What matters for innovative startup growth? A study on local, firm-specific, and founder-specific factors[1]

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Abstract

Frame of the research: *While several studies have focused on the creation of innovative startups, less attention has been devoted to the drivers of growth for these startups.*

Purpose of the paper: *This study investigates the drivers of growth in innovative startups by jointly considering factors at different levels: local, firm-specific, and founder-specific.*

Methodology*: The study analyzes 701 innovative Italian startups and tests the research hypotheses using multiple regression analysis.*

Findings: *The findings reveal a positive association between the number of incubators in a province and the growth of innovative startups. Additionally, a highly educated workforce is positively related to startup growth. Furthermore, the prevalence of young individuals in the entrepreneurial team is associated with higher growth, while entrepreneurs' gender does not lead to significantly different growth rates, suggesting that the slower growth observed in women-led startups in previous studies does not characterize women-led innovative startups.*

Research limits: *The research has limitations, as it analyzes growth over a relatively short period and focuses solely on the Italian context. Further research is encouraged to examine drivers of long-term growth and to investigate the growth of innovative startups in different national contexts.*

Practical implications: *The study highlights the importance of supporting the establishment of incubators, as they contribute to the development of an entrepreneurial ecosystem that fosters the growth of new ventures. Additionally, findings suggest that policymakers should support young entrepreneurship, as firms created by this group tend to grow faster than others.*

Originality of the paper: *The study adopts a multilevel perspective by jointly analyzing factors at three levels - local, firm-specific, and individual - to respond to the call for research on startup growth drivers that considers factors of diverse natures.*

Key words: *growth; innovative startup; entrepreneurship; new venture*

1. Introduction

The aim of this study is to investigate the drivers of innovative startup growth. Growth is a relevant dimension of firm success (Davidsson *et al.*, 2006; Miroshnychenko *et al.*, 2021), particularly important for innovative new firms as it may represent a condition for their competitiveness and survival (Lomi and Lorenzoni, 2000). Moreover, various studies have highlighted that entrepreneurship in a geographic area plays a crucial role in enhancing economic development and employment (Audretsch and Keilbach, 2004; Fritsch and Schindele, 2011; Gambardella, 2014); the impact that new entrepreneurial initiatives have on local employment and growth depends not only on the startup rates of an area but also on new ventures' ability to survive, be competitive, and grow. Hence, consideration of both the creation of new ventures and the subsequent evolution of startups within local contexts is important. However, previous literature on high-tech and innovative startups has devoted limited attention to these firms' growth (Innocenti and Zampi, 2019), focusing mainly on the drivers that favor their creation (Acosta *et al.*, 2011; Cavallo *et al.*, 2020; Colombelli, 2016; Giudici *et al.*, 2019; Venkataraman, 2004).

This study addresses this gap and aims to answer the following research question: *What are the drivers of innovative startup growth?* In doing so, we respond to the call for studies that investigate the drivers of startup growth, examining factors of different natures (Innocenti and Zampi, 2019). Previous literature on growth has highlighted enablers of firm growth, including both internal and external factors (Almus and Nerlinger, 1999; Horne and Fichter, 2022), although these factors have frequently been analyzed separately. We adopt a multilevel perspective, jointly examining external factors - which characterize the local entrepreneurial ecosystem (Acs *et al.*, 2017; Cavallo *et al.*, 2019; Jacobides *et al.*, 2018; Stam, 2015) - and internal factors, corresponding to key internal resources of the new venture (including both intangible assets and characteristics of the entrepreneur). Specifically, we investigate factors at three levels: the *local context,* the fi*rm level,* and the *individual/entrepreneur level.*

Regarding the role of the local context, our starting point has been studies that identify local factors affecting the creation of high-tech and innovative startups. These studies have shown the relevance of local knowledge and related opportunities for knowledge spillovers in explaining innovation and new venture creation in particular areas (Audretsch and Lehmann, 2005; Audretsch and Link, 2019; Giudici *et al.*, 2019; Woodward *et al.*, 2006) as well as the role played by forms of support, such as incubators, that enable nascent entrepreneurs to obtain resources, competencies, and access to networks of relationships needed to launch a new venture (Del Bosco *et al.*, 2021; Cavallo *et al.*, 2020; Colombelli, 2016). In this study, we aim to investigate whether these specific local factors (regarding knowledge availability and the presence of incubators), besides affecting innovative startup creation, also influence subsequent growth.

