during the phase of star-up (M'Chirgui et al. 2018; van Weele et al. 2018; Xiao and North 2017). Accordingly, the emerging suggestions could be useful to enlarge the debate going deep into the discussion on the knowledge and information sharing mechanism between business incubators and incubates and the effect of the different services offered as key assets to the commercialization of research results (M'Chirgui et al. 2018). Also the findings we discussed reveal a strong influence generated by technical–financial resources (Xiao and North 2018) and by external collaboration agreements. So future research need to put attention and focus on the collaboration between incubates and incubator management and rules (Rubin, Aas, and Stead 2015), the alliance between spin-offs and external stakeholders (Parida et al. 2017; Hagedoorn, Lokshin, and Malo 2018), the role of universities as generators and disseminators of valuable knowledge (S.-H. Chang 2017; Fischer et al. 2018) and a clear understanding of the key asset enhancing the capabilities/efficiencies of innovation systems and the access to financial capital (Partanen, Chetty, and Rajala 2014; Soetanto and van Geenhuizen 2015).

Influences at Competitive Environment Level

It is customary to think that the less competition a business faces, the more it thrives. But some scholars shows that exposure to competition in the early phase of a firm's life can increases the long-term survival prospects. As the market for startups is characterized by

uncertainty and also because they are completely new businesses, there is a long and stable operating history, since it does not have statistics or experience, which makes them companies with high risk of mortality in the first years of activity.. So, if a firm stand up during this early period, it is more likely to increase its market share. The great challenge of these companies is to remain essentially creative not only in innovation in products or services, but also in the company's management mechanisms.

Even if several studies analysed how entrepreneurial strategy together with specific market skills (S.-H. Chen 2016) can support startups growth in the competitive environment, it emerges the need to focus attention on which specific marketing skills a start-up requires and compare them with those of consolidated companies (S.-H. Chen 2016). In this direction future research need to analysed also the mechanism that lead the entrepreneurial strategies (D. Miller and Le Breton-Miller 2017) through new approaches as for example neuromarketing and social and sentiment analysis. New technologies and tools can support star-ups in the process of surpassing the death-valley and to acquire a precise market position (Steinfield, Scupola, and Lopez-Nicolas 2010).

Influences at Macro Environment Level

The macro environmental includes all the indirect factors affecting start-up growth. Conducting a macro environment analysis within which the business is operating will help in determining the outcomes of a strategy. This analysis includes political, economic, social-cultural, technological, legal and environmental factors that affect business. In this sense, literature mainly focuses on political and economic aspects like the role played by venture capital, angel investment, policy programmes, market shocks for the development of innovative products (Block and Wagner 2014; Maresch et al. 2016; Roma, Messeni Petruzzelli, and Perrone 2017; Patzelt and Shepherd 2009).

Despite this huge attention to political and economic factors, a more contextual study on this topic is required. In particular, it would be useful to know which characteristics ,a

priori , a startup need, in relation to the product/service developed, in order to be considered valuable from a venture capitalits (VCs) or the effect of public/private funds on start-up performances during a long timespam. Legal aspects are another missing topic in the literature. Each Country, through the formation of start-ups, regulates its own legislative system, aiming to favor greater social mobility and a reversal of trends in terms of economic growth and employment, especially for youth employment (Davari and Farokhmanesh 2017). The analysis of regulatory frameworks across Countries at federal, national and municipal levels, would not be sufficiently complete. Every regulatory area should include taxes and securities codes, employment and privacy acts, antitrust laws, advertising, commerce and telecommunications management, intellectual property administration, financial services and insurance acts and, finally, transportation, health and safety codes. Also, regulations have the same power of laws carrying penalties for their violation, since they are adopted by governmental agencies under a granted authority. For this reason, understanding how laws and regulations are recognized by each Country could be helpful to understand how the process of building a start-up is driven by the specific government (Schneider and Teske 1992; Minniti 2008).

Level of analysis	*Findings*	*Research gaps*
Firm level	• The combination of intellectual resources with product innovation capability can improve start-up performance ; • Human capital is crucial for value added generation; • Accurate recruitment procedures can influence value added generation;	• Need of more structured research on how start-ups leverage on high skilled workforces
	• founders and CEO experience can	• Contrasting opinions on this

	positively of negatively influence the start-up growth.	as some consider CEO age and relative experience as a negative signal
Network Level	• Incubation help start-ups to face market challenges;	• It is necessary to strengthen the studies on the relationships between incubans and incubators and above all which services really favor growth
	• university–industry collaborations can favour the access to financial capital • The lack of resources, knowledge and competence is compensated by the generation of alliance with spin-offs or other firms;	• Lack of research on the solutions facilitating collaborations between small firms and universities. • Lack of research on the conditions fostering universities' collaborations with firms.
Competitive Environment level	• entrepreneurial strategy together with specific market skills can support startups growth	• Lack of research on degree of complementarity between members' knowledge in the new configuration.
	• the use of ICT and technological	• Lack of analysis on

	discontinuities determine decisive competitive advantages;	neuromarketing and social and sentiment analysis
	• start-ups need to remain essentially creative not only in innovation in products or services, but also in the company's management mechanisms.	• Few information of process of creative construction: knowledge spillovers, entrepreneurship and economic growth
Macro Environment Level	• venture capital, angel investment, policy programmes, market shocks play a foundamental role for the development of innovative products; • M&A transactions, allowing the company to expand not only locally but also internationally; • knowledge and technology intensity of the industry matter, have a high impact on start-ups in terms of growth; • functional integration and spatial proximity are particularly decisive for a start-up's development	• a deep analysis of the effect of public/private funds on start-up performances during a long timespam • understand how the process of building a start-up is driven by specific government actions.

Table 2: Summary of the Finding and Research gaps

This paper contributes to the innovation management literature by reviewing contributions on the various factors that intervene, at multiple levels, to improve or reduce start-up innovative performances. This study also offers suggestions for future research and provides a novel point of view.

Appendix 1 - Classification framework

A classification framework was developed using the number and letter codes to classify the 154 articles.

Dimension	*Classification*	*Code*
Emphasis (discussion)	Innovative performance as central emphasis	1A
	As support for other discussion/technical aspects	1B
Aspects	Technical	2A
	Human	2B
	Managerial	2C
Research method	Qualitative	3A
	Quantitative	3B
	Mixed	3C
Research design/technique	Case study	4A
	Interviews	4B
	Survey	4C
	Literature review	4D
	Mixed methods	4E
	Simulation/programming/others	4F
Approach	Theoretical/conceptual	5A
	Empirical	5B
Focus	Emerging economies	6A
	Developed economies	6B
	Not applicable	6C
Level of influence	Firm	7A
	Network environment	7B
	Competitive environment	7C
	Macro-environment	7D
Type of influence	Positive	8A
	Negative	8B
	Multiple	8C

Framework with the classification and codes used in the analysis

Appendix 2 - Summary of the 154 articles analyzed

AUTHORS	TITLE	1	2	3	4	5	6	7	8
Dalmarco, Gustavo; Hulsink, Willem; Blois, Guilherme V.	Creating entrepreneurial universities in an emerging economy: Evidence from Brazil	1B	2C	3A	4A	5B	6A	7B	8A
M'Chirgui, Zouhaier; Lamine, Wadid; Mian, Sarfraz; Fayolle, Alain	University technology commercialization through new venture projects: an assessment of the French regional incubator program	1A	2C	3C	4E	5B	6B	7B	8A
van Weele, Marijn; van Rijnsoever, Frank J.; Eveleens, Chris P.; Steinz, Henk; van Stijn, Niels; Groen, Menno	Start-EU-up! Lessons from international incubation practices to address the challenges faced by Western European start-ups	1A	2C	3A	4B	5B	6B	7B	8A
Dan, Sujan M.; Spaid, Brian I.; Noble, Charles H.	Exploring the sources of design innovations: Insights from the computer, communications and audio equipment industries	1A	2C	3B	4F	5A	6C	7D	8C
Held, Lukas; Herrmann, Andrea M.; van Mossel, Allard	Team formation processes in new ventures	1B	2C;2B	3B	4A	5A	6B	7A	8C
Ben-Hafaiedh, Cyrine; Micozzi, Alessandra; Pattitoni, Pierpaolo	Academic spin-offs' entrepreneurial teams and performance: a subgroups approach	1A	2C	3B	4A	5B	6C	7A	8C
Hagedoorn, John; Lokshin, Boris; Malo, Stephane	Alliances and the innovation performance of corporate and public research spin-off firms	1A	2C	3C	4E	5A	6C	7B	8C
Fischer, Bruno Brandao; Schaeffer, Paola Rucker; Vonortas, Nicholas S.; Queiroz, Sergio	Quality comes first: university-industry collaboration as a source of academic entrepreneurship in a developing country	1B	2A;2C	3B	4A	5A	6A	7B	8C
Schierjott, Irena;	Entrepreneurial Attitudes as Drivers of	1B	2B	3B	4C	5B	6B	7A	8A

Brennecke, Julia; Rank, Olaf N.	Managers' Boundary-Spanning Knowledge Ties in the Context of High-Tech Clusters								
Li, Jun; Qu, Jingjing; Huang, Qihai	Why are some graduate entrepreneurs more innovative than others? The effect of human capital, psychological factor and entrepreneurial rewards on entrepreneurial innovativeness	1A	2B;2C	3A	4C	5B	6A	7A	8C
Xiao, Li; North, David	The role of Technological Business Incubators in supporting business innovation in China: a case of regional adaptability?	1B	2A;2C	3B	4A	5A	6A	7B	8A
Kato, Masatoshi; Zhou, Haibo	Numerical labor flexibility and innovation outcomes of start-up firms: A panel data analysis	1A	2B;2C	3C	4C	5B	6C	7A	8A
Yang, Chun; Bossink, Bart; Peverelli, Peter	High-tech start-up firm survival originating from a combined use of internal resources	1B	2C	3A	4D	5B	6A	7A	8A
Chen, Tianxu; Qian, Lihong; Narayanan, Vadake	Battle on the Wrong Field? Entrant Type, Dominant Designs, and Technology Exit	1B	2A	3B	4A	5B	6C	7D	8C
Roma, Paolo; Petruzzelli, Antonio Messeni; Perrone, Giovanni	From the crowd to the market: The role of reward-based crowdfunding performance in attracting professional investors	1A	2C	3B	4A	5A	6C	7D	8A
Colombo, L.; Dawid, H.; Piva, M.; Vivarelli, M.	Does easy start-up formation hamper incumbents' R&D investment?	1A	2C	3A	4F	5A	6C	7A	8A
Moser, Kilian J.; Tumasjan, Andranik; Welpe, Isabell M.	Small but attractive: Dimensions of new venture employer attractiveness and the moderating role of applicants' entrepreneurial behaviors	1A	2B	3C	4F	5A	6C	7A	8A
Miller, Danny; Le Breton-Miller, Isabelle	Sources of Entrepreneurial Courage and Imagination: Three Perspectives, Three Contexts	1B	2B;2C	3A	4D	5A	6C	7C	8A
Santi, Caterina; Santoleri, Pietro	Exploring the link between innovation and growth in Chilean firms	1A	2C	3A	4B	5A	6A	7D	8A
Neubert, Mitchell J.;	The Role of Spiritual Capital in Innovation	1A	2C	3A	4F	5A	6A	7A	8A

Bradley, Steven W.; Ardianti, Retno; Simiyu, Edward M.	and Performance: Evidence from Developing Economies								
Xiao, Li; North, David	The graduation performance of technology business incubators in China's three tier cities: the role of incubator funding, technical support, and entrepreneurial mentoring	1A	2A;2C	3C	4F	5B	6A	7B	8A
Chang, Shu-Hao	The technology networks and development trends of university-industry collaborative patents	1B	2A	3A	4F	5B	6C	7B	8C
Rossi, Matteo; Festa, Giuseppe; Solima, Ludovico; Popa, Simona	Financing knowledge-intensive enterprises: evidence from CVCs in the US	1B	2C	3A	4F	5B	6C	7D	8C
Moeen, Mahka; Agarwal, Rajshree	INCUBATION OF AN INDUSTRY: HETEROGENEOUS KNOWLEDGE BASES AND MODES OF VALUE CAPTURE	1B	2C	3A	4D	5A	6C	7A	8A
Jun, Seung-Pyo; Kim, Sang-Gook; Park, Hyun-Woo	The mismatch between demand and beneficiaries of R&D support programs for SMEs: Evidence from Korean R&D planning programs	1B	2C	3C	4F	5B	6B	7D	8C
Ehrenhard, Michel; Wijnhoven, Fons; van den Broek, Tijs; Stagno, Marc Zinck	Unlocking how start-ups create business value with mobile applications: Development of an App-enabled Business Innovation Cycle	1A	2C	3A	4A	5A	6C	7D	8C
Parida, Vinit; Pesamaa, Ossi; Wincent, Joakim; Westerberg, Mats	Network capability, innovativeness, and performance: a multidimensional extension for entrepreneurship	1B	2B;2C	3A	4F	5A	6C	7B	8A
Lehmann, Erik E.; Schwerdtfeger, Manuel T.	Evaluation of IPO-firm takeovers: an event study	1B	2C	3A	4F	5A	6C	7C	8C
Estrada, Isabel; Faems, Dries; Martin Cruz, Natalia; Perez Santana,	The role of interpartner dissimilarities in Industry-University alliances: Insights from a comparative case study	1B	2B;2C	3A	4A	5A	6C	7B	8C

Pilar									
Slavtchev, Viktor; Goktepe-Hulten, Devrim	Support for public research spin-offs by the parent organizations and the speed of commercialization	1A	2B;2C	3A	4A	5B	6C	7D	8A
Maresch, Daniela; Fink, Matthias; Harms, Rainer	When patents matter: The impact of competition and patent age on the performance contribution of intellectual property rights protection	1B	2C	3B	4A	5B	6C	7D	8A
Barajas, Ascension; Huergo, Elena; Moreno, Lourdes	SME Performance and Public Support for International RJVs*	1B	2A;2C	3A	4F	5B	6B	7D	8A
Colombelli, Alessandra; Krafft, Jackie; Vivarelli, Marco	To be born is not enough: the key role of innovative start-ups	1B	2C	3A	4F	5B	6C	7D	8C
Vandenbroucke, Elien; Knockaert, Mirjam; Ucbasaran, Deniz	Outside Board Human Capital and Early Stage High-Tech Firm Performance	1B	2B	3A	4C	5B	6B	7A	8A
Xiao, Li; Ramsden, Mark	Founder Expertise, Strategic Choices, Formation, and Survival of High-Tech SMEs in China: A Resource-Substitution Approach	1B	2B;2C	3C	4B	5B	6A	7A	8C
Mian, Sarfraz; Lamine, Wadid; Fayolle, Alain	Technology Business Incubation: An overview of the state of knowledge	1B	2C	3A	4D	5A	6C	7B	8C
Soetanto, Danny; Jack, Sarah	The impact of university-based incubation support on the innovation strategy of academic spin-offs	1B	2C	3A	4F	5B	6B	7B	8A
Cattaneo, Mattia; Meoli, Michele; Signori, Andrea	Performance-based funding and university research productivity: the moderating effect of university legitimacy	1B	2C	3A	4C	5B	6B	7D	8C
Zhou, Haibo; Sandner, Philipp G.; Martinelli, Simon Luca; Block, Joern H.	Patents, trademarks, and their complementarity in venture capital funding	1B	2A;2C	3A	4F	5A	6C	7D	8A
Dutta, Supradeep; Folta, Timothy B.	A comparison of the effect of angels and venture capitalists on innovation and value	1B	2C	3C	4A	5B	6C	7D	8A

	creation								
Harms, Rainer	Self-regulated learning, team learning and project performance in entrepreneurship education: Learning in a lean startup environment	1B	2B	3A	4F	5B	6C	7A	8A
Soderblom, Anna; Samuelsson, Mikael; Wiklund, Johan; Sandberg, Rickard	Inside the black box of outcome additionality: Effects of early-stage government subsidies on resource accumulation and new venture performance	1B	2C	3C	4F	5B	6C	7D	8C
Colombo, Massimo G.; Doganova, Liliana; Piva, Evila; D'Adda, Diego; Mustar, Philippe	Hybrid alliances and radical innovation: the performance implications of integrating exploration and exploitation	1B	2B	3C	4A	5B	6B	7B	8C
Murmann, Johann Peter; Ozdemir, Salih Zeki; Sardana, Deepak	The role of home country demand in the internationalization of new ventures	1B	2C	3C	4C	5B	6B	7D	8A
Rubin, Tzameret H.; Aas, Tor Helge; Stead, Andrew	Knowledge flow in Technological Business Incubators: Evidence from Australia and Israel	1B	2B;2C	3A	4A	5B	6B	7B	8C
Kolb, Cornelia; Wagner, Marcus	Crowding in or crowding out: the link between academic entrepreneurship and entrepreneurial traits	1B	2B;2C	3A	4A	5B	6B	7A	8C
Hoenig, Daniel; Henkel, Joachim	Quality signals? The role of patents, alliances, and team experience in venture capital financing	1B	2A;2C	3A	4C	5B	6B	7A	8C
Bertoni, Fabio; Tykvova, Tereza	Does governmental venture capital spur invention and innovation? Evidence from young European biotech companies	1A	2C	3A	4F	5A	6B	7D	8A
Soetanto, Danny; van Geenhuizen, Marina	Getting the right balance: University networks' influence on spin-offs' attraction of funding for innovation	1B	2C	3C	4A	5B	6C	7B	8A
Dai, Xiaoyong; Cheng, Liwei	The effect of public subsidies on corporate R&D investment: An application of the	1B	2C	3C	4F	5B	6A	7D	8C

	generalized propensity score								
Eesley, Charles E.; Hsu, David H.; Roberts, Edward B.	THE CONTINGENT EFFECTS OF TOP MANAGEMENT TEAMS ON VENTURE PERFORMANCE: ALIGNING FOUNDING TEAM COMPOSITION WITH INNOVATION STRATEGY AND COMMERCIALIZATION ENVIRONMENT	1A	2C	3A	4C	5B	6C	7A	8C
Marx, Matt; Gans, Joshua S.; Hsu, David H.	Dynamic Commercialization Strategies for Disruptive Technologies: Evidence from the Speech Recognition Industry	1B	2A;2C	3A	4F	5B	6C	7C	8C
Partanen, Jukka; Chetty, Sylvie K.; Rajala, Arto	Innovation Types and Network Relationships	1A	2C	3A	4F	5A	6C	7B	8A
Agarwal, Rajshree; Shah, Sonali K.	Knowledge sources of entrepreneurship: Firm formation by academic, user and employee innovators	1B	2C	3A	4D	5A	6C	7A	8A
Criaco, Giuseppe; Minola, Tommaso; Migliorini, Pablo; Serarols-Tarres, Christian	To have and have not: founders' human capital and university start-up survival	1B	2C	3A	4F	5A	6C	7A	8C
Lejpras, Anna	How innovative are spin-offs at later stages of development? Comparing innovativeness of established research spin-offs and otherwise created firms	1A	2C	3A	4A	5A	6B	7D	8A
Loof, Hans; Nabavi, Pardis	Survival, productivity and growth of new ventures across locations	1A	2C	3A	4A	5B	6B	7D	8C
Anokhin, Sergey; Wincent, Joakim	Technological arbitrage opportunities and interindustry differences in entry rates	1A	2C	3C	4F	5B	6C	7D	8A
Boyer, Tristan; Blazy, Regis	Born to be alive? The survival of innovative and non-innovative French micro-start-ups	1A	2B	3C	4F	5A	6B	7A	8C
Barbero, Jose L.; Casillas, Jose C.; Wright, Mike; Ramos Garcia, Alicia	Do different types of incubators produce different types of innovations?	1B	2A;2C	3B	4A	5B	6C	7B	8A