We also include internal factors in the analysis, as the growth of each entrepreneurial initiative, besides being influenced by the local context, may be affected by its specific resources and decisions made by the entrepreneur

(Almus and Nerlinger, 1999; Horne and Fichter, 2022). At the firm level, we focus on analyzing the role of research and development (R&D) activity, as well as human and intangible resources, which are critical factors for the performance of innovative startups (Colombelli *et al.*, 2016; Pérez *et al.*, 2004; Innocenti and Zampi, 2019). Once a firm has been established, indeed, its activity and competitiveness depend not only on opportunities to access external knowledge within the local context but also on the availability of internal knowledge and capabilities for its development and exploitation (Belitski *et al.*, 2021). Moreover, entrepreneurs play a critical role in influencing the future of startups, as their motivation and desire for success propel the development trajectory of the new ventures (Huggins *et al.*, 2017), while their skills contribute to the firms' resources. In particular, the growth ambitions of the founding entrepreneurs appear to be important determinants of startup growth (Stam and Wennberg, 2009), and approaches to firm growth may vary among different categories of entrepreneurs. Our analysis, therefore, includes factors at the individual/entrepreneurial level to account for this aspect.

A distinctive trait of this study is the effort to jointly investigate factors of different natures and at various levels. Indeed, some of the factors included in the analysis have been examined in previous studies, but extant literature has frequently focused on only one level of analysis, for example, investigating individual factors in some studies or focusing solely on the macro-level study of local factors in others. Given that these factors together determine the growth performance of innovative startups, it is important to jointly investigate their roles.

Thus, we study the relationship between the growth of innovative startups and three kinds of factors: local, firm-specific, and founder-specific. Accordingly, we investigated a sample of innovative Italian startups using a dataset we created by combining data from various sources, namely the Innovative Startups database of the Italian Chambers of Commerce, the Bureau Van Dijk AIDA database, and the Italian National Institute of Statistics (ISTAT). The use of multiple sources allowed for coverage of different kinds of potential explanatory factors.

This paper provides both a theoretical and practical contribution by offering a better understanding of how different categories of factors may influence the growth path of innovative startups. First, it contributes to the literature on innovative startups, extending the focus beyond creation to encompass growth. Second, by jointly studying drivers of innovative startup growth at different levels, the study provides a better understanding of how local, firm-specific, and founder-specific factors interact and contribute to startup growth. Finally, by identifying factors that affect innovative startups' growth, it offers practical guidance and insights for entrepreneurs and policymakers.

The paper is structured as follows: the next section presents a literature review supporting the development of the study's hypotheses, followed by the presentation of the methodology applied, the investigated sample, and the data sources. The study's main findings are then presented and discussed, highlighting practical and theoretical implications, and in the final section, we offer concluding remarks, identifying limitations and opportunities for future research.

2. Literature review and hypotheses development

The extant literature on entrepreneurship, one of the most dynamic research fields (Audretsch, 2012; Ferreira *et al.*, 2019), has mainly investigated factors affecting innovation and new venture creation in specific geographic areas (Audretsch and Keilbach, 2004; Fritsch and Schindele, 2011; Gambardella, 2014), while the impact of various factors on startup growth has received less attention and remains an under-explored research field (Innocenti and Zampi, 2019).

Given the central role founders play in decision-making and business shaping, human capital may help predict startup growth (Colombo and Grilli, 2010). As noted in previous studies, opportunity identification and exploitation phases are influenced by founders' sociodemographic and personal traits (Block *et al.*, 2017), yet further insights are needed to understand these effects in the later stages of entrepreneurship (Lee and Lee, 2016). Although founders' traits seem to be key elements in startups' growth, the current context, characterized by several initiatives aimed at stimulating entrepreneurial activities and promoting development, requires investigation not only into founders' traits but also into the entrepreneurial ecosystem (Reynolds and Uygun, 2018). This is especially relevant in Italy, where forming innovative startups is more challenging than in other countries (Cavallo *et al.*, 2021). The strong interdependencies among economic actors within a local context suggest that the entrepreneurial ecosystem plays an important role in the successful development of the innovative startups of the area (Tripathi *et al.*, 2019).

2.1 Local factors and startup growth

The literature on entrepreneurship has revealed the importance of local contexts as sources of knowledge and expertise that can facilitate (or inhibit) the creation and development of innovative, high-tech startups (Collinson and Gregson, 2003). Local contextual characteristics can offer new entrepreneurial opportunities, helping startups meet new market demands by effectively exploiting their knowledge and technological advances (Wang *et al.*, 2013). Thus, external knowledge sources help explain the influence of local contexts on new ventures' growth paths.

Previous studies have explored the relationship between education and entrepreneurship, considering both entrepreneurs' education and local schooling levels. Studies focusing on education within specific populations indicate that a qualified workforce is crucial for innovative startups (Woodward *et al.*, 2006). A well-educated labor force can better support startups, as employees are equipped to quickly grasp and adopt new technologies and production techniques (Doms *et al.*, 2010; Lin, 2011; Skinner and Staiger, 2005). In areas with a significant proportion of educated individuals, entrepreneurs are more likely to find and hire employees with higher-order skills (Piva *et al.*, 2011). Consequently, startups operating in labor markets with abundant highly educated workers incur lower search costs for specialized skills (Doms *et al.*, 2010).