Sternberg, Rolf	Success factors of university-spin-offs: Regional government support programs versus regional environment	1B	2C	3A	4F	5B	6C	7D	8A
Rasmussen, Einar; Mosey, Simon; Wright, Mike	The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures	1B	2C	3A	4A	5A	6C	7B	8C
Heblich, Stephan; Slavtchev, Viktor	Parent universities and the location of academic startups	1A	2B;2C	3A	4A	5B	6C	7D	8C
Visintin, Francesca; Pittino, Daniel	Founding team composition and early performance of university Based spin-off companies	1B	2C	3A	4F	5B	6B	7D	8A
Hayter, Christopher S.	Conceptualizing knowledge-based entrepreneurship networks: perspectives from the literature	1B	2C	3A	4D	5B	6C	7B	8A
Clausen, Tommy H.; Rasmussen, Einar	Parallel business models and the innovativeness of research-based spin-off ventures	1B	2C	3B	4A	5B	6B	7D	8A
Koch, Andreas; Spaeth, Jochen; Strotmann, Harald	The role of employees for post-entry firm growth	1A	2B;2C	3A	4A	5B	6B	7A	8C
Bradley, Samantha R.; Hayter, Christopher S.; Link, Albert N.	Proof of Concept Centers in the United States: an exploratory look	1A	2A	3A	4B	5B	6B	7D	8A
Robson, Paul; Akuetteh, Charles; Stone, Ian; Westhead, Paul; Wright, Mike	Credit-rationing and entrepreneurial experience: Evidence from a resource deficit context	1A	2B	3A	4A	5B	6A	7A	8A
Dick, Johannes M. H.; Hussinger, Katrin; Blumberg, Boris; Hagedoorn, John	Is success hereditary? Evidence on the performance of spawned ventures	1B	2B;2C	3C	4A	5B	6B	7A	8A
Bertoni, Fabio; Colombo, Massimo G.; Grilli, Luca	Venture capital investor type and the growth mode of new technology-based firms	1A	2C	3A	4A	5A	6C	7D	8A
Santarelli, Enrico; Hien	The interplay of human and social capital	1A	2B	3A	4A	5A	6A	7A	8A

Thu Tran	in shaping entrepreneurial performance: the case of Vietnam								
Alexy, Oliver T.; Block, Joern H.; Sandner, Philipp; Ter Wal, Anne L. J.	Social capital of venture capitalists and start-up funding	1B	2C	3A	4A	5B	6C	7D	8A
Audretsch, David B.; Huelsbeck, Marcel; Lehmann, Erik E.	Regional competitiveness, university spillovers, and entrepreneurial activity	1A	2B;2C	3A	4A	5A	6C	7C	8A
Robson, Paul J. A.; Akuetteh, Charles K.; Westhead, Paul; Wright, Mike	Innovative opportunity pursuit, human capital and business ownership experience in an emerging region: evidence from Ghana	1A	2B	3A	4F	5A	6A	7A	8C
Siegel, Donald S.; Wessner, Charles	Universities and the success of entrepreneurial ventures: evidence from the small business innovation research program	1A	2C	3B	4A	5B	6B	7B	8C
Huang, Hao-Chen; Lai, Mei-Chi; Lo, Kuo-Wei	Do founders' own resources matter? The influence of business networks on start-up innovation and performance	1A	2B;2C	3A	4A	5B	6A	7A	8A
Jaspers, Ferdinand; Prencipe, Andrea; van den Ende, Jan	Organizing Interindustry Architectural Innovations: Evidence from Mobile Communication Applications	1A	2A	3A	4E	5A	6C	7D	8A
Piva, Evila; Rentocchini, Francesco; Rossi-Lamastra, Cristina	Is Open Source Software about Innovation? Collaborations with the Open Source Community and Innovation Performance of Software Entrepreneurial Ventures	1B	2A;2B	3A	4D	5A	6C	7D	8A
Matusik, Sharon F.; Fitza, Markus A.	Diversification in the venture capital industry: leveraging knowledge under uncertainty	1B	2B;2C	3A	4F	5A	6C	7A	8A
Maine, Elicia; Lubik, Sarah; Garnsey, Elizabeth	Process-based vs. product-based innovation: Value creation by nanotech ventures	1A	2C	3A	4A	5A	6C	7D	8A
Hewitt-Dundas, Nola	Research intensity and knowledge transfer	1A	2C	3A	4F	5A	6B	7D	8C

	activity in UK universities								
Wang, Jue; Shapira, Philip	Partnering with universities: a good choice for nanotechnology start-up firms?	1A	2C	3A	4F	5A	6B	7D	8A
Parhankangas, Annaleena; Lindholm-Dahlstrand, Asa	Spin-offs to stock markets as a complementary form of entrepreneurship: Contrasting US, UK and Japanese experiences	1A	2C	3A	4A	5B	6B	7D	8A
Hunter, Emily M.; Perry, Sara Jansen; Currall, Steven C.	Inside multi-disciplinary science and engineering research centers: The impact of organizational climate on invention disclosures and patents	1B	2C	3C	4A	5B	6C	7D	8A
Helmers, Christian; Rogers, Mark	Does patenting help high-tech start-ups?	1A	2C	3B	4A	5B	6B	7D	8A
Bertoni, Fabio; Colombo, Massimo G.; Grilli, Luca	Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects	1A	2C	3B	4A	5B	6B	7D	8A
Presutti, Manuela; Boari, Cristina; Majocchi, Antonio	The Importance of Proximity for the Start-Ups' Knowledge Acquisition and Exploitation	1A	2C	3A	4F	5A	6C	7D	8A
Balasubramanian, Natarajan	New Plant Venture Performance Differences Among Incumbent, Diversifying, and Entrepreneurial Firms: The Impact of Industry Learning Intensity	1B	2C	3C	4A	5B	6B	7A	8A
Lange, Bastian	Professionalization in space: Social-spatial strategies of culturepreneurs in Berlin	1A	2B;2C	3A	4F	5A	6B	7D	8C
Zheng, Yanfeng; Liu, Jing; George, Gerard	The dynamic impact of innovative capability and inter-firm network on firm valuation: A longitudinal study of biotechnology start-ups	1B	2A;2C	3A	4A	5B	6C	7B	8A
Steinfield, Charles; Scupola, Ada; Lopez-Nicolas, Carolina	Social capital, ICT use and company performance: Findings from the Medicon Valley Biotech Cluster	1A	2C	3A	4C	5A	6B	7C	8A
Stam, Erik; Wennberg, Karl	The roles of R&D in new firm growth	1A	2C	3A	4A	5A	6C	7B	8A
Waguespack, David M.;	Scanning the Commons? Evidence on the	1A	2C	3A	4F	5A	6C	7D	8A

Fleming, Lee	Benefits to Startups Participating in Open Standards Development								
Chatterji, Aaron K.	SPAWNED WITH A SILVER SPOON? ENTREPRENEURIAL PERFORMANCE AND INNOVATION IN THE MEDICAL DEVICE INDUSTRY	1B	2C	3A	4F	5A	6C	7A	8C
Patzelt, Holger; Shepherd, Dean A.	Strategic Entrepreneurship at Universities: Academic Entrepreneurs' Assessment of Policy Programs	1B	2C	3C	4A	5B	6C	7D	8A
Gruber, Marc; MacMillan, Ian C.; Thompson, James D.	Look before you leap: Market opportunity identification in emerging technology firms	1B	2C	3A	4D	5B	6C	7C	8C
Bond, Edward U., III; Houston, Mark B.; Tang, Yihui (Elina)	Establishing a high-technology knowledge transfer network: The practical and symbolic roles of identification	1B	2C	3A	4A	5B	6B	7B	8A
Yim, Hyung Rok	Quality shock vs. market shock: Lessons from recently established rapidly growing US startups	1A	2C	3C	4F	5B	6C	7D	8A
Wong, Poh Kam; Lee, Lena; Foo, Maw Der	Occupational choice: The influence of product vs. process innovation	1B	2A;2C	3A	4D	5A	6C	7D	8A
Lin, Pei-Chou; Huang, Deng-Shing	Technological regimes and firm survival: Evidence across sectors and over time	1B	2A	3A	4F	5B	6C	7D	8A
Naude, Wim; Gries, Thomas; Wood, Eric; Meintjies, Aloe	Regional determinants of entrepreneurial start-ups in a developing country	1A	2C	3A	4A	5B	6A	7D	8C
Huggins, Robert	Universities and knowledge-based venturing: finance, management and networks in London	1A	2C	3A	4A	5A	6B	7D	8A
Song, Michael; Podoynitsyna, Ksenia; van der Bij, Hans; Halman, Johannes I. M.	Success factors in new ventures: A meta-analysis	1A	2A	3B	4A	5B	6B	7D	8A
Bayus, Barry L.; Agarwal, Rajshree	The role of pre-entry experience, entry timing, and product technology strategies in explaining firm survival	1A	2A;2C	3A	4A	5B	6B	7A	8C

Heirman, Ans; Clarysse, Bart	Which tangible and intangible assets matter for innovation speed in start-ups?	1B	2C	3A	4F	5A	6C	7D	8C
Backes-Gellner, Uschi; Werner, Arndt	Entrepreneurial signaling via education: A success factor in innovative start-ups	1A	2B;2C	3A	4A	5B	6B	7A	8C
Mueller, Pamela	Exploiting entrepreneurial opportunities: The impact of entrepreneurship on growth	1B	2B	3A	4F	5A	6C	7A	8A
Cumming, Douglas	Government policy towards entrepreneurial finance: Innovation investment funds	1A	2C	3C	4F	5B	6B	7D	8A
Mann, Ronald J.; Sager, Thomas W.	Patents, venture capital, and software start-ups	1A	2C	3A	4F	5A	6C	7D	8A
Hsu, DH	Venture capitalists and cooperative start-up commercialization strategy	1A	2C	3A	4F	5A	6B	7D	8A
Chang, YC; Chen, MH; Hua, MS; Yang, PY	Managing academic innovation in Taiwan: Towards a 'scientific-economic' framework	1A	2C	3A	4C	5A	6B	7D	8A
Aspelund, A; Berg-Utby, T; Skjevdal, R	Initial resources' influence on new venture survival: a longitudinal study of new technology-based firms	1A	2A	3A	4C	5A	6B	7A	8A
Markman, GD; Gianiodis, PT; Phan, PH; Balkin, DB	Innovation speed: Transferring university technology to market	1B	2A	3A	4D	5A	6C	7D	8A
Saemundsson, R; Dahlstrand, AL	How business opportunities constrain young technology-based firms from growing into medium-sized firms	1A	2A;2C	3A	4F	5A	6B	7A	8C
Kim, SH; Nam, S	Across the threshold: Role of performance and compatibility in innovative new products' market penetration	1B	2C	3A	4F	5A	6C	7A	8C
Chang, SJ	Venture capital financing, strategic alliances, and the initial public offerings of Internet startups	1A	2C	3A	4F	5A	6C	7D	8A
Vivarelli, M	Are all the potential entrepreneurs so good?	1B	2C	3A	4A	5B	6B	7A	8A
Baum, JAC; Silverman, BS	Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and	1A	2C	3A	4F	5A	6C	7A	8C

	performance of biotechnology startups								
Stern, I; Henderson, AD	Within-business diversification in technology-intensive industries	1A	2C	3A	4F	5A	6B	7A	8A
Littunen, H; Tohmo, T	The high growth in new metal-based manufacturing and business service firms in Finland	1A	2C	3C	4A	5B	6B	7B	8A
Baum, JAC; Calabrese, T; Silverman, BS	Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology	1B	2C	3A	4F	5A	6C	7A	8C
Brush, CG; Chaganti, R	Businesses without glamour? An analysis of resources on performance by size and age in small service and retail firms	1B	2B	3C	4C	5A	6B	7A	8C
Busenitz, LW; Barney, JB	Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making	1A	2B;2C	3A	4A	5A	6C	7A	8C
OLSON, PD; BOKOR, DW	STRATEGY PROCESS-CONTENT INTERACTION - EFFECTS ON GROWTH-PERFORMANCE IN SMALL, START-UP FIRMS	1B	2C	3A	4A	5A	6C	7A	8C
MANIMALA, MJ	ENTREPRENEURIAL HEURISTICS - A COMPARISON BETWEEN HIGH PI (PIONEERING-INNOVATIVE) AND LOW PI VENTURES	1A	2C	3B	4F	5B	6C	7A	8C
Knoben, J; Bakker, RM	The guppy and the whale: Relational pluralism and start-ups' expropriation dilemma in partnership formation	1A	2B	3A	4F	5B	6B	7B	8A
Nuscheler, D; Engelen, A; Zahra, SA	The role of top management teams in transforming technology-based new ventures' product introductions into growth	1B	2B	3B	4A	5B	6B	7A	8C
Sauermann, H	Fire in the belly? Employee motives and innovative performance in start-ups versus established firms	1B	2B	3A	4A	5A	6B	7A	8A
Braun, T; Ferreira, AI; Schmidt, T; Sydow, J	Another Post-heroic View on Entrepreneurship: The Role of Employees	1A	2B;2C	3C	4E	5A	6C	7A	8A

	in Networking the Start-up Process								
Hashai, N; Zander, I	The evolution of vertical boundaries in new high technology ventures	1A	2A;2C	3A	4F	5A	6C	7A	8C
Symeonidou, N; Nicolaou, N	Resource orchestration in start-ups: Synchronizing human capital investment, leveraging strategy, and founder start-up experience	1A	2B;2C	3A	4F	5A	6B	7A	8C
Di Pietro, F; Prencipe, A; Majchrzak, A	Crowd Equity Investors: AN UNDERUTILIZED ASSET FOR OPEN INNOVATION IN STARTUPS	1A	2C	3A	4A	5A	6B	7D	8C
Fehrer, JA; Woratschek, H; Brodie, RJ	A systemic logic for platform business models	1A	2C	3A	4A	5A	6C	7D	8C
Gomber, P; Kauffman, RJ; Parker, C; Weber, BW	On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services	1B	2A	3A	4F	5A	6C	7C	8C
Tzabbar, D; Margolis, J	Beyond the Startup Stage: The Founding Team's Human Capital, New Venture's Stage of Life, Founder-CEO Duality, and Breakthrough Innovation	1B	2C	3A	4A	5A	6B	7A	8A
Autio, E	Strategic Entrepreneurial Internationalization: A Normative Framework	1B	2C	3A	4F	5A	6C	7C	8A
Ter Wal, ALJ; Alexy, O; Block, J; Sandner, PG	The Best of Both Worlds: The Benefits of Open-specialized and Closed-diverse Syndication Networks for New Ventures' Success	1A	2C	3A	4F	5A	6B	7B	8C
Basu, S; Phelps, CC; Kotha, S	Search and Integration in External Venturing: An Inductive Examination of Corporate Venture Capital Units	1B	2C	3B	4A	5B	6C	7D	8A
Adams, P; Fontana, R; Malerba, F	User-Industry Spinouts: Downstream Industry Knowledge as a Source of New Firm Entry and Survival	1A	2C	3A	4A	5A	6C	7A	8A
Cavusgil, ST; Knight, G	The born global firm: An entrepreneurial and capabilities perspective on early and	1B	2C	3A	4D	5A	6C	7C	8C

	rapid internationalization								
Hsu, DH; Lim, K	Knowledge Brokering and Organizational Innovation: Founder Imprinting Effects	1A	2B;2C	3A	4A	5B	6C	7A	8A
Park, HD; Steensma, HK	THE SELECTION AND NURTURING EFFECTS OF CORPORATE INVESTORS ON NEW VENTURE INNOVATIVENESS	1A	2C	3A	4F	5A	6C	7D	8A
Maula, MVJ; Keil, T; Zahra, SA	Top Management's Attention to Discontinuous Technological Change: Corporate Venture Capital as an Alert Mechanism	1A	2A	3A	4A	5A	6C	7C	8A
Gruber, M; MacMillan, IC; Thompson, JD	Escaping the Prior Knowledge Corridor: What Shapes the Number and Variety of Market Opportunities Identified Before Market Entry of Technology Start-ups?	1A	2C	3C	4B	5A	6C	7D	8A
Gruber, M; MacMillan, IC; Thompson, JD	From Minds to Markets: How Human Capital Endowments Shape Market Opportunity Identification of Technology Start-Ups	1B	2C	3A	4D	5A	6C	7A	8A
Ceccagnoli, M; Forman, C; Huang, P; Wu, DJ	COCREATION OF VALUE IN A PLATFORM ECOSYSTEM: THE CASE OF ENTERPRISE SOFTWARE	1A	2A;2C	3A	4A	5B	6C	7B	8A
Clarysse, B; Bruneel, J; Wright, M	EXPLAINING GROWTH PATHS OF YOUNG TECHNOLOGY-BASED FIRMS: STRUCTURING RESOURCE PORTFOLIOS IN DIFFERENT COMPETITIVE ENVIRONMENTS	1A	2C	3A	4E	5B	6C	7D	8C
Agarwal, R; Audretsch, D; Sarkar, MB	THE PROCESS OF CREATIVE CONSTRUCTION: KNOWLEDGE SPILLOVERS, ENTREPRENEURSHIP, AND ECONOMIC GROWTH	1B	2C	3A	4F	5A	6C	7C	8C
Yan, L; Zhao, H; Baron, RA	Influence of founder-CEOs' personal values on firm performance: Moderating effects of firm age and size	1B	2C	3A	4A	5A	6C	7A	8A
Nosella, A; Petroni, G; Verbano, C	Innovation development in biopharmaceutical start-up firms: An Italian case study	1A	2C	3A	4A	5A	6B	7A	8A

Block, JH; De Vries, G; Schumann, JH; Sandner, P	Trademarks and venture capital valuation	1A	2C	3A	4F	5A	6C	7D	8C
Cosenz, F; Noto, G	A dynamic business modelling approach to design and experiment new business venture strategies	1B	2C	3A	4A	5A	6C	7C	8A
Acs, ZJ; Stam, E; Audretsch, DB; O'Connor, A	The lineages of the entrepreneurial ecosystem approach	1B	2C	3A	4A	5A	6C	7A	8A

Appendix 3 – Coding System Results

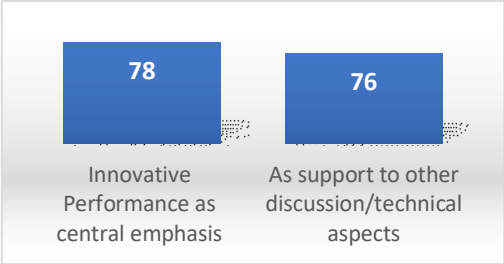

Figure 5 - Emphasis of the discussion

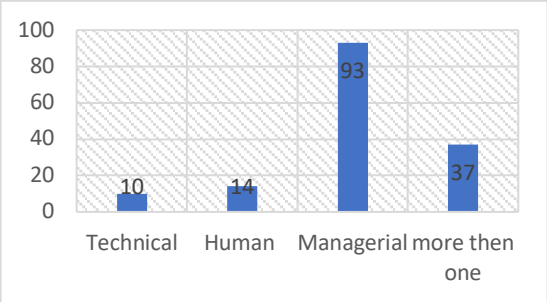

Figure 6 - Aspects covered

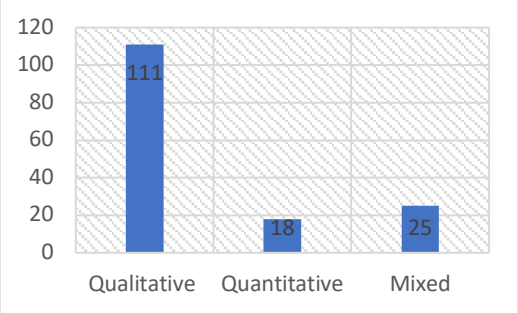

Figure 7 - Method

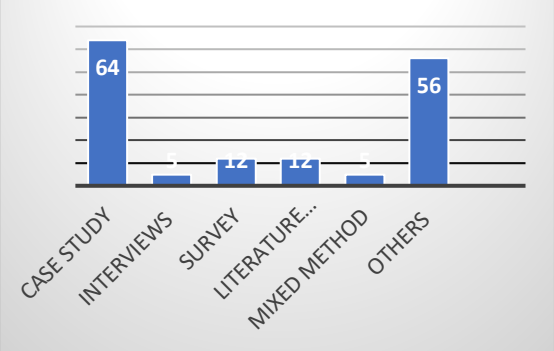

Figure 8 - Research techniques

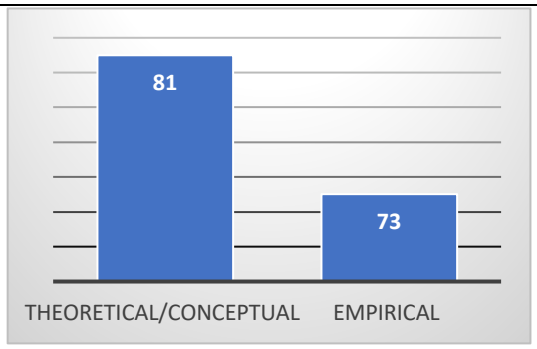

Figure 9 - Approach

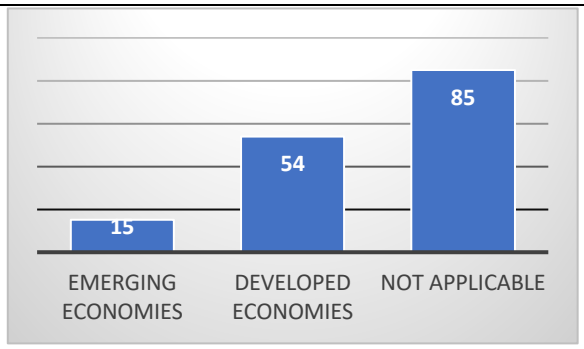

Figure 10 – Focus

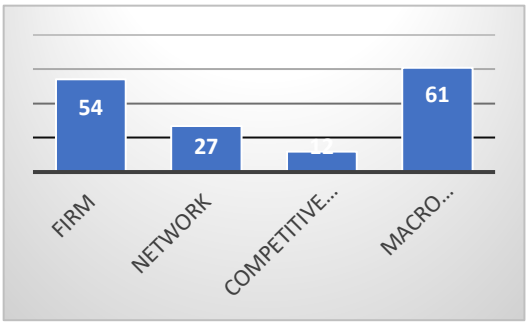

Figure 11 – Level of Influence

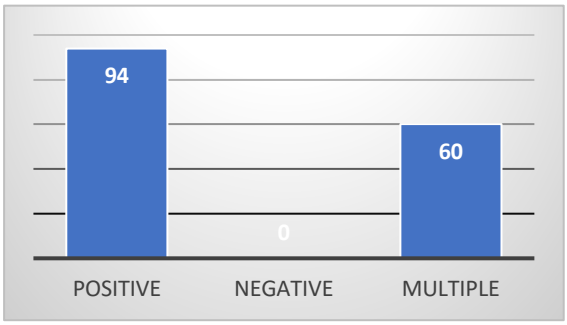

Figure 12 – Type of influence

3. Source of funding and specialized competences: the Impact on the Innovative performance of start-ups.

3.1 Introduction

In a knowledge-based society, innovation is the driving force of the economy in all types of organization and on all levels. Due to high risks related to new products and services introduction, innovation is usually pushed into the market thanks to start-up companies. Several studied in literature states that one third of countries economic growth is attributed to start-ups activities (Shabangu 2014). A start-up company is an entrepreneurial venture which is typically a newly emerged, fast-growing business that aims to meet a marketplace need by developing a viable business model around innovative products, services, processes or platforms (Puhtila 2017).

Economic development on all levels can be promoted by encouraging more people to establish and grow new start-ups (Z. Acs and Storey 2004), particularly those that exploit new ideas (Z. J. Acs and Szerb 2007), and innovation is of central importance in entrepreneurship (Marvel and Lumpkin 2007). Start-ups constitute an important instrument through which new ideas are brought to life, especially those ideas that require an alternative response to that from the already-established companies in the industry. In this context political, economic, social, technological, (external level) influencing factors, as well as the main factors within the organizational (internal level) boundaries, are to be considered as crucial for start-up innovation and growth. Several studies have suggested a positive link between innovation and start-up growth. Innovation can enhance market power (Schumpeter 2008), improve the ability to escape competition (Porter 1990), reduce production costs (W. M. Cohen and Klepper 1996a), support dynamic capabilities and lead to enhanced absorptive capacity. In other cases, it

can lead to less linear start-up processes (Samuelsson and Davidsson 2009) or more skewed returns (Scherer and Harhoff 2000).

Innovating can mean improving products and services of established companies (Mitchell 1991), in the eyes of existing customers. Such innovations enable incumbents to sell more products to their most profitable customers and do not necessarily affect existing markets, as it involves new product releases or improved services (Christensen, Raynor, and McDonald 2015).

Also innovation could be targeted at an emerging market, more common for start-ups companies, applying a different set of values for users, which ultimately could overtake an existing market (Bower and Christensen 1995).

In same case, innovation may have minor improvements or simple adjustments in current technology (Dewar and Dutton 1986; Gatignon et al. 2002), other times may involve changes in a company's trajectory, and provide more benefits to the customer than what was previously available in the industry (Dewar and Dutton 1986; Gatignon et al. 2002; Chandy and Tellis 2000). In all these cases, making innovation means investing time, skills and money. Making innovation for a start-up also means developing a lot of research activities. In fact, the R&D activities intensity influences product and process innovation in start-up companies (Hall, Lotti, and Mairesse 2009; Stam and Wennberg 2009) and are fundamental for producing radical innovation. R&D activities can strengthen innovative performance and ensure start-up survival and growth.

In an attempt to fill the above gaps, we use R&D expenses (the Amount of company's expenses attributed to R&D activities), and we measure innovative performance of start-up as the sum of all the expenses destined for the realization of research activities or for the realization of innovative products / services and processes.

We focus on some relevant drivers of the innovative performance of start-up, namely the number of grants received, the total Amount of grants received and the presence of high qualified team.

We develop testable hypotheses about the (both separate and joint) impact of these factors on the innovative performance of Start-ups, and we test them on a sample of 405 Innovative Start-ups established in Italian Country and registered into the Chamber of Commerce official database.

In brief, our analysis reveals that both the Grants Numbers and total amount of grants received by each start-ups impact positively innovative performance. The same is for the integration of Total amount of Grants with the presence of high qualified team.

The paper is organized as follows. In the next sections, we briefly review the relevant literature and develop four testable hypotheses on the relationships between the presence of a high qualified team, the Grants Number and total amount of grants received and the innovative performance of Start-ups. Then, we set out methods and results of our study. Finally, we offer a discussion of our statistical findings and outline some concluding remarks and implications for both academics and practitioners.

3.2 Theory and Hypotheses

3.2.1 Startup growth & Innovation

The growth of a start-up is closely linked to the improvement of its performance (Damanpour 1991; K. G. Smith, Collins, and Clark 2005). There are many studies analyzing the impact of innovation in companies and start-ups performance (e.g., Lööf and Heshmati 2006; Thornhill 2006) or the factors that have explanatory power to shape innovation performance (e.g., (Frenz and Ietto-Gillies 2009; Frishammar and Ake Horte 2005). Decisions about innovation are influenced by several factors. For instance, Duguet (Duguet 2006) found that strong diversity of knowledge sources, accompanied by both formal and informal internal R&D, and various kinds of spillovers are important for producing radical innovation. Hall, Lotti, and Mairesse (Hall, Lotti, and Mairesse 2009)

found that product and process innovation are influenced by the same group of variables (firm size, R&D intensity, investment in equipment), though with different impact sizes.

As consequence, more and more firms and start-ups are investing in innovative outputs, in terms either of type of innovation (product or process) or in terms of novelty degree (incremental or radical), and their impact on company performance (Duguet 2006; Hall, Lotti, and Mairesse 2009; Vega-Jurado et al. 2008; 2008). Product innovation is usually linked to strategic factors and process innovation is more driven by market pressures (Roper and Hewitt-Dundas 2008). In turn, radical innovation may be a means for a new firm to enter a market, while incremental innovations contribute to enhancing and sustaining financial performance of successful radical innovations (Iyer, LaPlaca, and Sharma 2006). Moreover, radical innovation is usually identified as crucial to economic growth, having power to create entire industries or to significantly alter competition in an industry by bringing large and incumbent firms to declining while projecting new and small start-ups to market leadership (Chandy and Tellis 2000).

One important aspect for start-up innovative growth is the entrepreneurial innovativeness, as an exploratory behavior characterized with doing something different rather than imitations and variants of what others are also offering (McGrath 2001). Exploiting opportunities represents entrepreneurial actions in anticipation of shaping future demand and the environment (Lumpkin and Dess 2001). Exploration also aims to reap benefits that come from developing knowledge breakthrough, which is more likely to lead to a sustainable competitive advantage for the business the entrepreneur starts (D. Long and Dong 2017).

Although growth is perceived to be an essential characteristic of start-up companies (Sadler–Smith et al. 2003), the actual process of growth is complex. One way to appreciate the phenomenon of growth is the link between networking activity and growth (Chell and Baines 2000; Huggins 2000; Jarillo 1989; Lechner and Dowling 2003). The network perspective is increasingly being embraced as a mechanism for considering the

creation and development of new ventures, inter-firm networks represent a key factor for the growth of the start-ups and their innovative performance (Anderson, Dodd, and Jack 2010), they offer important advantages such as knowledge integration and risks or costs sharing.

Managers of start-up firms make a number of important yet understudied decisions, such as whether or not to develop a new product, whether or not to choose a high-technology product or service, whether or not to use external assistance, and the amount of time and effort they will devote to their new company. These choices are informed by their access to various resources, such as the size of the management team, its education level, the available funding resources, the possibility to perform R&D activities and other attributes (Allen and Hall 2008). All these variables can influence the start-up growth and the development of innovative performances. The availability of funding sources and the work team core competences are fundamental for the development of young firms, thanks to financial resources and human capital they can perform R&D activities for strengthening innovative performance and for ensuring survival and growth. These variables are interconnected for many reasons, for example successful teams have more possibility to obtain start-up funding, essential for R&D activities.

3.2.2 Funding Sources, Complexity of Innovation and Start-up Innovative performances

The concept of complexity in innovation can be described as combining numerous components which draw on a variety of knowledge bases and sources, these elements have multiple interactions and constitute a non-decomposable whole (Singh 1997). The more the complexity of the innovation, the higher the number of different elements start-ups have to search across, and hence the broader the span of their search. In our case we focus on core competences, founding sources and R&D activities for start-up growth and innovative performances.

Innovative start-ups play a critical role in stimulating economic growth, increasing productivity and contributing to national competitiveness. Financial constraints are often identified as major obstacles for the development of young firms. A striking finding is that the highest average amounts of capital are allocated to firms in the start-up phase, while the level of external funding decreases considerably in the later phases of firm development. In particular, innovative start-ups with growth ambitions are considered to contribute disproportionately to innovation, the creation of jobs, and wealth in the larger economy (Storey 2016; Birch, Haggerty, and Parsons 1995; Kirchhoff et al. 2007). There are a number of potential financing sources available for startup firms, including commercial banks, venture capitalists, business angels, government agencies, private individuals, leasing or factoring companies, customers, and suppliers, amongst others. The funding sources can be categorized as insider funding or as outsider funding , but in our analysis we will use the general concept of "*grants*" (Söderblom et al. 2015).

A grant could be an amount of money that government or other institution or person gives to an organization for a particular purpose. So, this term groups all kind of founding sources mentioned before. Most start-ups did not resort to debt-based funding, as bank loans because they are characterized by high uncertainty and risk. Personal capital was by far the most important source of start-up financing (Colombo and Grilli 2007). Follow government founding, crowdfunding, venture capital and other grants.

Government grants can be in the form of financial support subsidies, loan, interest rates lower than the one prevailing in the market, and other measures. In case of start-up grants it is highly important that firms getting the grant would remain vital and serve as good tax payers, in this way guaranteeing efficiency (quick "payback") of financial aid (Lukason and Masso 2013). Several empirical studies exist on the effects of pubic R&D subsidies. Busom (Busom ∗ 2000) studies show that for most start-up companies public funding induced more R&D activities. Lach (Lach 2002) demonstrates that public subsidies

do not crowd out company-financed R&D expenditure completely. Wallsten (Wallsten 2000) states that government subsidies have no effect on R&D activities or employment. However, Wallsten (Wallsten 2000) mentions another possible and important impact of public funding: "while the grants did not allow firms to increase R&D activity, they instead allowed firms to continue their R&D at a constant level rather than cutting back."

Moreover, the studies carried out by Almus and Czarnitzki (Almus and Czarnitzki 2003) show that companies that have received public funding reach on average a higher intensity (intended as the ratio between R&D expenditure and sales) than the others. Other microeconomic approaches take different output measures into consideration. Examples include the effects of subsidies on patent applications, productivity, fixed-asset investments, returns on capital, returns on sales, and growth of sales or employment (Klette, Møen, and Griliches 2000). Moreover, Lerner (Lerner 1996) discovers that the government subsidy performs an important signaling effect to external providers of venture capital, allowing recipients to leverage funding from external investors in subsequent financing rounds. Importantly, recipients demonstrate higher growth rates than non-recipients. A good alternative to government grants is the crowdfunding, it is an emerging online trend representing a new potential pool of capital as a source of start-up equity financing. A central tenant of crowdfunding is that the crowd funds what the crowd wants. Crowdfunding is derived from another social media phenomenon termed crowdsourcing (Ley and Weaven 2011). Callaghan's studies (Callaghan 2014) demonstrate that crowdfunding and crowdsourcing can accelerate significantly R&D productivity, and if applied in fields such as medical research in general can accelerate increases in research output and therefore benefits to society. Another type of outsider funding is the venture capital, venture capital investors could be independent or corporate, independent ones have more powerful incentives than corporate, but both have a positive and sizeable long-term treatment effect on the sales and employment growth of portfolio start-ups (Bertoni, Colombo, and Grilli 2011). Since the early 1990s, the economics and finance

literature has been interested in assessing the impact of Venture Capital investments on firm and start-ups growth. Overall, results almost unanimously show that venture capital-backed companies grow more than the others and that this phenomenon is due to not only a sorting effect (i.e., the fact that investors select companies with the best growth prospects) but also to a positive and genuine treatment effect of these types of investments (J. A. C. Baum and Silverman 2004; Bertoni, Colombo, and Grilli 2011). Venture capital is an important internal factor in the early stages of a startup, existing evidence indicates that the presence of this funding is relevant to explaining differences across start-up companies (Hellmann and Puri 2000). Corporate venture capital devotes significant management resources to understanding new technologies and markets, finding promising startups in those spaces, providing them with financial resources for R&D activities, and coaching them through the early part of their lives. They take an active role in the board, monitoring the evolution of the start-up and the management of R&D activities (Fried, Bruton, and Hisrich 1998), venture capitalists bring a network of contacts with experienced infrastructure providers, they bring a reputation effect that facilitates other R&D incentives and interest in joining the team (Gorman and Sahlman 1989; Fried and Hisrich 1995). Although there are many types of grants, in the initial life of a start-up it is not often easy to obtain funding sources for technological and innovation development (H. W. Chesbrough 2003; Laursen and Salter 2006). A way to make it simpler is the formation of R&D alliances between new start-ups to acquire and integrate knowledge and technologies (Teece 1992; Powell, Koput, and Smith-Doerr 1996; Frank T. Rothaermel and Boeker 2008), thus exploring new opportunities and solutions, or to share with partners the costs and the risks associated with R&D activities (Hagedoorn 1993). The formation of R&D alliances between start-ups has significantly increased over the last few decades, especially in high-technology sectors (Hagedoorn 2002). R&D alliances can speed up start-ups learning and innovation processes, extending their benefits beyond the life of the alliance, since new firms learn from their partners and

increase their capabilities (Mowery, Oxley, and Silverman 1996; Doz and Hamel 1997). Ahuja (Ahuja 2000) demonstrates a positive relationship between the extension of a solid alliance activity and its innovativeness.

The above arguments suggest the following hypothesis:

H1a. The Number of Grants received by a start-up is ***positively*** *related to the Start-ups Innovative Performance*

H1b. The total amount of Grants received by a start-up is ***positively*** *related to the Start-ups Innovative Performance.*

3.2.3 Funding Sources, Core Competences and the innovative performance of start-ups

Another important aspect for start-up innovative growth is the entrepreneurial and innovative mindset of the team, as a core competence for start-up success. Different studies have been carried on the most essential process within new venture creation: the team formation. The process of team formation describes the assembly of a start-up most crucial resource: human capital. A great number of studies have found that the human capital embodied by start-up founders is the most significant predictor for new companies survival and growth (Bates 1990; A. C. Cooper, Gimeno-Gascon, and Woo 1994; Bosma et al. 2004; Delmar and Shane 2004; Colombo and Grilli 2005). Based on these insights, other group formation studies claim that employees contribute both to a company's human capital and subsequently to its survival (Weber and Zulehner 2010; Koch, Späth, and Strotmann 2013; Dahl and Klepper 2015; Coad, Nielsen, and Timmermans 2017). Consequently, we conceptualize the team formation process as the time commitments of founders, employees, and service providers at any time between inception of the venture and the point it reaches profitability or fails (Held, Herrmann, and van Mossel 2018).

Within the concept of complexity in innovation, it's possible to consider the correlation between funding sources, team formation and R&D activities as innovative performance.

Teams which have a history of being successful (i.e. credible teams) and teams with an outstanding track record were found to be essential criteria for obtaining start-up funding (Venkataraman et al. 2012).

Schilling and Shankar (Schilling and Shankar 2019) in her book "Strategic Management of Technological Innovation" analyzes size and composition of teams. About size, bigger team is not always better because large teams create more administrative costs and communication problems, but they have higher potential for social loafing. About composition, including members from multiple functions ensures greater coordination between functions; diversity in functional backgrounds increases breadth of knowledge base of team, increases the chances of receiving funds, but diversity can also raise coordination costs.

Innovation in teams requires transformational leadership qualities, such as inspiring others, stimulating frequent and high-quality social interaction, expressing strong entrepreneurial visions, and using the talents and individual capacities of team members (Bass 1999; García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez 2012; Howell and Avolio 1993; Özaralli 2003). Furthermore, transformational leadership qualities are supportive for start-up innovative performances (Gumusluoglu and Ilsev 2009) and an innovative team climate, which are needed for the entrepreneurial exploitation of business opportunities (Howell and Avolio 1993). Furthermore, transformational leadership is particularly important to enhance new ventures or start-ups performance (Ensley, Hmieleski, and Pearce 2006) and venture growth in small, entrepreneurial firms (J. R. Baum, Locke, and Kirkpatrick 1998).

Another important aspect in start-up team is the academic entrepreneurship, different studies have been carried out in order to understand the impact of academic entrepreneurship on start-ups innovative growth and success. Li et al. (Li, Qu, and Huang 2018) suggest that innovation behavior of graduate start-ups is influenced by the quantity of human capital, phycological make-up and expectations of entrepreneurial reward.

Education contributes to the development of human capital (Becker 1962), and provides students a set of opportunities and resources unavailable to those less qualified (Rosa 2003). In fact, academic spin-offs have higher probability to receive funding. Many authors (Di Gregorio and Shane 2003; Grimaldi and Grandi 2005) have studied the factors fostering their creation, ranging from institutional support (e.g. government laws, financial and non-financial incentives, etc.), university policies (e.g. spin-off regulations, business plan competitions, university business incubators, etc.), local context characteristics (e.g. venture capital availability, entrepreneurial support mechanisms, science parks, proximity to universities, opportunities offered by industrial sectors, etc.), and technology characteristics (e.g. commercialization potential, appropriability, value to customers, etc.).

People with high human capital have been found to be more likely to identify more entrepreneurial opportunities (Ucbasaran, Westhead, and Wright 2008), to exploit opportunities (Shane 2003), and to have better performance of their new ventures (Unger et al. 2011). Human capital has been shown to facilitate nascent entrepreneurship (Davidsson and Honig 2003), fund performance of venture capitalists (Dimov and Shepherd 2005; Zarutskie 2010), the number of opportunities entrepreneurs identify (Corbett 2007; Ucbasaran, Westhead, and Wright 2008), and venture survival (Bosma et al. 2004; Gimeno et al. 1997). However, Ben-Hafaïedh et al. (Ben-Hafaïedh, Micozzi, and Pattitoni 2018) observe that academic spin-offs entrepreneurial teams generally concentrate high levels of research and development experience while they are often found lacking in commercial skills, this prompts the integration of surrogate entrepreneurs (practitioners), more familiar with market dynamics. In particular, corporate venture capital financing can help entrepreneurs in this sense, venture capitalists take an active role in the board, monitoring the evolution of the start-up, the team and the management of R&D activities (Fried, Bruton, and Hisrich 1998). Founders can seek out external assistance, ranging from tax-preparation advice to help in acquiring

skilled new employees. As Evans and Volery (D. Evans and Volery 2001) point out, such help allows access to resources that even very talented entrepreneurs might not have. Furthermore, in case of venture capital founding , the number of employees increases in the months prior to the funding round and further increases during the months after the event (Davila, Foster, and Gupta 2003).