Therefore, we propose the following hypothesis:

H1: The level of education within a local population is positively related to innovative startup growth.

Individuals' willingness to create new firms, along with their survival and growth, is influenced by the opportunities and constraints within their localities (Bergmann *et al.*, 2016). According to the knowledge spillover theory, the extent of knowledge accessible within a particular area influences economic growth by enabling individuals to perceive and exploit entrepreneurial opportunities. Several studies have suggested that knowledge spillovers can benefit startups in contexts involving spatial proximity to universities and research facilities (Mueller, 2006), which are conducive to forming formal and informal networks that facilitate knowledge exchange (MacGregor and Madsen, 2013). Through interaction with these networks, entrepreneurs can acquire diverse resources that contribute to enhancing their innovative startups' performance (Gao *et al.*, 2023). Universities have been identified as potential enablers of local development since they can positively influence the entrepreneurial pipeline, especially in innovative, high-tech, and knowledge-intensive industries (Modina *et al.*, 2023). Furthermore, Audretsch and Lehmann (2005) found that university knowledge spillovers may affect firm growth. Collaborating with universities and research centers allows startups to access the knowledge and expertise of researchers without requiring substantial investments during the initial phases of their development and growth (Galvão *et al.*, 2019). Universities and research institutions can support firms by increasing the available knowledge capital in a given region (Nicotra *et al.*, 2018) and sharing technical resources (Chan and Lau, 2005). Additionally, the presence of universities and research institutions encourages the transfer of knowledge and technology (Calcagnini *et al.*, 2016), which may contribute to the growth of innovative startups.

Therefore, we propose the following hypothesis:

H2: The density of universities and research centers within a local area is positively related to innovative startup growth.

Previous studies have also emphasized the role of support organizations, such as incubators, in fostering entrepreneurship, particularly in creating and developing innovative and high-tech ventures (Aernoudt, 2004; Cavallo *et al.*, 2020). Incubators provide a supportive environment through various services, including shared workspaces, administrative assistance, and value-added services like technical and managerial advice, fundraising support, and networking opportunities (Fukugawa, 2018). Specifically, networking opportunities offered by incubators can provide access to diverse knowledge, thereby promoting the success of new ventures (Mas-Verdú *et al.*, 2015). By offering support facilities and networking services, incubators help entrepreneurs establish and grow their venture ideas (Ahmed *et al.*, 2022). Incubators act as catalysts, connecting entrepreneurs with other actors who can facilitate the launch, survival, and expansion of entrepreneurial initiatives (Theodoraki *et al.*, 2018).

The support available to incubated firms can assist entrepreneurs in addressing typical challenges, such as identifying and mobilizing

resources necessary for launching and growing a new venture. This business-friendly environment allows new entrepreneurs to mobilize resources they might otherwise lack and provides opportunities to form networks that enable access to valuable information, advice, and resources essential for market competition (Galvão *et al.*, 2019). Moreover, the presence of incubators in a local area contributes to the transmission of entrepreneurial and community logics and favors the generation and exploitation of opportunities for interactions and collaboration among local firms (Roundy, 2017). They often attract startups with complementary characteristics, fostering a high degree of synergy among firms (Chan and Lau, 2005; Monsson and Jørgensen, 2016; Shih and Aaboen, 2019). This context facilitates the development of an entrepreneurial ecosystem that promotes entrepreneurship by enabling the identification and exploitation of opportunities and supporting the scaling of new ventures (Cavallo *et al.*, 2019; Stam, 2015).

The presence of incubators in a local area, which provides services and fosters networks among local firms, is thus expected to stimulate the growth of innovative startups. Therefore, we propose the following hypothesis:

H3: The number of incubators in a local area is positively related to innovative startup growth.

2.2 Firm-specific factors and startup growth

Given the importance of knowledge in innovation and entrepreneurial processes, analyses of the drivers of innovative startups' growth should consider both external knowledge sources and internal knowledge available at the firm level. Accordingly, previous studies have investigated the relationship between innovation activities and the ability of startups to survive and grow. Engagement in innovation and investment in R&D activities have been found to help new ventures survive longer (Colombelli *et al.*, 2016; Pérez *et al.*, 2004). However, the relationship between R&D investments and firm growth is complex, as evidenced by mixed findings in the literature. While some studies found no significant impact of R&D investments on growth (Lamperti *et al.*, 2017), others focusing on innovative and high-tech startups found that R&D investments support growth in these specific ventures (Innocenti and Zampi, 2019; Stam and Wennberg, 2009).

The competitiveness and growth of new ventures may also be influenced by available resources, particularly human resources and intangible assets. Specifically, human capital has been widely studied in the entrepreneurship literature, as launching and developing successful, innovative, high-tech ventures requires advanced qualifications and technical skills (Lasch *et al.*, 2007). Human capital has been recognized as an important driver of startup success (Kaiser and Muller, 2015), as highly educated employees with technical skills can contribute to valuable innovation, reduce firm failure, and drive firm growth (Ouimet and Zarutskie, 2014). Employees' talent, skills, and competencies are essential assets for new ventures and their growth (Zhao *et al.*, 2021). According to Stam and Wennberg (2009), highly educated entrepreneurs are more likely

to establish innovative ventures reliant on product development and R&D investments. Additionally, studies suggest that firm survival and growth are influenced by education levels combined with previous experience (Bates, 1995; Peña, 2002). Thus, entrepreneurs' and employees' human capital are crucial resources for new ventures' creation and growth (Gimmon and Levie, 2010).

Similarly, the availability of patents can offer startups incremental economic benefits, impacting their growth and success (Farre-Mensa *et al.*, 2019). Studies examining patents' role indicate several positive effects on new ventures' development and productivity (Kogan *et al.*, 2017; Mann and Sager, 2007). Patents act as catalysts, enabling startups to grow and succeed by increasing sales, creating jobs, and fostering innovation (Farre-Mensa *et al.*, 2016).

Therefore, we propose the following hypotheses:

H4a: R&D investments are positively related to the growth of innovative startups.

H4b: A highly educated workforce is positively related to the growth of innovative startups.

H4c: The availability of patents is positively related to the growth of innovative startups.

2.3 Founder-specific factors and startup growth

At the individual level, literature has explored the influence of entrepreneurs' traits not only on startup creation (Shane, 2003) but also on their development (Rauch and Frese, 2007). Studies have investigated the relationship between startup success and entrepreneur-specific characteristics, including age, gender, nationality, motivation, work experience, and pre-founding activities (Cuervo, 2005; Lasch *et al.*, 2007). Regarding gender, previous studies on startups indicate that women face more challenges than men when establishing new ventures (Chatterjee *et al.*, 2018), and they tend to start and manage high-performance firms less frequently than men (Cliff *et al.*, 2005; Dahlqvist *et al.*, 2000). The survival of women-owned firms is often shorter than that of firms owned by men (Arribas and Vila, 2007). Women-led startups generally underperform, appearing smaller, with less initial capital and external financing, lower sales revenues, slower growth, and lower profitability compared to those created by men (Albort-Morant and Oghazi, 2016; Aragon-Mendoza *et al.*, 2016). Even women's approaches to entrepreneurial activity appear to differ in some ways from those of male entrepreneurs. Women are primarily motivated by autonomy, change, challenge, determination, self-realization, and work-life balance, while men tend to be driven by business opportunities, wealth, status, and financial success (BarNir, 2012; Buttner and Moore, 1997; Carter *et al.*, 2003). Women's sociodemographic characteristics, personality traits, and motivations may impact their willingness to engage in entrepreneurship and their ability to successfully manage startup growth (Audretsch, 2012; Laudano *et al.*, 2019; Mari *et al.*, 2016).

Other studies have examined young entrepreneurs, who are often considered more ambitious, motivated, enthusiastic, and energetic than older individuals (Blanchflower and Meyer, 1994). Notably, research indicates that entrepreneurs' age at the startup phase is significantly associated with success, with younger entrepreneurs more likely to capitalize on market opportunities and achieve superior performance (Ughetto, 2016).

Therefore, we propose the following hypotheses:

H5a: The prevalence of women in entrepreneurial teams is negatively related to innovative startup growth.

H5b: The prevalence of young individuals in entrepreneurial teams is positively related to innovative startup growth.

3. Methodology

3.1 Sample and data sources

This empirical analysis is based on a dataset of innovative Italian startups. Law Decree 221/2012, known as the Italian Startup Act, defines an innovative startup as an enterprise that produces, develops, and commercializes innovative goods or services of high technological value. New ventures must meet specific criteria to qualify as innovative startups: they must operate in Italy, have a turnover of less than 5 million euros, have been incorporated for no more than 60 months, not be listed, not distribute profits, and not result from a merger or transfer of a business or a part thereof (Law Decree 221/2012). Additionally, an innovative startup must meet at least one of the following three criteria: (1) R&D expenditures account for at least 15% of the higher value between turnover and annual costs; (2) at least one-third of its workforce consists of individuals with a Ph.D., Ph.D. students, or researchers, or at least two-thirds of the team holds a master's degree; (3) the startup owns a registered patent, is a licensee, or has applied for an industrial property right; alternatively, it owns an original registered software program (Law Decree 221/2012).

The study's dataset includes various information collected from multiple data sources. Using the database on innovative startups maintained by the Italian Chambers of Commerce, which registers Italian firms, we gathered data on 1,199 innovative startups founded in 2014. We decided to analyze data from innovative Italian startups founded in 2014 and 2015-2017 revenue growth rates to completely avoid the possibility that the data could be biased based on the COVID-19 situation.