Nowadays start-up teams are not intended only as a group of people who physically collaborate, but also as people virtually connected. In virtual teams, members may be a great distance from each other, but they are still able to collaborate intensely via videoconferencing, groupware, email, and internet chat programs. Virtual teams enable people with special skills to be combined without disruption to their personal lives. However, there may be losses of communication due to lack of proximity and direct, frequent contact. Start-ups are always threatened by rapid technological developments and corporate M&A (merger and acquisition), they are trying to secure a sustainable competitive advantage using outside knowledge and expertise under open innovation and virtual teams to overcome these shortcomings (H. Chesbrough, Vanhaverbeke, and West 2006; Wi, Oh, and Jung 2011).

The advent of information technology and the paradigm of virtual teams has enabled a new business differential: crowdsourcing, that has drastically decreased the costs involved in R&D field (Callaghan 2014). However, a further potential may exist, the potential of crowdfunding, or the use of the crowd to source resources, which also has the potential to draw funds from very large numbers of individuals. The rise of crowdfunding is expected to contribute significantly to economic growth, innovation and job creation (Thompson 2014). The synthesis of both crowdfunding and crowdsourced R&D can potentially offer a new paradigm through which exponential mechanisms of fund raising can be harnessed while, at the same time, exponential mechanisms of knowledge sourcing can also be enabled (Stieger et al. 2012).

The above arguments suggest the following hypothesis:

H2a. In the growth path of a start-up, the interaction between the Total Grants received and the presence of a high qualified team is positive related to the Start-ups Innovative Performance.

H2b. In the growth path of a start-up, the interaction between the Number of Grants received and the presence of a high qualified team is positive related to the Start-ups Innovative Performance

3.3 Methodology

3.3.1 Data Sample

We tested our hypotheses on a sample of 465 Innovative Start-ups established In Italian Country[4]. This Law identifies three prerequisites for obtaining the status of "innovative start-up":

- at least 15% of the company's expenses can be attributed to R&D activities;
- at least 1/3 of the total workforce are PhD students, the holders of a PhD or researchers; alternatively, 2/3 of the total workforce must hold a Master's degree;
- the enterprise is the holder, depositary or licensee of a registered patent (industrial property) or the owner of a program for original registered computers.

We decide to focus our analysis on the first criteria: "*at least 15% of the company's expenses can be attributed to R&D activities"*. The R&D activities has widely recognized in the literature as a good proxy to evaluate firm's innovativeness (e.g. (Sampson 2007; W. M. Cohen and Klepper 1996a; Griliches 1991).

Italy represents a favorable environment for the establishment and the development of innovative companies. So, we tested our hypotheses in this specific domain since it gives interesting opportunities for advancements in innovation theories and managers'

[4] In accordance to the Decree-Law 179/2012 on "Further urgent measures for Italy's economic growth", converted into Law 221/2012.

practices, due to the high technology context, the rapid dynamics, and the high competitive environment.

The start-up innovative performance were described by the Amount of Start-ups' expenses attributed to R&D activities. We consider all the innovative start-ups registered into the Chamber of Commerce official database (http://startup.registroimprese.it/isin/home). This database has been improved adding information related to:

- the *Number of Grants received by a start-up,*
- *the Total Amount of Grants received by a start-up;*
- *the Number of a high qualified team.*

The information relating to these 3 indicators was collected through the websites consultation (company web site and several on-line database) and only for missing information we used phone survey. For 60 start-ups it was not possible to gather all the necessary information so, in the end, we obtained a the final sample of 405 start-ups located in the 20 Italian regions as show in the table below.

< Insert Table 1 about here >

3.3.2 Variables

In Table 2 all variables have been reported.

< Insert Table 2 about here >

Dependent Variable

Our dependent variable is the innovative performance of Start-up (*InnPerf*). We measured the innovative performance of a Start-up as the Amount of company's expenses attributed to R&D activities. In our study we take into consideration, for each start-up, the sum of all the expenses destined for the realization of research activities or

for the realization of innovative products / services and processes. Previous researches have largely adopted the R&D expenses to evaluate firm's innovativeness. Research and development have at least two functions. First, R&D builds knowledge within the start-up to generate inventions (Rosenberg 2009). Second, it improves the start-up ability to understand and absorb knowledge from outside such as the knowledge spillovers generated by other organizations R&D (W. M. Cohen and Levinthal 1989; Baumol 2002). Initial R&D improves the exploitation of new product development; second, initial R&D improves the exploitation of interfirm alliances (Stam and Wennberg 2009). Moreover, Rosenberg (Rosenberg 2009) argued that firms in high-tech industries need to do R&D in order to understand better how and where to innovate. R&D activities intensity influences product and process innovation in start-up companies (Hall, Lotti, and Mairesse 2009; Stam and Wennberg 2009), in particular, formal and informal R&D are important for producing radical innovation. R&D activities can strengthen innovative performance and ensure start-up survival and growth.

Independent Variables

Start-up Grant Number and Total Grant received

To construct the variables, in this study, we considered all the measures and grants devoted to support the Italian innovative start-up ecosystem. There are a number of potential financing sources available for startup firms, (commercial banks, venture capitalists, business angels, government agencies, leasing or factoring companies, etc.). Start-ups grants could be internal (stemming from the founders themselves or from closely associated family and friends) or external (from actors without close relationships with the founders). On the one hand we took into consideration the number of grants received from each start-up analyzed (*GrantNumber*), on the other hand the total Amount of grants received (*TotalGrant*). Several studies have shown the existence of a strong link between grants and business growth (Söderblom et al. 2015). In particular, the highest

average amounts of capital are allocated to firms in the start-up phase, while the level of external funding decreases considerably in the later phases of firm development. Companies that have received grants reach on average a higher intensity (intended as the ratio between R&D expenditure and sales) than the others. Also, grants in crowdfunding and crowdsourcing form can accelerate significantly R&D productivity (Almus and Czarnitzki 2003; Callaghan 2014; J. A. C. Baum and Silverman 2004; Bertoni, Colombo, and Grilli 2011). Furthermore, R&D alliances between new firms make obtaining grants simpler (Hagedoorn 1993).

Team High Level

The team high level, as a core competence for start-up success, represents the most significant predictor for new companies survival and growth (Bates 1990; A. C. Cooper, Gimeno-Gascon, and Woo 1994; Bosma et al. 2004; Delmar and Shane 2004; Colombo and Grilli 2005). In our study, we consider the (Team High Level) as the number of high specialized team in each start-up analyzed. In particular, the analysis was done including, in the team high level concept, the following requirement: at least 1/3 of the total workforce are PhD students, the holders of a PhD or researchers; alternatively, 2/3 of the total workforce must hold a Master's degree) in accordance to the Decree-Law 179/2012 on "Further urgent measures for Italy's economic growth", converted into Law 221/2012.

This variable is one of the three fundamental requirements that regulate the status of innovative start-ups in Italy. Team working requires transformational leadership qualities, such as inspiring others, stimulating frequent and high-quality social interaction, expressing strong entrepreneurial visions, and using the talents and individual capacities of team members (Bass 1999; García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez 2012; Howell and Avolio 1993; Özaralli 2003). Teams with high human capital are more likely to identify entrepreneurial opportunities (Ucbasaran, Westhead, and

Wright 2008), to exploit opportunities (Shane 2003), and to reach better performance (Unger et al. 2011). Human capital has been shown to facilitate nascent entrepreneurship (Davidsson and Honig 2003) and fund performance (Dimov and Shepherd 2005; Zarutskie 2010). Moreover, academic spin-off teams have higher possibility to obtain venture capital grants and innovative resources (D. Evans and Volery 2001).

Control Variables

In order to avoid bias from other effects on the of Start-up innovative performance, we introduced several control variables. In particular, we included a variable to control connection and influences with and from the company production size (ProductiveSize), measured as the ratio between a Production/Income range.

In several studies, productive size of a start-up is often linked to innovation, particularly, to technological innovation Geroski (Geroski 1991), but Bartelsman et al. (Bartelsman, van Leeuwen, and Nieuwenhuijsen 1996) showed that it was mostly the increase in the capital-labour ratio which improved productive size, while the advanced technology effect less significant results. Moreover, Crépon et al. (Crepon, Duguet, and Mairessec 1998) found positive correlation between innovation output (as measured by patent numbers or share of "innovative sales") and increasing of start-up productive size. And Bartel (Bartel 1989) found evidence that also training investment increased productivity substantially. Considering the correlation between start-up productivity and founding sources, Wright (Wright 1998) state that venture capital-backed start-ups grow faster, have more patent and have higher productivity. Regarding productive with the advent of artificial intelligence, Brynjolfsson et al. (Brynjolfsson, Rock, and Syverson 2017) talk about a paradox. Systems that use artificial intelligence increase operational efficiency, taking advantage of rapid advances in other technologies and pushing stock prices skyrocketing.

We also controlled for focal firm size effect (*CompanySize*). Some authors proposed that size is positively associate to innovation. In 1940s, Schumpeter argued that large companies would be more effective innovators. They can obtain more financing, and they can spread R&D costs over large volume (Z. J. Acs and Audretsch 1987; W. M. Cohen 2010; Stock, Greis, and Fischer 2002). Large size may also enable greater economies of scale and learning effects, and taking on large scale or risky projects. However, large firms might also be disadvantaged at innovation because R&D efficiency might decrease due to loss of managerial control, these firms have more bureaucratic inertia and more strategic commitments tie firm to current technologies. While big companies may be able to tap into a pool of information that is more varied (Cáceres, Guzmán, and Rekowski 2011), transfer of relevant knowledge within a large firm is not obvious (Aalbers, Dolfsma, and Koppius 2014; Szulanski 1996). Instead, small firms are often considered more flexible and entrepreneurial. In newly established small start-ups, entrepreneurs and employees are more motivated to contribute to innovation efforts, so the effects of their contribution is more direct (Uhlaner et al. 2013). Almeida et al. (Almeida, Dokko, and Rosenkopf 2003) suggest that as startups grow, they may have increasing opportunities to access and exploit external knowledge, but their motivation (and hence ability) to learn from more informal sources may decrease. Finally, smaller companies tend to have lower likelihood of survival but higher rates of post-entry growth (Ahn 2001).

Moreover, in order to better analyze start-up performaces, we include three more control variable regarding the Board of Management structure (*measured by % del share capital + % Administrators*). The first variable is the prevalence of women (*PrevWomen*). Participation of women in entrepreneurship is increasing, but the rate across countries is measurable at about two-thirds that of men. These results suggest that women are influenced by many of the same factors that affect men when making entrepreneurial decisions, but the systematically lower rate of female participation indicates that some

differences also exist (Minniti and Arenius 2003). Some studies report that women have less access to financial resources (De Bruin, Brush, and Welter 2007; Gatewood et al. 2009; Marlow and Patton 2005), less quality and diversification in their product and services (Shneor et al. 2016; Costin 2012), and a less qualified team (Costin 2012). A possible explanation to this "underperformance hypothesis" is the social expectation. Women are expected to play a primary role as mothers and caregivers. Consequently, women in business receive little support from the family (Achtenhagen et al. 2013; Venugopal 2016) and are still doing most of the household chores (Statistics 2016). This fact may impact on women's ability and time horizon for strategic planning (Mitchelmore and Rowley 2013). Women have less time available to devote to the business (Marlow and Patton 2005) and to participate in exhibitions, events (Greene et al. 2003) and networks (Kalafatoglu and Mendoza 2017; Surangi 2016; Wing-Fai 2016). Moreover, in start-ups, men chief led bigger teams than women (Kuschel, Labra, and Díaz 2018). But according to a study conducted in the U.S. by First Round Capital (2015), startups with at least one woman in the top management team have had 63% more success than those startups with only.

The second variable and third variable regard the prevalence of Youth people (*PrevYouth*) and Foreign people (*PrevForeign*) in the start-up board. Some studies consider the diversity among the team members a crucial aspect that may affect performance positively (Hambrick, Cho, and Chen 1996). A heterogeneous composition may increase problem solving and creativity (Cox 1994), which in turn increases the odds of making innovative and strategic decisions (Bantel and Jackson 1989; Barkema and Shvyrkov 2007; Beckman, Burton, and O'Reilly 2007; Talke, Salomo, and Rost 2010; Wiersema and Bantel 1992). Heterogeneity increases breadth of knowledge base of team and chances of receiving funds, but it can also raise coordination costs (Schilling and Shankar 2019). In particular, age diversity has a marginal, negative effect on ROA but a strong, positive

impact on sales growth, but particularly from low and moderate levels of heterogeneity. The effects of age diversity can become negatively related to sales growth at high levels.

3.3.3 Estimation Method

To test hypotheses 1(a-b) and 2(a-b), the OLS regression were applied. Before computing interaction terms, the indipendent variables were transformed logarithmically, a procedure commonly employed to avoid problems of non-linearity of relationships, normality and homoschedasticity of residues (Ebersberger and Herstad 2013). In particular, in this study, even if we were not able to confirm the normal univariate distribution, it was verified that the distribution does not deviate from the normal multivariate distribution. After this operation, multicollinearity was verified by examining variance inflation factors (VIFs). All VIF values are below 5, indicating that multicollinearity is not a problem for the analysis.

3.4 Results

Table 3 reports descriptive statistics and the correlation values for all the variables. As shown, for all the independent variables exist a positive linear correlation, thus indicating acceptable discriminant validity (J. Cohen et al. 2003).

< Insert Table 3 about here >

The results of the Ordinary Least Square (OLS) regression are reported in Table 4. Model 1 loans only the control variables, whereas in Models 2-4 each independent variable is added. Finally, in Model 5 the simultaneous effects exerted by all the variables are investigated. The discussion is based on this last model. The omitted Control variable are

all the 5 industrial Sectors , the prevalence of youth and foreign people in the board of management.

< Insert Table 4 about here >

Regarding control variables, we can assert that all these are significant and have a *p* value < 0,01 (1%).

Analyzing the first group of control variable (Pruductive Size), even if it is divide into 5 sub group (A-E), it should be stressed that most of the sample falls into the first two classes (A) and (B). The results show us that as the production size increases, the correlation with the dependent variable changes from negative to positive, that is, for those start-ups whose production exceeds 2,000,000.00 Euros.

Different considerations emerge analyzing the second group of control variable "Company Size"; Also here, even if the start-ups are categorized into 3 sub group (A-C), it should be stressed that most of the sample falls into the first two classes of (A) and (B). In Start-ups with up to 9 employees, a positive correlation emerges which tends to decrease and become negative when this threshold is exceeded. Regarding the last control variable (PrevWomenDummy), data reveal that the prevalence of women in the board of management is not significant.

Considering the independent variables, data reveal that Grants Number and the Total Grants amount received have a positive relationship with the innovative performance of start-ups, thus confirming Hypothesis 1a (β=0.150, $p < 0.1$) and 1b (β=0.130, $p < 0.1$).

In fact, it emerges that it is necessary to have funding in the preliminary phase of start-up growth and that these investments are mainly used in R&D expenses. This is because only through research activities can these companies generate innovation. Moreover, grants allow companies to grow more than the others not only because they are addressed to fast growing start-ups, but also for a positive and genuine effect of these types of investments in start-up management.

Also Hypothesis 2(a) is confirmed, since the interaction between the Total amount of Grants received and the presence of a high qualified team is positive related to the Start-ups Innovative Performance (β=0.170, $p < 0.1$). This shows that start-ups in their growth phase consider R&D mainly in terms of the use of qualified resources and that the greater the total amount of grants, the greater the research activity carried out.

Finally, Hypothesis 2b is not significant. Actually, this result does not surprise us as the number of grants received linked to the number of people employed does not lead to significant results compared to R&D expenditure since start-ups tend to focus on one or a few research topics, so we will hardly have start-ups with multiple types of funding and multiple lines of research.

3.5 Discussion and conclusion

Studying the main factors impacting the growth of a start-up is fundamental to understand which are the best strategies to adopt. The start-up survival depends on the ability to innovate and promptly respond to market changes. To innovate, a start-up needs both suitable financial instruments and specialized skills. For this reason, Start-ups, unlike traditional companies, pay a lot of attention to R&D investments to enlarge their knowledge about technologies, customers, and markets.

More in details, previous studies focused only on received grants or on the role played by the team in relation to R&D; moreover, these studies mainly focused on SMEs and not on start-ups.

Our analysis, on the other hand, aims to study the coexistence of the two phenomena in order to understand how this mix of variables influences the R&D activities. Furthermore, another aspect that characterizes this study is the choice of the sample, based on innovative start-ups in accordance to the Decree-Law 179/2012 on “Further urgent measures for Italy’s economic growth”, converted into Law 221/2012. So, employing a

sample of 405 Innovative Start-ups tested the effects exerted by the number and total amount of grants received and presence of a high qualified team, both separately and jointly.

Results suggest that Grants Number and the Total Grants amount received have a positive relationship with the R&D expenses of start-ups.

This data is in line with what emerged from various studies in the literature; the authors who studied this phenomenon noted that public funding induced more R&D activities (Busom ∗ 2000) and that companies that receive public funding reach on average a higher intensity (intended as the ratio between R&D expenditure and sales) than the others (Almus and Czarnitzki 2003).

The search for funding is therefore essential for start-ups, especially for those defined as innovative. If we consider the Italian context, grants are, in most cases, non-repayable, small-size, generally disbursed at regional level and often linked to competitions. In recent years, however, the use of crowdfunding through specialized and thematic platforms is also becoming widespread. Adoption of crowdfunding as a source of early stage start-up finance may result in an increased rate of societal innovation (Ley and Weaven 2011). Therefore, as just explained by Roma et. al. (Roma, Messeni Petruzzelli, and Perrone 2017), pledging a higher amount of money in the crowdfunding campaign can ignite professional investors interest and thus help start-up companies to secure subsequent funding for R&D activities. However this positive effect emerges and becomes more intense when it is complemented by the presence of high level skills. And that's why in our study we decided to correlate in addition to an external variable (Founding source) also an internal variable (specialized competences). The results indeed show that high specialized teams are more likely to get funding. Teams cognitive and social orientation also influences the ability to secure capital and resources for newly initiated corporate projects. Specifically, the way the team plans its activities should increase the likelihood of funding, because a detailed plan can serve as a blueprint to securing capital, accessing

markets, recruiting key employees, developing a strategic plan, and for projecting growth objectives.

Another important aspect emerging form this study regard the influence of a start-up production size. The model show that there is a change in correlation from negative to positive, for those start-ups with an high production value.

This result is certainly in line with the typical characteristics of a start-up. In fact, small start-ups tend to invest in R&D only small budget shares, and generally tend to spread them over time (Wright 1998). These companies, in the first years of activity, mainly employ the know-how of the directors and shareholders, very often conferred in kind, therefore not charged to the balance sheet items; in other cases, R&D concerns the purchase of machinery and products or semi-finished products whose depreciation rates are spread over several accounting years. Start-ups with greater size , often born as spin-offs of large companies, or owner of innovative technologies, already start with a well-defined organizational structure and strong know-how and this allows them to invest heavily in R&D from the early stages (W. M. Cohen 2010; Brynjolfsson, Rock, and Syverson 2017).

Even the "Company Size" assumes an important role in particular has emerged the In Start-ups with up to 9 employees, a positive correlation emerges which tends to decrease and become negative when this threshold is exceeded.

Small Start-ups are considered more flexible and entrepreneurs and employees are more motivated to contribute to innovation efforts, so the effects of their contribution is more direct e immediate (Uhlaner et al. 2013). Instead, start-up with more employees might also be disadvantaged at innovation because R&D efficiency might decrease due to loss of managerial control, more bureaucratic inertia (Stock, Greis, and Fischer 2002; W. M. Cohen 2010).

The present study contributes to the existing literature on start-up innovative performance in several ways.

First, the choice of the dependent variable, in terms of innovation performance, was made considering one of three prerequisites for obtaining the status of "innovative start-up" according to the Italian Law. Then, having used as a sample, the innovative start-ups registered into the Chamber of Commerce official database, gives this study, obviously with reference to the Italian territory, a certain rigor in the analyzes followed.

Second, the academic literature has mainly studied the impact of R&D on new product development ,the interfirm alliances mainly in SMEs context (W. M. Cohen and Levinthal 1989; Baumol 2002; Stam and Wennberg 2009; Hall, Lotti, and Mairesse 2009). Differently, and changing perspective, this study tries to understand how the mix of variables influence R&D investments of young firm defined by Law as Start-ups.

Third, researchers who investigated start-ups growth (e.g. (Ahuja 2000; Sampson 2007), payed however less attention to multiple factors affecting innovative performance a start-up (C. Kim and Song 2007). Differently, this paper in one of few attempt focusing on the determinants of start-up innovative performance. Political, economic, social, technological, (external level) influencing factors, as well as the main factors within the organizational (internal level) boundaries, are to be considered as crucial for start-up innovation and growth. Specifically, we propose that such performance depends on both the source funding (external variable), and the presence of specialized competences within the team (internal variable).

In terms of policy implications, findings seems to suggest that policy makers should introduce integrated measures to support start-ups.

Considering the characteristics of the Italian production system, it would be desirable, in fact, a regional governance model capable of supporting the birth of new start-ups taking into account the real needs and potential of the territory. Furthermore, it is essential that the funding measures are conceived in an integrated manner so as to guide these companies throughout the life cycle, from the creation of the idea, to incubation up to industrial consolidation. In fact, the study shows that most start-ups have received small

funding especially in the initial phase. Only in some cases there is the presence of grants associated with different stages of business growth.

While we believe that the present paper may represent an important contribution to the existing literature, it has some limitations that may represent fruitful venues for future research.

In the analysis conducted, we do not consider the types of grants but do an analysis of the total value received. It would be interesting to study how the different types of grants (commercial banks, venture capitalists, business angels, government agencies, private individuals, leasing or factoring companies, customers, and suppliers, among others) influence investments in R&D.

Another aspect worthy of analysis concerns the relationship between the type of grant received and the type of product / service developed by the start-up and therefore the influence of the sector in which it operates.

In fact, from our study, the "Sector" control variable was omitted because it is not relevant, this most likely because we have not divided the various types of grants and thus the model has given us not significant values

Another relevant aspect for future studies concerns the composition of the team. In this study we have limited ourselves to considering the total number of specialized personnel but it would certainly be interesting to study which competences influence the performance.

Surely the analysis of the team skills with respect to the industrial sector and the types of grants received could provide further insights and relevant considerations.

Finally, considering that the database used is constantly evolving, and the number of innovative start-ups increases every year, surely the analyzes made should be monitored over time.

TABLES AND FIGURES

Table 1 – Research Sample

Region	*N° of Innovative Start-ups*	*Expenses attributed to R&D activities*	*N° of Grants*	*Total Amount of Grants*	*N° of a high qualified team*
ABRUZZO	20	802.001,50 €	20	1.228.500,00 €	46
BASILICATA	7	430.120,00 €	7	525.000,00 €	13
CALABRIA	11	636.946,00 €	10	670.000,00 €	24
CAMPANIA	49	2.837.642,09 €	49	3.411.515,00 €	116
EMILIA-ROMAGNA	32	1.437.461,00 €	34	3.177.999,00 €	75
FRIULI-VENEZIA GIULIA	8	332.500,00 €	7	375.000,00 €	13
LAZIO	43	4.961.400,06 €	50	4.572.710,00 €	117
LIGURIA	11	897.336,00 €	15	1.246.000,00 €	24
LOMBARDIA	76	4.195.157,10 €	79	19.048.051,00 €	212
MARCHE	8	202.072,00 €	5	183.000,00 €	13
MOLISE	1	2.000,00 €	0	0,00 €	1
PIEMONTE	24	1.537.605,13 €	24	1.726.000,00 €	52
PUGLIA	20	730.839,18 €	13	1.645.000,00 €	43
SARDEGNA	7	351.580,00 €	7	862.825,00 €	21
SICILIA	32	1.228.075,00 €	21	2.200.600,00 €	61
TOSCANA	15	753.377,00 €	17	1.614.096,00 €	37
TRENTINO-ALTO ADIGE	6	173.912,82 €	7	403.407,00 €	14
UMBRIA	4	159.000,00 €	3	385.000,00 €	11
VALLE D'AOSTA	2	160.000,00 €	3	335.000,00 €	5
VENETO	29	907.791,35 €	25	1.653.000,00 €	61
ITALIA	**405**	**22.736.816,23** €	**387**	**45.262.703,00** €	**959**

Table 2 – Definition of the dependent, independent, and control variables

Variable Name	Variable description
Dependent Variable	
InnPerf	Amount of company's expenses attributed to R&D activities
Indipendent variables	
GrantNumber	Number of grants received (number of measure/grants to support the italian innovative start-up ecosystem)
TotalGrant	Total Amount of grants received
teamHighLevel	Number of high specialized team (at least 1/3 of the total workforce are PhD students, the holders of a PhD or researchers; alternatively, 2/3 of the total workforce must hold a Master's degree)
Control variables (set 1)	
agricuture	Dummy variable assuming value 1 if the start-up operate in the market/product segment of agriculture
commerce	Dummy variable assuming value 1 if the start-up operate in the market/product segment of commerce

industry	Dummy variable assuming value 1 if the start-up operate in the market/product segment of industry
service	Dummy variable assuming value 1 if the start-up operate in the market/product segment of service
tourism	Dummy variable assuming value 1 if the start-up operate in the market/product segment of tourism
Control variables (set 2)	
ProductiveSize(A)	Dummy variable assuming value 1 if the start-up as a Production/Income range (0 - 100.000 euro)
ProductiveSize(B)	Dummy variable assuming value 1 if the start-up as a Production/Income range (100.001 - 500.000 euro)
ProductiveSize(C)	Dummy variable assuming value 1 if the start-up as a Production/Income range (500.001 - 1.000.000 euro)
ProductiveSize(D)	Dummy variable assuming value 1 if the start-up as a Production/Income range (1.000.001 - 2.000.000 euro)
ProductiveSize(E)	Dummy variable assuming value 1 if the start-up as a Production/Income range (2.000.001 - 5.000.000 euro)
Control variables (set 3)	
CompanySize(A)	Dummy variable assuming value 1 if the start-up as an employee range (0-4)
CompanySize(B)	Dummy variable assuming value 1 if the start-up as an employee range (5-9)
CompanySize(C)	Dummy variable assuming value 1 if the start-up as an employee range (10-19)
Control Variables (set 4)	
PrevWomen	Dummy variables indicating a prevalence of women [% of share capital + % Administartor]
PrevYouth	Dummy variables indicating a prevalence of youth [% of share capital + % Administartor]
PrevForeign	Dummy variables indicating a prevalence of foreign [% of share capital + % Administartor]

Table 3a – Descriptive statistics and correlation matrix (N=405)

Panel (A): indipendet variables								
	Min	Max	Mean	S.D.	1	2	3	4
1.logInnPerf	2,65	5,83	4,38	0,59	1,00	0,69	0,73	0,69
2.logGrantAmount	-0,3	6,3	3,2	2,51		1,00	0,82	0,65
3.GrantNumber(VI)	0	4	0,96	0,87			1,00	0,68
4.TeamHighLevel (VI)	1	13	2,39	1,5				1,00

Table 3b – Descriptive statistics and correlation matrix (N=405)

Panel (B): Control variables													
	Min	Max	Mean	S.D.	1	2	3	4	5	6	7	8	9
1.logInnPerf	2,65	5,83	4,38	0,59	1,00	-0,07	-0,04	0,05	-0,02	0,01	-0,12	-0,06	-0,03
2.Agricolture	0	1	0,01	0,09		1,00	-0,02	-0,04	-0,16	-0,01	0,05	0,12	-0,01
3.Commerce	0	1	0,03	0,17			1,00	-0,08	-0,33	-0,01	0,06	0,08	0,17
4.Industry	0	1	0,18	0,38				1,00	-0,88	-0,03	-0,08	-0,02	0,06
5.Services	0	1	0,78	0,41					1,00	-0,13	0,04	-0,03	-0,12
6.Tourism	0	1	0	0,07						1,00	-0,03	-0,03	-0,01
7.PrevWomenDummy	0	1	0,13	0,34							1,00	0,07	0,09
8.PrevYouthDummy	0	1	0,16	0,37								1,00	-0,02
9.PrevForeignDummy	0	1	0,02	0,15									1,00

Table 3c – Descriptive statistics and correlation matrix (N=405)

Panel (C): indipendet varables													
	Min	Max	Mean	S.D.	1	2	3	4	5	6	7	8	9
1.InnPerf	2,65	5,83	4,38	0,59	1,00	-0,61	0,33	0,39	0,21	0,16	-0,34	0,31	0,15
2.ProductiveSize(A)	0	1	0,58	0,49		1,00	-0,80	-0,33	-0,17	-0,10	0,34	-0,31	-0,17
3.ProductiveSize(B)	0	1	0,32	0,47			1,00	-0,19	-0,10	-0,06	-0,12	0,15	-0,02
4.ProductiveSize(C)	0	1	0,07	0,26				1,00	-0,04	-0,02	-0,35	0,30	0,16
5.ProductiveSize(D)	0	1	0,02	0,14					1,00	-0,01	-0,04	0,00	0,11
6.ProductiveSize(E)	0	1	0,01	0,09						1,00	-0,21	0,06	0,40
7.CompanySize(A)	0	1	0,86	0,35							1,00	-0,91	-0,35
8.CompanySize(B)	0	1	0,12	0,32								1,00	-0,05
9.CompanySize(C)	0	1	0,02	0,14									1,00

Table 4: The Ordinary Least Square (OLS) regression Model (N=405)

Dependent Variable: LogInnPerf		Model 1 (Baseline)		Model 2		Model 3		Model 4		Model 5		Model 6 (comprehensive)	
		B	Stand. Error	B	Stand. Error	B	Stand. Error	B	Stand. Error	B	Stand. Error	B	Stand. Error
Indipendent variables													
Grant number	H1A			0,36	0,03							0,15	0,20
Log Total Grant amount	H1B					0,11	0,01					0,13	0,75
Log Total Grant amout * team high level	H2A							0,34	0,04			0,17	0,75
Log Grant number * team high level	H2B									0,84	0,11	0,07	0,77
Control variables													
ProductiveSize(A) -234		-0,81	0,31	-0,47	0,26	-0,53	0,26	-0,54	0,24	-0,41	0,24	-0,48	0,23
ProductiveSize(B) - 128		-0,25	0,32	-0,11	0,26	-0,17	0,26	-0,28	0,24	-0,16	0,24	-0,25	0,23
ProductiveSize(C) - 30		0,22	0,33	-0,01	0,27	0,18	0,26	0,00	0,25	0,01	0,25	-0,08	0,24
ProductiveSize(D) - 10		0,32	0,35	0,17	0,29	0,26	0,28	0,02	0,27	0,08	0,27	-0,01	0,26
ProductiveSize(E) - 3		0,59	0,42	0,17	0,35	0,52	0,34	0,20	0,35	0,13	0,35	0,02	0,34
CompanySize(A) - 348		0,35	0,44	0,12	0,36	0,04	0,36	0,02	0,36	0,01	0,34	0,02	0,30
CompanySize(B) - 48		0,50	0,45	0,26	0,37	0,17	0,36	0,03	0,06	-0,04	0,07	0,06	0,07
CompanySize(C) - 9		0,24	0,48	0,05	0,39	-0,12	0,39	-0,13	0,18	-0,22	0,19	-0,08	0,19
PrevWomenDummy	-	-0,12	0,07	-0,06	0,05	-0,08	0,05	-0,07	0,07	-0,10	0,07	-0,06	0,06
Costant		4,56	0,54	4,21	0,45	4,32	0,44	3,20	0,32	4,44	0,25	3,16	0,39
No. Of Obs		405		405		405		405		405		405,00	
AIC		496,82		340,04		326,06		173,75		177,68		131,38	
Log likelihooh		-238,41		-159,02		-152,03		-76,87		-78,84		-52,69	
R^2		0,45		0,63		0,64		0,54		0,54		0,56	

4. Start-ups – Incubators joint innovations: The impact of geographical distance and funding source.

4.1 Introduction

Nowadays, it is well understood that the creation and application of new knowledge are the primary factors that drive the economic growth.

In this context, intellectual property law has always been a determining factor and the growth of our economies has developed on it. Within it there are also very different elements such as the law of trademarks, patents, industrial design, know-how, up to copyright.

The exploitation of the patent right cannot be a single defensive weapon in the case of startups, as happens in the industrial world, in which a patent is filed only to prevent competitors from taking advantage of it, even if the solution is not implementable internally.

This represents a no-return and unsustainable cost for a startup. Instead, it is necessary to exploit the possible leverage effect concerning the ability to attract capital by exploiting intellectual property, demonstrating for example the potential of patented innovation with the aim of attracting potential investors. In this context start-ups-incubators joint collaboration play a crucial role for the creation of new knowledge and innovation as the Incubators are organizations that provide start-ups with a broad range of services and resources needed for survival and growth (Aerts, Matthyssens, and Vandenbempt 2007; Bergek and Norrman 2008; Bruneel et al. 2012). They act as bridges or mediators among investors, incubator members, academic institutions, and various supporting structures that provide financial, technical, or management assistance (M'Chirgui et al. 2018). Their

success depends not only on their internal resources but also on external conditions, including institutional arrangements and resources provided by external actors: industry, university, and various levels of government (Corona, Doutriaux, and Mian 2006; M'Chirgui et al. 2018). The presence of different institutional structures affects strategy and policy implementation: the incubator can be viewed as mediating the impacts of institutions on members, amplifying their positive influences and mitigating negative ones (Hackett and Dilts 2004).

The present study aims at contributing to the debate about Start-ups – Incubators joint innovation, focusing on the factors making some collaborations better than others. Specifically, differently from previous works that have mainly focused their attention to identify start-ups characteristics and relations that promote this kind of collaboration (e.g. Debackere and Veugelers 2005; Veugelers and Cassiman 2005; F. T. Rothaermel, Agung, and Jiang 2007), I analyse how these characteristic interact each other, investigating the role that both Geographical distance and Grants received compared to the innovative value of start-up.

In an attempt to fill the above gaps, we focused on industrial property, measuring the innovative value of start-up as the as the number of patents, licenses, property rights owned by the start-up for the realization of innovative products / services and processes. We focus on some relevant drivers of the innovative value of start-up, namely the Number and Total Amount of Grants received, and the Geo distance, expressed in kilometers, between the start-up headquarters and the nearest incubator and the Relationship Intensity. We develop testable hypotheses about the impact of these factors on the innovative performance of Start-ups, and we test them on a sample of 1841 Innovative Start-ups established in Italian Country and registered into the Chamber of Commerce official database.

In brief, our analysis reveals that both the relationship Intensity and the Number of Grants received by each start-ups impact positively innovative value of a Start-up. Instead, the Geo Distance and the Total Amount of Grant Received however, they have a negative relationship tending towards zero. The paper is organized as follows. In the next sections, we briefly review the relevant literature and develop four testable hypotheses considering the Geograpgical Distance and the Relationship Intensity with incubators and the role of Grants received and the innovative Value of Start-ups. Then, we set out methods and results of our study. Finally, we offer a discussion of our statistical findings and outline some concluding remarks and implications for both academics and practitioners.

4.2 Theory and Hypotheses

4.2.1 Startup – Incubators joint Collaborations

Nowday incubators represent a preferred option for supporting the birth, survival, and early-stage growth of new innovative entrepreneurial ideas (S. A. Mian 1994; Phan, Siegel, and Wright 2005; Chan and Lau 2005; Aerts, Matthyssens, and Vandenbempt 2007). In this context, to offset the risks associated with start-ups, European governments increasingly support them through incubators. It is estimated that there are currently over 1000 European incubators, 85% of which is located in Western European countries, and that their number has seen a fivefold increase between 2007 and 2013 (Aerts, Matthyssens, and Vandenbempt 2007; Ahmad and Ingle 2013; Salido, Sabás, and Freixas 2013). Accordingly, incubators are considered to be the mainstays of European high-technology industrial development, (Oakey 2012), and an institutionalized component of the EU's and its member states national innovation systems (Ahmad and Ingle 2013).

Incubators can strengthen the entrepreneurial ecosystem by supporting local start-ups in various ways (van Weele et al. 2018). First, as part of the business ecosystem support services (Spigel 2017; Stam 2015), 'first generation' incubators focus on providing start-ups with shared office space and other tangible resources, such as meeting rooms, to create economies of scale (Barrow 2001; Bruneel et al. 2012). More specialized incubators (e.g affiliated with universities) also provide access to equipment or laboratories (S. A. Mian 1997). From the early 1990s, incubators increasingly focus on supporting technology-based start-ups (Ahmad and Ingle 2013; Bruneel et al. 2012); but the founders of these start-ups lacked entrepreneurial experience, so incubators start providing professional consultancy services, as well as coaching and training for entrepreneurs, as a way for entrepreneurs to develop missing business knowledge (Rice 2002). These incubators also provide financial capital by investing in their tenant companies (Aerts, Matthyssens, and Vandenbempt 2007; Barrow 2001), or by making accessible other funding channels.

Incubators also act as a node in the entrepreneurial ecosystem, by curating the relationship between entrepreneurs and their peers, or between entrepreneurs and other actors (Bergek and Norrman 2008; Spigel 2017). This is the focus of the 'third generation' incubators, emerged in the late 1990s, which aim to facilitate access to external resources and networks (Bøllingtoft and Ulhøi 2005; Hansen et al. 2000). These incubators stimulate start-ups to collaborate and exchange knowledge with each other in the incubator community, by co-locating start-ups in the incubator premises, by creating synergies among start-ups through the selection processes, by organizing network events, and by acting as relational 'brokers' to make one-on-one connections (C. E. Cooper, Hamel, and Connaughton 2012; Hughes, Ireland, and Morgan 2007; Tötterman and Sten 2005).

Moreover, incubators can protect start-ups from unfavorable institutions (Amezcua et al. 2013; Hackett and Dilts 2004). Incubator community creates a culture of support and encouragement (C. E. Cooper, Hamel, and Connaughton 2012), which may compensate

the absence of such a culture in the entrepreneurial ecosystem (van Weele et al. 2018). Moreover, incubators may act as 'institutional entrepreneurs' (Amezcua et al. 2013): actors who transform or create institutions that favor their interests (DiMaggio 1988). For example, by organizing a collective group

of start-ups, the incubator increases power and legitimacy of the individual start-ups (Pacheco et al. 2010).

Furthermore, universities that foster entrepreneurial activities are considered to be more efficient when it comes to commercializing scientific knowledge, mainly through patents and licenses, or through the development of business incubators and technology parks (Bramwell and Wolfe 2008; O'Shea et al. 2007). Beyond research and education, universities have become knowledge centers, working alongside with young and established companies and public and private research institutes in regional innovation networks to improve the commercialization of research results, fostering new business models, hereby bringing R&D to a higher level (Qiao and Yang 2015; Dalmarco, Hulsink, and Blois 2018). Hence, universities are going beyond their traditional mission in terms of teaching and research activities, undertaking an entrepreneurial "third mission", that has significantly increased interactions and collaborations with the industrial environment (Etzkowitz and Leydesdorff 2000; Nelson 2005; Frank T. Rothaermel and Thursby 2005; Siegel, Wright, and Lockett 2007). There are different forms of collaboration, such as employment by industry of university graduates, joint research programmes, licensing of university patents, etc. (e.g. (W. M. Cohen, Nelson, and Walsh 2002; Schartinger, Rammer, and Fröhlich 2006; Pablo D'Este and Iammarino 2010; Giuliani and Arza 2009). In particular, Veugelers and Cassiman (Veugelers and Cassiman 2005) empirically demonstrate that firm size, industry, government support, and involvement in innovative activities positively affect the probability to establish R&D collaborations with universities. Companies that establish university collaborations usually have a strong research exploratory behaviour and a centralized organization of R&D activities (Bercovitz and

Feldman 2007). Regarding universities, entrepreneurial orientation, existence and productivity of technology transfer offices, creation of new firms, and environmental context are generally seen as the most important factors influencing their capability to collaborate and develop joint innovations with the industrial environment (F. T. Rothaermel, Agung, and Jiang 2007; Petruzzelli 2011). Furthermore, in general collaborations of spin-off start-ups with other firms, in particular alliances with large firms, increase their innovation performance (Hagedoorn, Lokshin, and Malo 2018).