The data collected included information on each firm's geographical location, R&D costs, presence of a highly educated workforce, patents, and details about the gender, ages, and nationalities of the startups' capital owners and board members. We also collected economic and financial data on the startups for the three-year period (2015-2017) and details on their fields of activity from the AIDA database at Bureau van Dijk. Additionally, we obtained provincial data on the number of incubators from the certified incubators database maintained by the Italian Chambers of Commerce,

the number of universities and research centers from the Ministry of Education, University and Research database, as well as education levels, population densities, and growth rates from the ISTAT database. Finally, we acquired data on the number of existing firms from the Movimprese database of the Italian Chambers of Commerce.

Since the study aimed to explore the effects of local, firm-specific, and founder-specific factors on growth in innovative startups' sales, startups with zero revenue in 2015 (the year following their establishment) or those missing sales revenue data for 2015 and 2017 were excluded. Our final sample included 701 innovative Italian startups that met the study's criteria and had complete data for the analysis.

3.2 Method and variables

We conducted a multiple regression analysis to test our hypotheses, estimating the growth of innovative startups. There is no consensus on the most effective measures for assessing the performance of recently established firms (Söderblom *et al.*, 2015), as sales are easier to compare across sectors but tend to be more volatile than employee numbers. Our analysis used the growth rate of sales revenue as the dependent variable since sales reflect customers' commitment to adopting the startups' products or services (Autio and Rannikko, 2016). Specifically, following Ferguson and Olofsson (2004), we measured the growth rate of sales revenue as the ratio of the difference in sales revenue between 2015 (the year after the startups' establishment) and 2017 to the sales revenue in 2015, expressed as a percentage.

The main independent variables in the analysis pertained to local factors, firm-specific factors, and founder-specific factors.

Regarding local factors, we measured the presence of universities and research centers in each province as the density of universities and research centers in 2015, calculated as the ratio of the number of universities and research centers to the total population of the province. Education level was measured as the percentage of graduates among the population over 14 years in each province in 2011. Another local factor was the number of certified incubators in each province in 2015.

Among firm-specific factors, R&D investments were measured as a dummy variable, with a value of 1 if the startup's R&D costs were at least 15% of the higher value between turnover and annual costs; otherwise, 0. The presence of a highly educated workforce was also a dummy variable, with a value of 1 assigned if at least one-third of a startup's workforce had a Ph.D., were Ph.D. students or researchers, or if at least two-thirds held a master's degree; otherwise, 0. Internal availability of patents was a dummy variable as well, with a value of 1 if a startup was the owner or licensee of a registered patent (or had applied for an industrial property right) or owned an original registered software; otherwise, 0. Information on firm-specific factors was verified by the Italian Chambers of Commerce before including firms in the innovative startups dataset.

For founder-specific factors, we measured the prevalence of particular entrepreneur categories (women or young individuals) as contributors

of startup capital and board members as a dummy variable. A value of 1 was assigned if the mean of the percentage of startup capital owned by a particular category and the percentage of board members in that category exceeded 50%; otherwise, 0.

To avoid bias, several control variables associated with the local context, startups, and entrepreneurial teams were included in the analysis. For contextual factors, we controlled for population density in 2015, population growth rate during 2015-2017, and the density of existing firms in each province in 2015. We also controlled for firm-specific factors, such as the industry, social orientation, employee count in 2015, debt/equity ratio, and independence/ownership structure. Lastly, we controlled for the prevalence of immigrants in the entrepreneurial team. Tab. 1 shows the description of the study's variables.

In the correlation analysis, pairwise correlations among variables ranged from -0.457 to 0.774. Since some correlation values were relatively high, we assessed the variance inflation factor (VIF) to check for potential multicollinearity. VIF values were below 3 (Hair *et al.*, 2021), except for the number of incubators, which is still under 5 and thus, according to the extant literature, under an acceptable threshold (Hair *et al.*, 2010), indicating that multicollinearity among the studied variables was not a significant issue (Tab. 2).

4. Results

Tab. 2 presents the results of the analysis, which reveal that among local factors, the number of certified incubators had a positive and significant association with innovative startup growth ($\beta = 1.615$, $t = 2.990$, $p < 0.01$), supporting H3. Additionally, there was a significant relationship between education level and innovative startup growth, but the association was negative, contrary to H1 ($\beta = -127.548$, $t = -3.066$, $p < 0.01$). The coefficient for the density of universities and research centers was not significant ($\beta = 8.630$, $t = 0.716$, $p > 0.05$), thus H2 was rejected.

Among firm-specific factors, there was a positive and significant relationship between the presence of a highly educated workforce and innovative startup growth ($\beta = 3.357$, $t = 2.097$, $p < 0.05$), supporting H4b. However, the coefficients for R&D investments ($\beta = 2.098$, $t = 1.288$, $p > 0.05$) and patent availability ($\beta = 1.133$, $t = 0.683$, $p > 0.05$) were not significant; therefore, H4a and H4c were not supported.

Lastly, among founder-specific factors, there was a positive and significant association between the prevalence of young individuals on entrepreneurial teams and innovative startup growth ($\beta = 4.145$, $t = 2.420$, $p < 0.05$), supporting H5b. However, the coefficient for the prevalence of women in entrepreneurial teams was not significant ($\beta = -1.930$, $t = -1.149$, $p > 0.05$), leading to the rejection of H5a.

Tab. 1: Description of the study variables

Variables	Description	Mean	Std. deviation
Dependent variable			
Innovative startup growth	Ratio of the difference in sales revenue between 2015 and 2017 and the sales revenue in 2015 (%)	4.270	15.867
Independent variables			
Density of universities and research centers	Number of universities and research centers located in the province per 10,000 inhabitants (2015)	.052	.052
Education level	Percentage of graduates out of the total provincial population above the age of 14 years (2011)	.108	.023
Number of incubators	Number of certified incubators in the province (2015)	1.69	2.300
Internal R&D investments	Dummy variable assigned a value of 1 if a startup's R&D costs are equal to or higher than 15% of the higher value between turnover and annual costs; otherwise 0	.56	.496
Internal presence of a highly educated workforce	Dummy variable assigned a value of 1 if at least one-third of a startup workforce comprises individuals with a PhD, PhD students, researchers, or if at least two-thirds of the team hold a master's degree; otherwise 0	.33	.470
Internal availability of patents	Dummy variable assigned a value of 1 if a startup is the owner or licensee of a registered patent (or it has submitted an application for an industrial property right) or it owns an original registered software program; otherwise 0	.26	.441
Prevalence of women in the entrepreneurial team	Percentage of startup capital owned by women plus the percentage of board members who are women, divided by 2. Dummy variable assigned a value of 1 if the value of the ratio exceeds 50%; otherwise 0	.15	.359
Prevalence of young individuals in the entrepreneurial team	Percentage of startup capital owned by young individuals plus the percentage of board members who are young individuals, divided by 2. Dummy variable assigned a value of 1 if the ratio value exceeds 50%; otherwise 0.	.15	.356
Control variables			
Population density	Number of inhabitants per square kilometer in the province (2015)	730.470	804.097
Population growth rate	Ratio of the difference in the population of the province between 2015 and 2017 and the population in 2015 (%)	-.275%	4,211%
Density of firms	Number of existing firms located in the province per 1,000 inhabitants (2015)	75.997	13.434
Number of employees	Number of employees in 2015	2.24	4.379
Startup industry	Dummy variables for each startup industry (based on the NACE code): manufacturing, agriculture, commercial services, information science and software, R&D, and other services (as the baseline)		
Startup social orientation	Dummy variable assigned a value of 1 if a startup has a social orientation; otherwise 0	.03	.171
Startup debt-to-equity ratio	Ratio of the total debt and equity of the startup in 2015 (%)	17,679	258.559
Startup independence/ ownership structure	Ordinal variable with four levels describing a firm's ownership structure based on the independence indicator provided by the Bureau van Dijk. The levels range from "independent startups" (level 1) to "concentrated startups" (level 4)	2.91	1.141
Prevalence of immigrants in the entrepreneurial team	Percentage of startup capital owned by immigrants plus the percentage of board members who are immigrants, divided by 2. Dummy variable assigned a value of to 1 if the ratio exceeds 50%; otherwise 0	.02	.135

Source: Authors' own elaboration

Tab. 2: Regression analysis (Y = Innovative Startup Growth)

Variables	B Coefficient	t test	VIF
Constant	12.733*	2.098	
Education level	-127.548**	-3.066	2.719
Density of universities and research centers	8.630	0.716	1.144
Number of incubators	1.615**	2.990	4.409
Internal R&D investments	2.098	1.288	1.869
Internal presence of highly educated workforce	3.357*	2.097	1.622
Internal availability of patents	1.133	0.683	1.532
Prevalence of women in the entrepreneurial team	-1.930	-1.149	1.037
Prevalence of young people in the entrepreneurial team	4.145*	2.420	1.061
Population density (2015)	-0.001	-1.052	2.013
Population growth rate (2015-2017)	-0.050	-0.341	1.186
Density of firms (2015)	0.015	0.257	1.858
Number of employees (2015)	-0.103	-0.752	1.031
Startup industry manufacturing	3.359	1.726	1.445
Startup industry agriculture	0.294	0.075	1.117
Startup industry commercial services	8.232*	2.402	1.112
Startup industry information science and software	2.412	1.571	1.582
Startup industry R&D	-0.201	-0.102	1.419
Startup social orientation	2.879	0.816	1.037
Startup debt-to-equity ratio	-0.001	-0.291	1.030
Startup independence/ownership structure	-0.918	-1.707	1.077
Prevalence of immigrants in the entrepreneurial team	-1.820	-0.411	1.023
R^2	0.057		
Adjusted R^2	0.028		
F statistics (Sig.)	1.947 (0.007)		