University-industry collaborations and start-ups incubation are mainly influenced by geographical distance (P. D'Este, Guy, and Iammarino 2013). Maietta (Maietta 2015) demonstrates that product innovation is positively affected by geographical proximity to a university but is negatively affected by the amount of its codified knowledge production. Petruzzelli (Petruzzelli 2011) suggests that geographical closeness between universities and firms seems to not favor the joint development of more valuable innovative outcomes. Local university structure and behaviour characterize the "knowledge context" in which the firm mainly operates and gathers information for R&D outsourcing (Beise and Stahl 1999). Geographical proximity (Morgan 2004) enables the transmission of tacit knowledge, which is personal and context-dependent. This knowledge cannot be easily bought via the market and is difficult to communicate without personal interaction in the context of shared experiences. In particular, geographical proximity matters when knowledge spillovers are informal and in the event of information asymmetry between researchers and research users, which arises when users cannot precisely evaluate the applicability of the transferred research until they attempt to translate it into new or improved products or processes (D. B. Audretsch and Feldman 1996; Jaffe, Trajtenberg, and Henderson 1993; Landry, Amara, and Ouimet 2007). Instead, when knowledge is transmitted through formal links between researchers and companies, geographical proximity is not strictly necessary because direct contact does not happen by chance but is carefully planned (D. B. Audretsch and Feldman 1996). Moreover, cognitive proximity is

generally lower in social science research than in natural science research because social science knowledge is less codified than natural science knowledge and is not based on a unified and established scientific methodology (D. B. Audretsch and Lehmann 2006; Maietta 2015). Studies by D'Este and Iammarino (Pablo D'Este and Iammarino 2010) demonstrate also that geographical proximity exerts a positive impact on the occurrence of university-industry partnerships, especially referring to engineering-related disciplines.

4.2.2. Geographical Distance, Relationship Intensity and Start-up Innovation Value

Knowledge is the main source of start-ups competitive advantage (Kogut and Zander 1992; Spender 1996) and start-ups have been thought to be the most affected by external networks during their knowledge processes (Eisenhardt and Schoonhoven 1996; B. R. Smith, Matthews, and Schenkel 2009). Geographical proximity represents a source of competitive advantage based on intangible assets such as new ideas and projects, innovative knowledge, and human capital (Calcagnini et al. 2016).

Geographical proximity between a start-up and its business partners is assumed to reinforce knowledge acquisition and exploitation since knowledge is partially tacit and localized (Cooke and Wills 1999; McEvily and Marcus 2005). Both strategic studies and economic geographers have considered geographical proximity the key parameter that start-ups can use to increase their exposure to potential knowledge spillovers (Alcácer and Chung 2007; D. B. Audretsch and Lehmann 2006; Freel 2003; Macpherson and Holt 2007). Abramovsky et al. (Abramovsky, Harrison, and Simpson 2007) demonstrate that closeness promotes collaboration and knowledge flows, moreover, geographical closeness compensates the difficulties arising from the lack of institutional proximity (Ponds, van Oort, and Frenken 2007). The positive effect of proximity also depends on the ability of organizations to exploit spillovers, which obviously differs across sectors and organizations (Calcagnini et al. 2016).

Simonen and McCann (Simonen and McCann 2008) argue that the process of knowledge spillover is significantly influenced by organizations' location since knowledge is argued bounded in space. Furthermore, the process of knowledge spillover tends to occur in organizational clusters like Silicon Valley due to the knowledge density.

Other economic geographers suggest that although geographical proximity may facilitate interactive learning, it is neither a prerequisite nor a sufficient condition for reinforcing the processes of knowledge acquisition and exploitation by co-localized start-ups (Antonelli 2000; Boschma 2005; Rallet and Torre 1999). These researchers point out that also the role of both social and cognitive dimensions of proximity is crucial in knowledge processes(Presutti, Boari, and Majocchi 2011; Boschma 2005; Kaiser 2002; J. Liao and Welsch 2005; Powell et al. 2002).

In general studies show that proximity to a university is a good predictor of an incubator, resident company, and research park performance (Link and Scott 2019). The short geographical distance is particularly important for the relationship between a start-up and its incubator. The incubator seeks an effective means to link technology, capital and know-how in order to leverage entrepreneurial talent, accelerate the development of new companies, and thus speed the exploitation of technology (Grimaldi and Grandi 2005). Small distances facilitate face-to-face interactions and foster knowledge transfer and innovation rise (Antonelli 2000); geographical proximity brings organizations together, favor interaction with a high level of information richness and facilitate the exchange of, especially tacit, knowledge between actors (e.g. (Boschma 2005). Empirical studies tend to confirm that knowledge externalities are geographically bounded, since collaborations between close organizations show better innovative performance than those between distant ones (e.g. (Jaffe, Trajtenberg, and Henderson 1993; A Phene and Tallman 2002). This depends on the fact that geography favours the creation of economical and institutional linkages between actors, and the development of common institutional practices, that are important to generate innovative activities and knowledge

spillovers (Wejnert 2002; Anupama Phene, Fladmoe-Lindquist, and Marsh 2006). Furthermore, studies have shown that geographical proximity to universities and incubators is positively correlated with regional start-up rates in high-tech industries (Frank T. Rothaermel and Ku 2008), and with regional economic development (Calcagnini et al. 2016).

Most incubators are born in universities, or from university-firm collaborations. Academic research quality and geographical proximity from start-up to university (D. B. Audretsch and Stephan 1996; Mansfield 1991; Mansfield and Lee 1996) are also universally recognised as influencing market-related interactions between incubators and start-ups, mainly through contract and collaborative research (Pablo D'Este and Iammarino 2010; P. D'Este, Guy, and Iammarino 2013; Laursen, Reichstein, and Salter 2011) and licensing (Mowery and Ziedonis 2015). However, Petruzzelli (Petruzzelli 2011) suggests that geographical closeness between universities and firms seems to not favor the joint development of more valuable innovative outcomes.

Incubators can be viewed as the link between university and industrial start-ups environment, and usually start-ups choose incubators in the same area. Mansfield and Lee (Mansfield and Lee 1996) demonstrate that firms and start-ups prefer to work with local university researchers within a hundred miles of the firm's R&D laboratory. Calderini (Calderini 2005), using publications and patents as proxies of the innovation output, empirically support the relevance of geo-graphical determinants in explaining knowledge-based interactions between the academic environment and the industrial one. Fabrizio (Fabrizio 2006) analyzes the number of citations to universities in firm patents, he finds that the greater distance from a research university to the focal firm, the lower will be that firm's rate of exploitation of public science. D'Este and Iammarino (Pablo D'Este and Iammarino 2010), conducting an extensive analysis of collaborative research grants, confirm the importance of geographical proximity for business collaborations. Specifically, the authors demonstrate that geographical proximity exerts a positive impact on the

occurrence of new partnerships, especially referring to engineering-related disciplines. However, the positive influence of spatial closeness tends to become less significant when dealing with high quality academic organizations, which are able to attract also distant business partners.

In this context, intellectual property rights, patents and launches of new products are an important consideration in business collaborations. One measure of output is the level of patenting activity in start-ups (Lindelöf and Löfsten 2004). Santoro and Gopalakrishnan (Santoro and Gopalakrishnan 2001) show that trust, geographic proximity and flexible university policies for intellectual property rights, patents and licenses are strongly associated with greater technology transfer activities. The geographical proximity the business incubator provides is therefore argued to enable knowledge acquisition and transfer between the startups (Lindelöf and Löfsten 2004). In fact, incubators are also space for co-working, collaboration and sharing for the incubated start-ups, knowledge is transferred between startups from the interactions by sharing and discussing experiences and suggestions related to their businesses. Socialization positively affect the transfer and acquisition of knowledge (McAdam and McAdam 2006). Sharing office space also should facilitate embedded relations, synergies and social capital aiding the development of innovations and open up for potential collaborations (Hansen et al. 2000). Hence the other startups can be seen as the sources of knowledge (Pettersson and Götsén 2016). Another process that should occur in a business incubator environment due to the knowledge density is knowledge spillover (Diez-Vial and Montoro-Sanchez 2017; Simonen and McCann 2008). Knowledge spillover takes place when an organization exploits knowledge, most often technical related knowledge, developed by another organization (Diez-Vial and Montoro-Sanchez 2017; Griliches 1991).

In particular in the launching phase geographical proximity between a start-up and its incubator is crucial in order to be able to get the coaching when needed. The incubator emphasizes the importance of the close distance with start-ups, who are normally in the

same building in the beginning. This way, they can work closely together and can make decisions much faster, which accelerates the whole business. When receiving more external funding, the companies can grow and become more independent and typically move to their own offices in the second or third year when the internationalization is already on the right track (Roelen-Blasberg and Weiss 2014).

The above arguments suggest the following hypothesis:

H1a. The Geographical distance between a start-up and the incubator is (positively) related to the creation of licensee (registered patent) or program for original registered computers.

H1b. The Relationship Intensity between a start-up and the incubator is (positively) related to the creation of licensee (registered patent) or program for original registered computers

4.2.3 Founding sources and Start-up Innovation Value

One of the most important challenges for start-up companies is securing financing. For this, it is crucial for start-ups to signal their projects profitability to potential investors. They need to reveal reliable information about their ability to attract investors during the early financing stages (Hahn, Kim, and Kwon 2017). In this path, it could be important to protect the start-up innovative value, through patents, trademarks, copyrights or trade secrets. Trademarks and service marks could be a word, phrase, symbol, design or other indicator that identifies a good or service by indicating its source of origin in the owner or licensee; copyright is a form of protection granted to works of authorship. Patents are rights granted by the government that excludes others from producing, using, or selling an invention, they must be useful, novel, and not be obvious. A start-up can also protect

proprietary product or process as trade secret without disclosing detailed information that would be required in patent (Schilling and Shankar 2019).

For technology-based start-ups, the number of filed patents is a useful signal to access seed investors (Hahn, Kim, and Kwon 2017). The economic literature on the measurement of the value of patents takes as an assumption that the value of any patent is reflected in the number of times the patent is cited, or the length of its renewal, or the number of countries where it is taken (Guellec and van Pottelsberghe de la Potterie 2000).

As Graham et al. (Graham et al. 2009) point out, technology start-ups tend to hold patents for a competitive advantage, to secure financing, and enhance their reputation. In particular, by analyzing the Berkely Patent Survey, they find that it is easier for start-ups to attract funding from external investors if they hold more patents. Conti et al. (Conti, Thursby, and Rothaermel 2013) empirically show that, in start-up financing, an increase in the level of patents raises both the frequency and number of investments from venture capitals. The reason is that patents unveil new venture's technological capabilities, and thus reduce the uncertainty about the technological viability of the new product idea and its value appropriability (Roma, Messeni Petruzzelli, and Perrone 2017). A start-up that shows the existence of good market prospects becomes more valuable in the eyes of professional investors when accompanied by evidence of technological viability and exclusive protection of the new product idea, as demonstrated by the presence of patents, that can enhance the ability of the start-up to capture the high value signaled by the relevant performance in the founding campaign (Roma, Messeni Petruzzelli, and Perrone 2017). Patents have a crucial role in reducing uncertainty surrounding new technology-based start-ups, and thus favoring access to grants from professional investors (J. A. C. Baum and Silverman 2004; Heeley, Matusik, and Jain 2007; Graham and Sichelman 2008; Conti, Thursby, and Rothaermel 2013). By filing a patent application and succeeding in the examination process, the new company informs potential investors about its capability to develop technological solutions that are novel, inventive, and

capable of industrial application (Haeussler, Harhoff, and Mueller 2014; Messeni Petruzzelli, Rotolo, and Albino 2015), as well as that may benefit from an exclusive protection over certain markets (Mann and Sager 2007; D. B. Audretsch, Bönte, and Mahagaonkar 2012; Conti, Thursby, and Rothaermel 2013; Haeussler, Harhoff, and Mueller 2014). In fact, patents can confer to the start-up the ability to appropriate the value of the given innovative product, and hence secure profit advantages in the future market through distinctive product offerings and/or production processes relying upon proprietary technologies (Helmers and Rogers 2011). In addition, turning knowledge into property rights via patenting can ensure the presence of a salvage value, and thus increase bargaining power of entrepreneurs and their investors when negotiating with third parties (Ziedonis 2004; Graham and Sichelman 2008; Hoenig and Henkel 2015).

Finally, patenting can demonstrate that the new venture has invested a significant effort, in terms of both time and resources, to satisfy the patenting criteria, hence revealing its technological capabilities and certifying that the underlying technology is at an advanced development stage (Lemley 2001; C. Long 2002).

On the basis of the above considerations, it appears clear that the presence of patents exerts a positive influence on the likelihood of securing external financing, this obviously allows the start-up to work for growing and obtaining other patents.

In fact, several studies show that companies that have received grants reach better business results, different output measures can be taken into consideration; examples include the effects of subsidies on patent applications, productivity, fixed-asset investments, returns on capital, returns on sales, and growth of sales or employment (Klette, Møen, and Griliches 2000).

Patents and other means for protecting innovation are not the only tools for measuring innovative performances for startups that receive grants, it is important to consider also the transfer of knowledge and skills. For example, corporate venture capital devotes significant management resources for understanding new technologies and markets,

finding promising startups in those spaces, providing them with financial resources for R&D activities, and coaching them through the early part of their lives with new knowledge assets (Hellmann and Puri 2000). Venture capitalists bring a network of contacts which can allow the start-up to expand its know-how in several fields, experienced infrastructure providers bring a reputation effect that facilitates other incentives and interest in joining the team (Gorman and Sahlman 1989; Fried and Hisrich 1995). Wallsten (Wallsten 2000) observes that public grants allow start-ups to continue R&D activity at a constant level, allowing them to produce new innovative outputs. Ley and Weaven (Ley and Weaven 2011) demonstrate that crowdfunding grants as a source of early stage start-up finance may result in an increased rate of societal innovation. Callaghan's studies (Callaghan 2014) show that crowdfunding and crowdsourcing can accelerate significantly innovation productivity, in particular start-up alliances can speed up start-ups learning and innovation processes, extending their benefits beyond the life of the alliance, since new firms learn from their partners and increase their capabilities (Mowery, Oxley, and Silverman 1996; Doz and Hamel 1997). Ahuja (Ahuja 2000) demonstrates a positive relationship between the extension of a solid alliance activity and its innovativeness.

Finally, most technological start-up companies are born as academic spin-off, for these firms university is a fundamental knowledge transfer. In fact, the emerging of knowledge-based economy has considerably highlighted the role of universities in commercializing innovations, in the form of new technologies and knowledge from the research centers (K. Miller, McAdam, and McAdam 2018; Breznitz and Etzkowitz 2017; O'Shea et al. 2007). Epure et al. (Epure, Prior, and Serarols 2016) indicate that innovative capacities as well as the quality of relationships with university positively influence the performance of academic spin-offs in terms of revenues, patents and employment. University spin-offs are usually well-defined as organizations that exploit intellectual property or patented innovation created from the academic research (Di Gregorio and Shane 2003). De Nicola

et al. (De Nicola, Prencipe, and Corsi 2018) observe that the patent activity of university is positively associated with the financial performance of university spin-offs generated, measured in term of ROA index. The availability of patents signals to key external players that a university is active in commercialize knowledge/technology and identifies the necessities of for-profit organizations because the academic institution was ready to invest the required effort, time and cost in gaining patents. Consequently, established companies may have a greater interest in obtaining the technology/knowledge developed by university (De Nicola, Prencipe, and Corsi 2018). Furthermore venture capitalists and other institutional investors with advance managerial and organizational capabilities may be interested to the potentials of a patented innovation and they can look for invest or be part of the technology development (Bell and McNamara 1991).

The above arguments suggest the following hypothesis:

H2a. In the growth path of a start-up, total amount of Grants received is (positive) related to the Numebr of licensee (registered patent) or program for original registered computers.

H2b. In the growth path of a start-up, the Number of Grants received is (positive) related to the Number of licensee (registered patent) or program for original registered computers.

4.3 Methodology

4.3.1 Data Sample

We tested our hypotheses on a sample of 1841 Innovative Start-ups established In Italian Country[5]. This Law identifies three prerequisites for obtaining the status of "innovative start-up" and we decide, in this chapter, to focus our analysis on one of this the prerequisites. In order to be considered "Innovative" a start-up have to be "

"*holder, depositary or licensee of a registered patent (industrial property) or the owner of a program for original registered computers"*.

The Intellectual property has always been a determining factor and the growth of our economies has developed on it.

The industrial property has widely recognized in the literature as a good proxy to evaluate firm's innovativeness, in particular the number of filed patents is also a useful signal to access seed investors (Hahn, Kim, and Kwon 2017), they can favor access to grants from professional investors (J. A. C. Baum and Silverman 2004; Heeley, Matusik, and Jain 2007; Graham and Sichelman 2008; Conti, Thursby, and Rothaermel 2013; Hsu 2007).

Moreover, patents are often the output of different forms of collaboration between start-ups and universities or incubators, that can support start-ups commercializing scientific knowledge, mainly through patents and licenses (Bramwell and Wolfe 2008; O'Shea et al. 2007),

The start-up innovative Value were described by the *Number of licensee of a registered patent (industrial property) or the owner of a program for original registered computers*.

We consider all the innovative start-ups registered into the Chamber of Commerce official database (http://startup.registroimprese.it/isin/home). This database has been improved adding information related to:

- *Number of licensee of a registered patent (industrial property) or the owner of a program for original registered computers.*
- the *Number of Grants received by a start-up,*

[5] In accordance to the Decree-Law 179/2012 on "Further urgent measures for Italy's economic growth", converted into Law 221/2012.

- *the Total Amount of Grants received by a start-up;*
- *Geographical distance, expressed in kilometers, between the start-up headquarters and the nearest incubator.*
- *Number of services/interaction between a start-up and the incubator.*
- *Regional Level of innovation (data from EC database)*

The information relating to these indicators was collected through the websites consultation (company website and several on-line database) and only for missing information we used phone survey.

Starting from a database of 1841 For 71 start-ups it was not possible to gather all the necessary information so, in the end, we obtained a the final sample of 1770 start-ups located in the 20 Italian regions.

4.3.2 Variables

In Table 1 all variables have been reported.

< Insert Table 1 about here >

Dependent Variable

Our dependent variable is the innovative Value of Start-up (*InnValue*). We measured the innovative value of a Start-up as the number of licensee of a registered patent (industrial property) or the owner of a program for original registered computers.

Several studies have suggested a positive link between innovation and start-up growth, as consequence it's crucial for start-up companies to certify innovative outputs through patents, intellectual property rights, licenses or other forms of protection and certification that are strongly associated with greater technology transfer activities (Santoro and Gopalakrishnan 2001).

The economic literature on the measurement of the value of patents takes as an assumption that the value of any patent is reflected in the number of times the patent is cited, or the length of its renewal, or the number of countries where it is taken (Guellec and van Pottelsberghe de la Potterie 2000). As Graham et al. (Graham et al. 2009) point out, technology start-ups tend to hold patents for a competitive advantage, to secure financing, and enhance their reputation. Patents certify new start-up technological capabilities, and thus reduce the uncertainty about the technological viability of the new product idea and its value appropriability (Roma, Messeni Petruzzelli, and Perrone 2017). Therefore, for technology-based start-ups, the number of filed patents is also a useful signal to access seed investors (Hahn, Kim, and Kwon 2017), they can favor access to grants from professional investors (J. A. C. Baum and Silverman 2004; Heeley, Matusik, and Jain 2007; Graham and Sichelman 2008; Conti, Thursby, and Rothaermel 2013; Hsu 2007). Furthermore, Calderini (Calderini 2005) use patents to confirm the relevance of geo-graphical determinants in explaining knowledge-based interactions within the business ecosystem. Santoro and Gopalakrishnan (Santoro and Gopalakrishnan 2001) show that geographic proximity and flexible university policies for intellectual property rights, patents and licenses are strongly associated with greater technology transfer activities. In fact, patents are often the output of different forms of collaboration between start-ups and universities or incubators, that can support start-ups commercializing scientific knowledge, mainly through patents and licenses (Bramwell and Wolfe 2008; O'Shea et al. 2007).

Furthermore, the availability of patents signals to key external players that a university or incubator is active in commercialize knowledge and new technology, this tendency identifies the necessities of for-profit organizations because the academic institution was ready to invest the required effort, time and cost in gaining patents (De Nicola, Prencipe, and Corsi 2018).