N = 701; *p < 0.05, **p < 0.01

Source: Authors' own elaboration

5. Discussion

This study aimed to enhance understanding of the factors influencing innovative startup growth through an empirical analysis encompassing three categories of growth determinants: local, firm-specific, and founder-specific.

Regarding local factors, the analysis focused on certain local characteristics that previous studies have shown relevant to startup creation, exploring whether these factors may also promote the subsequent growth of new innovative firms. Of the three external factors analyzed (density of universities and research centers, education level of local populations, and number of incubators), only the number of incubators demonstrated the expected positive relationship with innovative startup growth, supporting Hypothesis 3. This finding suggests that the availability of support organizations such as incubators contributes to an environment conducive to startup growth. New ventures may benefit from the facilities,

services, and networking opportunities provided by incubators, which can assist them in their developmental path (Fukugawa, 2018). Additionally, incubators may foster an entrepreneurial ecosystem (Roundy, 2021; Theodoraki *et al.*, 2018), offering opportunities for collaboration and knowledge spillover that can benefit all firms in the area. Incubators, indeed, support the formation of internal and external networks, facilitating information, knowledge, and resource exchange (Galvão *et al.*, 2019).

The density of universities and research centers was not significantly related to the growth of innovative startups. Thus, the results from our sample do not support Hypothesis 2, suggesting that a relatively high concentration of research institutions in an area is not a decisive factor for the growth of innovative startups. A possible interpretation of this result relates to the heterogeneity of universities and research centers. Indeed, previous studies have shown that the impact these research institutions have on the development of innovative startups may depend on their characteristics, attitudes toward collaboration and knowledge transfer, and the specific nature of their activities (Calcagnini *et al.*, 2016; Guerrero *et al.*, 2019).

The local education level (percentage of graduates in the population above 14 years old) was found to be negatively associated with revenue growth, which does not support Hypothesis 1, as we initially hypothesized a positive relationship. Further research is needed to understand the reasons behind this counterintuitive result. One possible explanation is that more intense competition may impact innovative, knowledge-based entrepreneurial initiatives in areas with a large proportion of highly educated people. Such contexts favor new venture creation (Andersson and Koster, 2011; Audretsch and Fritsch, 1994; Bull and Winter, 1991), making it easier for competitors to create knowledge-based ventures and hire skilled individuals who could contribute to their competitiveness (Doms *et al.*, 2010; Piva *et al.*, 2011).

When interpreting this result, it is also helpful to consider that evidence concerning firm-specific factors shows a positive association between a highly educated workforce within a startup and the rate of its sales growth. This finding highlights the importance of human capital and suggests that, after the creation of an innovative firm, the presence of a qualified workforce within the firm itself matters more than the broader availability of qualified people in the population. The multilevel approach adopted in this study enables testing the role of knowledge at different levels, underscoring that internal knowledge, stemming from a highly educated team, is more significant for innovative startup growth than external knowledge tied to the presence of universities or a highly educated local population.

Thus, it is essential for innovative startups to manage hiring processes effectively to build teams with highly educated members. Human capital is a central component of the bundle of resources and competencies that determines a firm's competitive advantage (Hatch and Dyer, 2004), especially for high-tech and innovative ventures. A qualified workforce can facilitate a new venture's development, as individuals' prior knowledge enables them to identify and exploit business opportunities (Shane, 2000). A highly educated workforce may also enhance access to external knowledge,

as skilled employees can foster dialogue and collaboration with external interlocutors with similar educational backgrounds.

This significant, positive relationship between workforce education level and innovative startup growth supports Hypothesis 4b. However, our findings did not support Hypotheses 4a (on internal R&D investments) and 4c (on patent availability). The growth of innovative startups during the early stages of their lifecycle appears to be influenced more by the quality of internal human capital than by patents held or R&D efforts. Notably, patents and R&D investments may have different impacts depending on the time horizon. Some studies indicate that R&D does not necessarily improve the short-term performance and survival of new ventures (Hyytinen *et al.*, 2015; Stam and Wennberg, 2009).

Our results suggest that human capital plays a crucial role in the early years after the establishment of innovative startups. One possible explanation is that, in the early lifecycle stages, a startup needs flexibility to receive feedback, refine its products and services, or adjust its business model. In this context, a highly educated team may be more beneficial than other intangible assets (such as patents), as it fosters learning and flexibility.