Independent Variables

Geographical Distance and relationship Intensity

The way start-ups and incubators interact represents a levarege for reinforce knowledge acquisition since knowledge is partially tacit and localized (Cooke and Wills 1999; McEvily and Marcus 2005). For this reason we considered for our analysis both the Geographical Distance (GeoDistance) and Relationship Intensity (IncubServShare) as independent variables. In literature many authors argued that the process of knowledge spillover is significantly influenced by organizations' location and it tend to improve in organizational clusters (Simonen and McCann 2008). In many cases, however, proximity is not enough and the established relationships between the actors involved become crucial. Moreover, geographical proximity favours the creation of economical and institutional relationships between business actors, and the development of common institutional practices, that are important for obtaining grants and for generating innovative outputs and knowledge spillovers (Wejnert 2002; Anupama Phene, Fladmoe-Lindquist, and Marsh 2006).

Start-up Grant Number and Total Grant received

One of the most important challenges for start-up companies is securing finances, it is important for start-ups to signal their projects profitability to potential investors. They need to reveal reliable information about their ability to attract investors during the early financing stages (Hahn, Kim, and Kwon 2017), in fact, the highest average amounts of capital are allocated to firms in the start-up phase, while the level of external funding decreases considerably in the later phases of firm development (Söderblom et al. 2015). On the one hand we took into consideration the number of grants received from each start-up analyzed (*GrantNumber*), on the other hand the total Amount of grants received (*TotalGrant*). Several studies show that companies that have received internal or external

grants reach better business results in terms of patent applications, productivity, fixed-asset investments, returns on capital, returns on sales, and growth of sales or employment (Klette, Møen, and Griliches 2000). All forms of financing received are fundamental for R&D activities and for the production of innovative outputs. Moreover, Graham et al. (Graham et al. 2009) find that it is easier for start-ups to attract funding from external investors if they hold more patents, Conti et al. (Conti, Thursby, and Rothaermel 2013) empirically show that, in start-up financing, an increase in the level of patents raises both the frequency and number of investments from venture capitals.

Control Variables

In order to avoid bias from other effects on the of Start-up innovative performance, we introduced several control variables. In particular, we included a variable to control connection and influences with and from the Start-up Share capital (ShareCapital). The Share Capital (also called Shareholder's Equity or Owners Equity) of a start-up can be defined as the funds contributed by shareholders through the purchase of shares plus (or minus) the accumulated retained earnings of the company. The management of equity capital ensures ownership interests are properly reflected and protected and that new stakeholders (like a new investor for example) can be effectively accommodated. The role of share capital is increasingly considered to be an important facilitating factor for the ability to innovate and the effectiveness of related policies (Adler and Kwon 2002; Akçomak and Ter Weel 2007; Aragón et al. 2014; Cantner, Conti, and Meder 2010; P. Evans 1996; Fountain 1998; Hauser, Tappeiner, and Walde 2007; Landry, Amara, and Lamari 2002; Malecki 2012; Obstfeld 2005). This is particularly relevant to startups where equity capital is usually the primary source of funding (before the business starts generating significant revenue). As a result, equity capital can change quickly and significantly (Bourdieu 1980; 1986; Coleman 1988; Bosma et al. 2004).

We also included the a variable to control connection and influences with and from the company production size (ProductiveSize), measured as the ratio between a Production/Income range.

In several studies, productive size of a start-up is often linked to innovation, particularly, to technological innovation Geroski (Geroski 1991), but Bartelsman et al. (Bartelsman, van Leeuwen, and Nieuwenhuijsen 1996) showed that it was mostly the increase in the capital-labour ratio which improved productive size, while the advanced technology effect less significant results. Considering the correlation between start-up productivity and founding sources, Wright (Wright 1998) state that venture capital-backed start-ups grow faster, have more patent and have higher productivity. Regarding productive with the advent of artificial intelligence, Brynjolfsson et al. (Brynjolfsson, Rock, and Syverson 2017) talk about a paradox. Systems that use artificial intelligence increase operational efficiency, taking advantage of rapid advances in other technologies and pushing stock prices skyrocketing.

We also controlled for focal firm size effect (*CompanySize*). Some authors proposed that size is positively associate to innovation. Large size may also enable greater economies of scale and learning effects, and taking on large scale or risky projects. However, large firms might also be disadvantaged at innovation because R&D efficiency might decrease due to loss of managerial control, these firms have more bureaucratic inertia and more strategic commitments tie firm to current technologies. While big companies may be able to tap into a pool of information that is more varied (Cáceres, Guzmán, and Rekowski 2011), transfer of relevant knowledge within a large firm is not obvious (Aalbers, Dolfsma, and Koppius 2014; Szulanski 1996). Instead, small firms are often considered more flexible and entrepreneurial. In newly established small start-ups, entrepreneurs and employees are more motivated to contribute to innovation efforts, so the effects of their contribution is more direct (Uhlaner et al. 2013).

Another control variable we took in consideration was the Regional Innovation Level (*ReInnoLev*). This value is a regional extension of the European Innovation Scoreboard, assessing the innovation performance of European regions on a limited number of indicators. It provides a more detailed breakdown of performance groups with contextual data that can be used to analyze and compare structural economic, business and socio-demographic structure differences between regions. There is a wide strand of literature, supported by sound empirical analysis, which shows the extent and the relevance of country-specific, as well as sector specific (Malerba 2000), different paths to innovation (Moulaert and Sekia 2003). In the end, in order to better analyze start-up performaces, we include two more control variable regarding the Board of Management structure (measured by % del share capital + % Administrators). The first variable is the prevalence of women (PrevWomen). Participation of women in entrepreneurship is increasing, but the rate across countries is measurable at about two-thirds that of men. These results suggest that women are influenced by many of the same factors that affect men when making entrepreneurial decisions, but the systematically lower rate of female participation indicates that some differences also exist (Minniti and Arenius 2003). Some studies report that women have less access to financial resources (De Bruin, Brush, and Welter 2007; Gatewood et al. 2009; Marlow and Patton 2005), less quality and diversification in their product and services (Shneor et al. 2016; Costin 2012), and a less qualified team (Costin 2012). The second variable regard the prevalence of Youth people (PrevYouth) in the start-up board. Some studies consider the age of the team members a crucial aspect that may affect performance positively (Hambrick, Cho, and Chen 1996; Cox 1994; Bantel and Jackson 1989; Barkema and Shvyrkov 2007; Beckman, Burton, and O'Reilly 2007; Talke, Salomo, and Rost 2010; Wiersema and Bantel 1992). Heterogeneity in team age increases breadth of knowledge base of team and chances of receiving funds, but it can also raise coordination costs (Schilling and Shankar 2019).

4.3.3 Estimation Method

To test hypotheses, OLS regression were applied. Before computing interaction terms, the independent variables were transformed logarithmically, a procedure commonly employed to avoid problems of non-linearity of relationships, normality and homoscedasticity of residues (Ebersberger and Herstad 2013). In particular, in this study, even if we were not able to confirm the normal univariate distribution, it was verified that the distribution does not deviate from the normal multivariate distribution. After this operation, multicollinearity was verified by examining variance inflation factors (VIFs). All VIF values are below 10, indicating that multicollinearity is not a problem for the analysis.

4.4 Results

Table 2 reports descriptive statistics and the correlation values for all the variables. As shown, for all the independent variables exist a positive linear correlation, thus indicating acceptable discriminant validity (J. Cohen et al. 2003).

<Insert Table 2 about here>

The results of the Ordinary Least Square (OLS) regression are reported in Table 3. Model 1 loans only the control variables, whereas in Models 2-4 each independent variable is added. Finally, in Model 5 the simultaneous effects exerted by all the variables are investigated. The discussion is based on this last model.

In identifying the regression model that best explains the dependence relationship between the dependent variable and a set of explanatory variables, the following independent variables were considered: Geo distance, log Total Grants received, Number Total Grants received, Intensity Relationship. On the other hand, the control variables

included in the analysis at first are: log Innovation Level, Number of incubators, production class A, B, C and E, Company Size A, B, C and D. However, the control variables, log level of innovation and Company Size A, B, C and D were found not to be significant, therefore it was decided to eliminate them from the regression model.

<Insert Table 3 about here>

Regarding control variables, we can assert that all these are significant and have a *p* value < 0,01 (1%).

Analyzing the first control variable (N of Incubators), we can notice the value (β= 0.00) . This data shows us that the presence of more than one incubator in the province in which the start-up is located does not influence any of the relationships between independent variables and dependent variable. This is because normally the start-up tends to be incubated or to have ties usually with only one incubator.With regards to the second group of control variable (Pruductive Size), even if it is divide into 5 sub group (A-E), it should be stressed that most of the sample falls into the first two classes (A) and (B). The results show us that as the production size increases, the correlation with the dependent variable changes from negative to positive, that is, for those start-ups whose production exceeds 2,000,000.00 Euros.

Considering the independent variables, data reveal that Geo Distance, Understood as the distance in km between the start-up headquarters and the nearest incubator or the one in which it is incubated, it has a negative relationship, however, tending to zero. This result seems to be in contrast with hypothesis 1a. (β= -0.010, $p < 0.1$).

In reality, by analyzing the values of the descriptive statistics, it emerges that on a sample of 1770 start-ups we have a minimum value = 0.054 km and a maximum value = 163.2 km with an average value of 3.61 km. These data show us that most of the startups analyzed are located within a radius of no more than 3.61 km from the nearest incubator

headquarters. This data does not surprise us as the start-up by its nature tends to arise from innovative environments such as incubators, accelerators, university laboratories and the founders tend to remain linked to these environments in order to take advantage of services and skills, especially in the first years.

The second independent variable analyzed is the relationship Intensity, intended as the Number of services and / or interaction between a start-up and the closest incubator or the one in which it is incubated.

The results show us a positive relationship on the dependent variable. Analyzing the values of the descriptive statistics, it emerges that on a sample of 1770 start-ups we have a minimum value = 1 and a maximum value = 5 with an average value of 2.46. Hypothesis 1b is therefore confirmed (β=0.180, $p < 0.1$).

This data confirms what has already been analyzed in the literature by various authors, even in different contexts, namely that the role of incubators is crucial in the generation of licensee of a registered patent (industrial property) or the owner of a program for original registered computers and even more so are the services provided.

In fact, incubators tend to provide start-ups with complementary services through highly specialized personnel; these services, taken together, are designed to offer a gradual growth path aimed at creating an innovative product or idea (Bruneel et al. 2012; Ahmad and Ingle 2013; Spigel 2017; Stam 2015).

The last two hypotheses instead show conflicting results. In particular, hypothesis 2a relating to the independent variable (Total Amount of Grant Received) is not verified as there is a negative relationship with the dependent variable (β= -0.020, $p < 0.1$).

In reality, even here as for hypothesis 1, the value tends to zero. This result tells us that the total amount of grant received by each start-up is not a value to be taken into consideration to understand how much a start-up is capable of creating new patents or licenses or new industrial property.

While hypothesis 2b relating to the variable (Total Number of Grants Received) is confirmed as the relationship with the dependent variable is positive ($\beta = 0.300$, $p < 0.1$). Analyzing the values of the descriptive statistics, it emerges that on a sample of 1770 start-ups we have a minimum value = 0 and a maximum value = 5 with an average value of 1.27.

This shows that, regardless of the amount of funding received, the start-up tends to develop 1 or 2 innovative ideas, also making use of specific loans also to protect it through an (industrial property)

4.5 Discussion and conclusion

What was worth in the past years for traditional companies, in terms of intellectual property rights, is also valid today for the growing ecosystem of startups: knowing how to recognize and value inventiveness, protecting creators through rights, is a fundamental step for ensure that even small innovative realities, with scarce economic availability and without bargaining power, can survive and scale.

A start-up company faces several hurdles and challenges including sources of funding, rigid labour regulations, finding a market for products and social or cultural issues.

In this context Start-ups-Incubators joint collaboration play a crucial role for the creation of new knowledge and innovation (Aerts, Matthyssens, and Vandenbempt 2007; Bergek and Norrman 2008; Bruneel et al. 2012).

More in details, previous studies mainly focused their attention to identify start-ups characteristics and relations that promote this kind of collaboration (e.g. (Debackere and Veugelers 2005; Veugelers and Cassiman 2005; F. T. Rothaermel, Agung, and Jiang 2007).

Our analysis, on the other hand, aims to study Start-ups – Incubators joint innovation, focusing on the factors making some collaborations better than others, analyzing how these characteristic interact each other, investigating the role that Geographical distance,

the relationship Intensity and Grants received, have on the innovative value of start-up. Results, in line with the emerging literature, suggest that both the relationship Intensity and the Number of Grants received by each start-ups impact positively innovative value of a Start-up. Instead, the Geo Distance and the Total Amount of Grant Received have a negative relationship tending towards zero.The authors who studied this phenomenon noted that Incubators can play a crucial role in supporting and helping budding entrepreneurs in setting up their business, they also function as advisory boards for start-ups and may also provide access to financial and technical support (Sanyal and Hisam 2018).

Incubators act as bridges or mediators among investors, incubator members, academic institutions, and various supporting structures that provide financial, technical, or management assistance (M'Chirgui et al. 2018). In particular, they can be seen as a node in the entrepreneurial ecosystem, most of them are linked to universities and face with possible investors, facilitating relationships within the ecosystem (Bergek and Norrman 2008; Spigel 2017).

Start-ups have been thought to be the most affected by external networks during their knowledge processes (Eisenhardt and Schoonhoven 1996; B. R. Smith, Matthews, and Schenkel 2009), and incubators act as a hub for this knowledge transfer.

In line with the literature, the results of this study show us that as the services provided by an incubator increase, the possibility of creating patents and more generally of exploiting intellectual property rights also increases.

Another important aspect that emerges from this study is the role of geographical proximity. In our study, most of the start-ups analyzed are located within a radius of no more than 3.61 km from the nearest incubator headquarters.

Geographical proximity favours the creation of economical and institutional linkages between actors, and the development of common institutional practices, that are important to generate innovative activities and knowledge spillovers (Wejnert 2002;

Anupama Phene, Fladmoe-Lindquist, and Marsh 2006). The short geographical distance is particularly important for the relationship between a start-up and its incubator. The incubator seeks an effective means to link technology, capital and know-how in order to leverage entrepreneurial talent, accelerate the development of new companies, and thus speed the exploitation of technology (Grimaldi and Grandi 2005). In general, collaborations between close organizations show better innovative performance than those between distant ones (e.g. Jaffe, Trajtenberg, and Henderson 1993; A Phene and Tallman 2002). In this context, publications, patents and the number of citations are proxies of the innovation output, Calderini (Calderini 2005) use them to confirm the relevance of geographical determinants in explaining knowledge-based interactions between the academic environment and the industrial one. Santoro and Gopalakrishnan (Santoro and Gopalakrishnan 2001) show that geographic proximity and flexible university policies for intellectual property rights, patents and licenses are strongly associated with greater technology transfer activities.

Incubators are often linked to academic environment, universities can support start-ups commercializing scientific knowledge, mainly through patents and licenses (Bramwell and Wolfe 2008; O'Shea et al. 2007), and also university-industry collaborations are mainly influenced by geographical distance (P. D'Este, Guy, and Iammarino 2013). Moreover, small distances facilitate face-to-face interactions and foster knowledge transfer and innovation rise (Antonelli 2000); geographical proximity brings organizations together, favor interaction with a high level of information richness and facilitate the exchange of, especially tacit, knowledge between actors (e.g. Boschma 2005).

Incubators stimulate also start-ups to collaborate and exchange knowledge with each other in their community, by co-locating start-ups in the incubator premises, by sharing resources and experiences, by organizing network events, and by acting as relational 'brokers' to make one-on-one connections (Hughes, Ireland, and Morgan 2007; Tötterman and Sten 2005).

The third important aspect emerging from this study is the relation between grants received and the number of licensee of a registered patent (industrial property) or the owner of a program for original registered computers. Indeed, it emerges that regardless of the amount of funding received, the start-up tends to develop one or two innovative ideas, making use of specific funding.

Callaghan's studies (Callaghan 2014) show that crowdfunding and crowdsourcing among start-ups can accelerate significantly innovation productivity, collaborations can speed up start-ups learning and innovation processes.

When receiving more external funding, companies can grow and become more independent (Roelen-Blasberg and Weiss 2014). Different studies states that the collaboration with university and incubators in the beginning phase leads the start-up to protect technological innovations through patents, thanks also to the possibility to obtain grants (Graham et al. 2009).

Not only, the literature also shows that in start-up financing, an increase in the level of patents raises both the frequency and number of investments from venture capitals (Conti, Thursby, and Rothaermel 2013). The reason is that patents unveil new venture's technological capabilities, and thus reduce the uncertainty about the technological viability of the new product idea and its value appropriability (Roma, Messeni Petruzzelli, and Perrone 2017). Patents reduce uncertainty surrounding new technology-based start-ups, and thus favoring access to grants from professional investors (J. A. C. Baum and Silverman 2004; Heeley, Matusik, and Jain 2007; Graham and Sichelman 2008; Conti, Thursby, and Rothaermel 2013; Hsu 2007). Moreover, companies that have received grants reach better business results in terms of patent applications, productivity, fixed-asset investments, returns on capital, returns on sales, and growth of sales or employment (Klette, Møen, and Griliches 2000). Venture capitalists and other institutional investors with advance managerial and organizational capabilities may be interested to

the potentials of a patented innovation and they can look for invest or be part of the technology development (Bell and McNamara 1991).

However, start-up innovative value is not only represented by patents or other forms of protection, the transfer of knowledge and skills also has a positive and significant impact. For example, venture capitalists bring a network of contacts which can allow the start-up to expand its know-how in several fields and public grants allow start-ups to continue R&D activity at a constant level, allowing them to produce new innovative outputs (Wallsten 2000).

Furthermore, the availability of patents signals to key external players that a university or incubator is active in commercialize knowledge and new technology, this tendency identifies the necessities of for-profit organizations because the academic institution was ready to invest the required effort, time and cost in gaining patents. Consequently, established companies may have a greater interest in obtaining the technology and the knowledge developed with university and incubators (De Nicola, Prencipe, and Corsi 2018).

In terms of policy implications, findings seem to suggest that policy makers should promote the establishment of Start-up – Incubators collaborations, considering not only partners' specific characteristics, but also how these interact each other at the collaboration level. For this reason, long-term and lasting relationships between Start-up – Incubators should be supported, because of prior collaborative experiences make linkages more valuable. Finally, global links between the academic and industrial environments appear to be fundamental in order to overcome the limitations of a local search, thus acquiring the required capabilities to create high impact innovations.

Of course the paper presents some limitations that may represent a venue for future researches.

First, in this study, among the independent variables, the intensity of the relationship with incubators is considered only in terms of the number of services actually provided.

It would be interesting to study and analyze the types of services to understand which ones actually act as a lever for the generation of new patents. Not only that, also understanding what professionalism the incubator provides and the success rate in obtaining new patents and new grants.

Another aspect concerns the competences and background of the start-up administrator/shareholders.

It would be interesting to understand how these variables are linked with the development of patents or industrial property rights, focusing for example on the prevalence of women or young people.

Finally, considering that the database used is constantly evolving, and the number of innovative start-ups increases every year, surely the analyzes made should be monitored over time.

TABLES AND FIGURES

Table 1 – Definition of the dependent, independent, and control variables

Variable Name	Variable description
Dependent Variable	
InnValue	Number of licensee of a registered patent (industrial property) or the owner of a program for original registered computers.
Indipendent variables	
GeoDistant	*Geographical distance, expressed in kilometers, between the start-up headquarters and the nearest incubator*
GrantAmout	Total Amount of Grant received (total grants received expressed in euro).
Number of Grants	Total Number of Grants received
Relationship Intensity	Number of services and/or interaction between a start-up and the incubator
Control variables (set 1)	
IncubNumber	Number of istitution offering incubation services at regional level (incubators/university/accelerator)
Control variables (set 2)	
ReInnoLev	Regional Innovation Level, assessing the innovation performance of European regions on a limited number of indicators
Control variables (set 3)	
ProductiveSize(A)	Dummy variable assuming value 1 if the start-up as a Production/Income range (0 - 100.000 euro)
ProductiveSize(B)	Dummy variable assuming value 1 if the start-up as a Production/Income range (100.001 - 500.000 euro)
ProductiveSize(C)	Dummy variable assuming value 1 if the start-up as a Production/Income range (500.001 - 1.000.000 euro)
ProductiveSize(D)	Dummy variable assuming value 1 if the start-up as a Production/Income range (1.000.001 - 2.000.000 euro)
ProductiveSize(E)	Dummy variable assuming value 1 if the start-up as a Production/Income range (2.000.001 - 5.000.000 euro)
Control variables (set 3)	
CompanySize(A)	Dummy variable assuming value 1 if the start-up as an employee range (0-4)
CompanySize(B)	Dummy variable assuming value 1 if the start-up as an employee range (5-9)
CompanySize(C)	Dummy variable assuming value 1 if the start-up as an employee range (10-19)
CompanySize(D)	Dummy variable assuming value 1 if the start-up as an employee range (20-49)
Control Variables (set 4)	
Share capital (1-2)	Dummy variable assuming value 1 if the start-up as a Production/Income range (1 -5.000 euro)
Share capital (3)	Dummy variable assuming value 1 if the start-up as a Production/Income range (5.001 - 10.000 euro)
Share capital (4)	Dummy variable assuming value 1 if the start-up as a Production/Income range (10.001 - 50.000 euro)
Share capital (5)	Dummy variable assuming value 1 if the start-up as a Production/Income range (50.001 -

	100.000 euro)
Share capital (6)	Dummy variable assuming value 1 if the start-up as a Production/Income range (100.001 - 250.000 euro)
Share capital (7-11)	Dummy variable assuming value 1 if the start-up as a Production/Income range (250.001 - 5.000.000 euro)
Control Variables (set 5)	
PrevWomen	Dummy variables indicating a prevalence of women [% of share capital + % Administartor]
PrevYouth	Dummy variables indicating a prevalence of youth [% of share capital + % Administartor]

Table 2a – Descriptive statistics and correlation matrix (N=1770)

Panel (A): indipendet variables										
	N. obs	Min	Max	Mean	1	2	3	4	5	6
1.InnoValue	1770	1	15	2,442373	1,00	0,00	0,29	0,80	0,57	0,58
2.GeoDistant	1770	0,05485	163,2806	3,610847		1,00	0,00	-0,01	0,00	-0,03
3.Log Total Grants amount Received	1770	0	14,83436	9,412163			1,00	0,42	0,26	0,72
4.Total Grants amount Received	1770	0	2770000	114548,4				1,00	0,43	0,61
5.IncubServShare (Intensity relationship)	1770	1	5	2,469492					1,00	0,48
6.Number of Grants Received	1770	0	5	1,274576						1,00

Table 2b – Descriptive statistics and correlation matrix (N=1770)

Panel (B): Control variables 1/2																
	N. obs	Min	Max	Mean	1	2	3	4	5	6	7	8	9	10	11	12
1.InnoValue	1770	1	15	2,442373	1,00	0,07	0,05	-0,65	0,12	0,32	0,53	0,47	-0,56	0,33	0,36	0,23
2.Innovation Level	1770	18	57	46,0226		1,00	0,60	-0,08	0,00	0,06	0,09	0,03	-0,04	0,00	0,04	0,04
3.IncubNumber	1770	1	44	18,05028			1,00	-0,07	0,00	0,07	0,06	0,03	-0,04	0,01	0,04	0,04
4.ProductiveSize(A)	1770	0	1	0,546328				1,00	-0,71	-0,35	-0,25	-0,15	0,39	-0,30	-0,21	-0,09
5.ProductiveSize(B)	1770	0	1	0,29322					1,00	-0,21	-0,14	-0,09	0,06	0,01	-0,08	-0,06
6.ProductiveSize(C)	1770	0	1	0,09435						1,00	-0,07	-0,04	-0,33	0,30	0,15	0,01
7.ProductiveSize(D)	1770	0	1	0,048023							1,00	-0,03	-0,40	0,26	0,33	0,03
8.ProductiveSize(E)	1770	0	1	0,017514								1,00	-0,31	0,03	0,21	0,49
9.CompanySize(A)	1770	0	1	0,861017									1,00	-0,80	-0,48	-0,24
10.CompanySize(B)	1770	0	1	0,092655										1,00	-0,06	-0,03
11.CompanySize(C)	1770	0	1	0,035593											1,00	-0,02
12.CompanySize(D)	1770	0	1	0,00904												1,00

Table 2c – Descriptive statistics and correlation matrix (N=1770)

Panel (B): Control variables 2/2													
	N. obs	Min	Max	Mean	1	2	3	4	5	6	7	8	9
1.InnoValue	1770	1	15	2,442373	1,00	-0,19	-0,18	0,07	0,11	0,13	0,33	-0,05	-0,09
2.Share capital (1-2)	1770	0	1	0,189831		1,00	-0,37	-0,28	-0,13	-0,11	-0,12	0,07	0,11
3.Share capital (3)	1770	0	1	0,369492			1,00	-0,45	-0,21	-0,18	-0,19	0,04	-0,01
4.Share capital (4)	1770	0	1	0,254802				1,00	-0,16	-0,13	-0,15	-0,06	-0,02
5.Share capital (5)	1770	0	1	0,070056					1,00	-0,06	-0,07	-0,03	0,01
6.Share capital (6)	1770	0	1	0,049718						1,00	-0,06	-0,06	-0,05
7.Share capital (7-11)	1770	0	1	0,059887							1,00	-0,04	-0,07
8.PreWomenDummy	1770	0	1	0,110169								1,00	0,05
9.PreYouthDummy	1770	0	1	0,154237									1,00

Table 3 – The Ordinary Least Square (OLS) regression Model (N=1770)

Dependent Variable: number licensee		Model 1 (Baseline)			Model 2			Model 3			Model 4			Model 5		
		B	Stand. Error	Sig	B	Stand. Error	Sig	B	Stand. Error	Sig	B	Stand. Error	Sig	B	Stand. Error	Sig
Indipendent variables																
Geo distance	H1				-0,01	0,01	0,063	-0,01	0,01	0,07	-0,01	0,01	0,16	-0,01	0,00	0,09
Log total grants received	H2A							0,03	0,01	0,00	-0,02	0,01	0,00	-0,02	0,01	0,02
Number total grants received	H2B										0,41	0,04	0,00	0,30	0,04	0,00
Intensity relationship	H3A													0,18	0,02	0,00
Control variables																
N. of Incubators		0,00	0,00	0,00	-0	0,00	0,01	0,00	0,00	0,01	0,00	0,00	0,42	0,00	0,00	0,64
Prodsize(A)		-5,67	0,10	0,00	-5,69	0,10	0,00	-5,58	0,10	0,00	-5,10	0,11	0,00	-4,84	0,11	0,00
Prodsize(B)		-4,19	0,11	0,00	-4,21	0,11	0,00	-4,14	0,11	0,00	-3,79	0,11	0,00	-3,69	0,11	0,00
Prodsize(c)		-2,62	0,12	0,00	-2,64	0,12	0,00	-2,60	0,12	0,00	-2,40	0,12	0,00	-2,44	0,12	0,00
Prodsize()		2,16	0,19	0,00	2,15	0,19	0,00	2,11	0,19	0,00	2,05	0,18	0,00	1,99	0,18	0,00
Costant		7,05	0,10	0,00	7,10	0,11	0,00	6,73	0,12	0,00	6,28	0,13	0,00	5,73	0,14	0,00
No. Of Obs		1770			1770			1770			1770,00			1770,00		
AIC		4691,05			4689,57			4659,02			4566,02			4463,52		
Log likelihooh		-2339,53			-2337,79			-2321,51			-2274,01			-2221,76		
R^2		0,78			0,78			0,78			0,79			0,80		

5. CONCLUSION

The present research investigated if and how, public/private grants, highly qualified team, geographical distance and relationship intensity with economic incubators can affect the innovative performance of a start-up.

This dissertation buds from the idea to shed further light on start-up' innovation processes, especially referring to how the improvement of the innovative performance of a start-up is the result of a set of determinants operating at different levels.

Several studies have suggested a positive link between innovation and start-up growth. Innovation can enhance market power (Schumpeter 2008), improve the ability to escape competition (Porter 1990), reduce production costs (W. M. Cohen and Klepper 1996a), support dynamic capabilities and lead to enhanced absorptive capacity. In other cases, it can lead to less linear start-up processes (Samuelsson and Davidsson 2009) or more skewed returns (Scherer and Harhoff 2000).

Nevertheless, an understanding of the main factors influencing start-up performance is still lacking. For this reason, I first examined which are the relevant drivers that influence the innovative performance of start-up, then, I conducted two empirical analyses: in the first one, I investigated the coexistence of multiple phenomena and their influence on the start-ups' R&D activities; differently, the second study is aimed at showing the Start-ups – Incubators joint innovation, focusing on the factors making some collaborations better than others.

Regarding the analysis on the start-ups' R&D activities, I focused on the number and the total amount of grants received, and the presence of a highly qualified team. Thereby, employing a sample of 405 Innovative Start-ups established in Italian Country and listed on the Chamber of Commerce official database, I tested the effect of these two

influencing factors on the innovative performance of Start-ups, both separately and jointly.

Results suggest that the grants number and the grants total amount received have a positive relationship with the R&D expenses of start-ups. The analysis reveals that both the grants number and the total amount of grants received by each start-up impact positively innovative performance.

This results are is in line with the main contribution coming from literature as the presence of Grants induce more R&D activities(Busom ∗ 2000) and companies that receive them reach on average a higher intensity (intended as the ratio between R&D expenditure and sales) than the others (Almus and Czarnitzki 2003).

In addition, the integration of total amount of grants with the presence of high qualified team is both positively related to the achievement of higher innovative outcomes. This is because team competences influences the ability to secure capital and resources for newly initiated corporate projects (Colombo and Grilli 2005), increasing the ability of developing strategic plan, the likelihood of funding, and capability of assessing the market opportunity (Delmar and Shane 2004).

My results provide only partial support with regards to the impact of Grants and high specialized team on Start-up R&D activities. This is because I focused the analysis on the aggerated values (in term of number and amount), not considering the different typologies of grants available on the market and typology of competence of team members.

Another limitation of our study concerns the use of production size only as a control variable and not as an independent variable, and this did not allow us to evaluate direct implications on R&D activities. Results show that there is a change in correlation (from negative to positive), for those start-ups with an high production value. In fact, as widely demonstrate in literature, small start-ups tend to invest in R&D only small budget shares, and generally tend to spread them over time (Wright 1998). Instead, large-scale start-ups,

characterized by a well-defined organizational structure and strong know-how tend to invest more in R&D from the early stages (W. M. Cohen 2010; Brynjolfsson, Rock, and Syverson 2017).

The same consideration concern the "Company Size" used only as control variable. Results demonstrated that In Start-ups with up to 9 employees there is a positive correlation which tends to decrease and become negative when this threshold is exceeded.

This is also in line with the literature that tells us that small Start-ups are considered more flexible and the team is more motivated to contribute to innovation efforts (Uhlaner et al. 2013). Instead, start-up with more employees might also be disadvantaged at innovation because R&D efficiency might decrease due to loss of managerial control, more bureaucratic inertia (Stock, Greis, and Fischer 2002; W. M. Cohen 2010).

Of course, the consideration and the limitations previously highlight may represent a venue for future researches.

It would be interesting to study how the different types of grants (commercial banks, venture capitalists, business angels, government agencies, private individuals, leasing or factoring companies, customers, and suppliers, among others) influence investments in R&D.

Another aspect worthy of analysis concerns the relationship between the types of grant received and the type of product/service developed by the start-up and therefore the influence of the sector in which it operates. In fact, from my study, the "Sector" control variable was omitted because it was not relevant, this most likely because I did not divided the specific typologies of grants and thus the model didn't give significant values.

Another relevant aspect to consider for future studies concerns the composition of the team. In this study, I have considered the total number of specialized personnel, but it would certainly be interesting to study which specific competences influence

performance. Surely the analysis of the team skills with respect to the industrial sector and the types of grants received could provide further insights and relevant considerations.

Finally, considering that the database used is constantly evolving, and the number of innovative start-ups increases every year, the analyzes made should be monitored over time.

In the study on Start-ups – Incubators joint innovation, I examined a sample of 1841 Innovative Start-ups located in the 20 Italian Regions. Results, suggest that both the relationship Intensity and the Number of Grants received by each start-ups impact positively innovative value of a Start-up. Instead, the Geo Distance and the Total Amount of Grant Received have a negative relationship tending towards zero. This finding reveals that regardless of the amount of funding received, the start-up tends to develop one or two innovative ideas, making use of specific funding that accelerate significantly innovation productivity. Moreover an increase in the level of patents raises both the frequency and number of investments from venture capitals (Conti, Thursby, and Rothaermel 2013).

Patents reduce uncertainty surrounding new technology-based start-ups, and thus favoring access to grants from professional investors (Conti, Thursby, and Rothaermel 2013; Hsu 2007). Moreover, start-ups that have received grants reach better business results in terms of patent applications, productivity and growth of sales or employment.

Results suggest also that as the services offered by the incubators increase, it also increases the possibility of creating patents and more generally of exploiting intellectual property rights also increases. The incubator seeks an effective means to link technology, capital and know-how in order to leverage entrepreneurial talent, accelerate the development of new companies, and thus speed the exploitation of technology (Grimaldi and Grandi 2005). In general, collaborations between close organizations show

better innovative performance than those between distant ones (e.g. (Jaffe, Trajtenberg, and Henderson 1993; A Phene and Tallman 2002).

Incubators stimulate also start-ups to collaborate and exchange knowledge with each other in their community, by co-locating start-ups in the incubator premises, by sharing resources and experiences, by organizing network events, and by acting as relational 'brokers' to make one-on-one connections (Hughes, Ireland, and Morgan 2007; Tötterman and Sten 2005).

Another important aspect that emerges from this study is the role of geographical proximity. Small distances facilitate face-to-face interactions and foster knowledge transfer and innovation rise (Antonelli 2000); geographical proximity brings organizations together, favor interaction with a high level of information richness and facilitate the exchange of, especially tacit, knowledge between actors (e.g. Boschma 2005). Geographical proximity favours the creation of economical and institutional linkages between actors, and the development of common institutional practices, that are important to generate innovative activities and knowledge spillovers (Wejnert 2002; Anupama Phene, Fladmoe-Lindquist, and Marsh 2006). The short geographical distance is particularly important for the relationship between a start-up and its incubator.

Results of our analysis confirm this consideration, in fact most of the start-ups analyzed are located near incubators. This data does not surprise us as the start-up by its nature tends to arise from innovative environments such as incubators, accelerators, university laboratories and the founders tend to remain linked to these environments in order to take advantage of services and skills, especially in the first years.

Of course, the paper presents some limitations that may represent a venue for future researches.

Firstly, in this study, among the independent variables, the intensity of the relationship with incubators is considered only in terms of the number of services provided.

It would be interesting to study and analyse the types of services to understand which ones act as a lever for the generation of new patents. Also understanding what professionalism the incubator provides and the success rate in obtaining new patents and new grants would be interesting to analyse.

Another aspect concerns the competences and background of the start-up administrator/shareholders. It would be interesting to understand how these variables are linked with the development of patents or industrial property rights, focusing for example on the prevalence of women or young people.

Finally, considering that the database used is constantly evolving, and the number of innovative start-ups increases every year, surely the analyses made should be monitored over time. I believe that the present two empirical studies provide several contributions from the academic, managerial, and policy point of view. Findings seem to suggest that policymakers should introduce integrated measures to support start-ups. Also, considering the characteristics of the Italian production system, it would be desirable, in fact, a regional governance model capable of supporting the birth of new start-ups considering the real needs and potential of the territory. Furthermore, the funding measures must be conceived in an integrated manner to guide these companies throughout the life cycle, from the creation of the idea to incubation up to industry consolidation. This study shows that most start-ups have received small funding, especially in the initial phase. Only in some cases, there is the presence of grants associated with different stages of business growth.

Moreover, Start-ups – Incubators collaborations need to be improved. Long-term and lasting relationships should be supported, because of prior collaborative experiences make linkages more valuable. Finally, global links between the academic and industrial environments appear to be fundamental to overcome the limitations of a local search, thus acquiring the required capabilities to create high impact innovations.

The present study provides **significant contributions from the academic, managerial, and policy point of view.**

From the academic side, the following study is part of the domain of start-ups and the mechanisms that lead to the generation of innovation. Surely a very important aspect is having focused the analysis on the context of Italian start-ups, using the official database provided by the chamber of commerce, as a basis for analysis. This is certainly an innovative aspect compared to the studies presented in the literature so far, even more because this database has been integrated with crucial information coming from websites consultation (company website and several on-line databases) and only for missing information a phone survey became necessary. In particular, the Number of licensees of a registered patent (industrial property) or the owner of a program for original registered computers were added; it was also added the number of grants received by a start-up; the total amount of grants received by a start-up the Geographical distance between the start-up headquarters and the nearest incubator (in km); the number of services/interaction between a start-up and the incubator; the Regional Level of innovation (data from EC database).

Another aspect of particular relevance from the academic point of view was the choice of independent variables. In both analyzes, the variables were chosen starting from prerequisites for obtaining the status of "innovative start-up" according to the Italian Law, guaranteeing in this sense a certain rigor in the analyzes followed.

In particular, with regard to the Amount of company's expenses attributed to R&D activities, it emerges that the academic literature has mainly focused on the impact of R&D on new product development , the relations between R&D and interfirm alliances growth and in general the analyzed sample was mainly in SMEs context (W. M. Cohen and Levinthal 1989; Baumol 2002; Stam and Wennberg 2009; Hall, Lotti, and Mairesse 2009).

With reference to Start-ups-Incubators joint collaboration, previous studies mainly focused their attention to identify start-ups characteristics and relations that promote this

kind of collaboration (e.g. (Debackere and Veugelers 2005; Veugelers and Cassiman 2005; F. T. Rothaermel, Agung, and Jiang 2007). Our analysis aims to study Start-ups – Incubators joint innovation, focusing on the factors making some collaborations better than others, analyzing how these characteristic interact each other, investigating the role that Geographical distance, the relationship Intensity and Grants received, have on the innovative value of start-up.

Also it can be noted that researchers who investigated start-ups growth (e.g. Ahuja 2000; Sampson 2007), payed however less attention to multiple factors affecting on start-up innovative performance (C. Kim and Song 2007). Differently, this study tries to understand how the mix of variables may positively or negatively influence the Start-up growth. Political, economic, social, technological, (external level) influencing factors, as well as the main factors within the organizational (internal level) boundaries, are to be considered as crucial for start-up innovation.

From the managerial point of view, the paper allows us to offer some provisional conclusions for managing strategically Start-up innovative performances.

In particular, in order to support start-up growth it is necessary to have funding in the preliminary phase of start-up growth and it is crucial to use these investments mainly for R&D expenses. This is because only through research activities these companies can generate innovation. Moreover, grants allow companies to grow more than the others not only because they are addressed to fast growing start-ups, but also for a positive and genuine effect of these types of investments in start-up management.

The start-up must also leverage its skills and therefore it is necessary to invest in human capital. Innovation in teams requires transformational leadership qualities, such as inspiring others, stimulating frequent and high-quality social interaction, expressing strong entrepreneurial visions, and using the talents and individual capacities of team members. Furthermore, transformational leadership qualities are supportive for start-up

performances and an innovative team climate, which are needed for the entrepreneurial exploitation of business opportunities.

Finally, it is essential for a start-up to have a thriving innovation context around it and this is why incubation becomes a tool for exponential growth. The geographical proximity and the intensity of the relationships activated becomes crucial both for the development of new research initiatives and for the generation of industrial property. In fact, incubators tend to provide start-ups with complementary services through highly specialized personnel; these services, taken together, are designed to offer a gradual growth path aimed at creating an innovative product or idea (Bruneel et al. 2012; Ahmad and Ingle 2013; Spigel 2017; Stam 2015).

Finally, in terms of policy implications, findings seems to suggest that policy makers should introduce integrated measures to support start-ups. Considering the characteristics of the Italian production system, it would be desirable, in fact, a regional governance model capable of supporting the birth of new start-ups taking into account the real needs and potential of the territory. Furthermore, it is essential that the funding measures are conceived in an integrated manner so as to guide these companies throughout the life cycle, from the creation of the idea, to incubation up to industrial consolidation. In fact, the study shows that most start-ups have received small funding especially in the initial phase. Only in some cases there is the presence of grants associated with different stages of business growth.

Another important aspect regards the promotion of new Start-up – Incubators collaborations, considering not only partners' specific characteristics, but also how they interact each other. For this reason, long-term and lasting relationships between Start-up – Incubators should be supported, because of prior collaborative experiences make linkages more valuable. Finally, global links between the academic and industrial environments appear to be fundamental in order to overcome the limitations of a local search, thus acquiring the required capabilities to create high impact innovations.

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