Lastly, we hypothesized that certain characteristics of entrepreneurs could influence the growth trajectories of their startups. Our findings supported Hypothesis 5b, highlighting the specific influence of young entrepreneurs, but not Hypothesis 5a regarding female entrepreneurs. These findings suggest that, even among innovative startups, ventures founded by young entrepreneurs have a higher propensity to grow than those founded by older entrepreneurs. One reason may be that, despite lacking the experience of their older counterparts, young entrepreneurs often possess traits such as motivation and ambition (Lasch *et al.*, 2007), which enable them to pursue and achieve better growth outcomes for their startups.

In contrast, the nonsignificant influence of the prevalence of women in entrepreneurial teams suggests that gender is not a critical factor in determining growth orientation and capability in this type of venture. This finding is interesting, as it indicates that although women's reasons for launching innovative startups may differ from men's (BarNir, 2012), and despite frequently facing more difficulties than men (Gatewood *et al.*, 2009), their entrepreneurial initiatives do not underperform compared to those founded by men. This result contrasts with other studies showing lower performance in firms created by female entrepreneurs (Klapper and Parker, 2011). A possible explanation for this finding is that innovation-oriented entrepreneurs, in general, tend to be more inclined to seek growth because they are more willing to embrace change and invest in uncertain projects. The literature suggests that R&D-oriented behaviors among nascent entrepreneurs make them more prepared to pursue firm growth, even in teams that might have a conservative approach (e.g., teams with family ties) (Muñoz-Bullón *et al.*, 2020). Similarly, our findings on innovative startups with a prevalence of women in their entrepreneurial teams indicate that innovation-oriented entrepreneurs seek growth, irrespective of gender differences.

6. Implications

This study, by allowing a better understanding of the drivers of innovative startup growth, provides a contribution from both the theoretical and practical point of view.

6.1 Theoretical implications

From a theoretical perspective, our study enriches the literature on high-tech and innovative startups by advancing insights into the drivers of their growth. This is a relatively under-researched topic, as previous literature on these startups has devoted limited attention to growth, focusing mainly on factors that favor their creation (Acosta *et al.*, 2011; Cavallo *et al.*, 2020; Giudici *et al.*, 2019; Venkataraman, 2004). Specifically, our study responds to calls for research into the relationship between local characteristics and innovative startup growth, as well as calls for studies considering firm-specific factors and characteristics of founding team members (Almus and Nerlinger, 1999; Innocenti and Zampi, 2019).

By investigating the influence of various determinants (belonging to different categories), the study demonstrates how growth is affected by different kinds of factors (local, firm-specific, and founder-specific) and clarifies which are most relevant. A multilevel study enables testing the importance of various factors while accounting for the presence of other potential influences at different levels, which enhances our understanding of growth drivers' overall framework. From this perspective, the study makes an empirical contribution by jointly testing the relevance of internal and external growth factors (Horne and Fichter, 2022).

Additionally, the study contributes to literature on the role of specific traits of entrepreneurs. In particular, it adds to research on female entrepreneurship by highlighting the unique aspects of innovation-oriented entrepreneurs. Our findings indicate that women who found innovative startups possess the intent and ability to achieve growth performance comparable to that of male entrepreneurs, contrasting with results obtained by previous studies on female entrepreneurship (e.g., Klapper and Parker, 2011).

Finally, from a resource-based perspective (Barney, 1991), the paper provides a contribution highlighting how, among internal resources, human capital, specifically a highly educated workforce, plays a central role in explaining the initial growth of innovative startups.

6.2 Practical implications

Identifying specific factors related to startup growth also has practical implications, providing guidance on potential strategies to foster growth, which is valuable for both entrepreneurs and policymakers.

Regarding local factors, our results emphasize the importance of policies promoting incubator creation, as incubators help build an entrepreneurial ecosystem that not only supports the creation of new ventures but also facilitates their growth. These findings also suggest that entrepreneurs

may benefit from establishing their ventures in areas with incubators, which offer support services and create opportunities for interaction and collaboration among local firms, thus promoting an environment conducive to innovative startup growth.

Moreover, our findings on founder-specific factors indicate that encouraging the creation of innovative startups by young entrepreneurs may be especially beneficial, as firms established by this group tend to grow faster. This finding implies that policymakers should pay particular attention to initiatives targeting young people when formulating policies to foster entrepreneurship and enhance its impact on economic development.

From the perspective of entrepreneurs, an interesting finding from the analysis is the positive association between the presence of a highly educated internal workforce and startup growth. This result has significant implications for hiring policies, emphasizing the value of a highly educated workforce in positively contributing to firm growth. Our study highlights that, once a firm has been established, the educational level of its internal workforce is critical in explaining growth, whereas the local level of education does not appear to be beneficial. This finding also has policy implications, suggesting the importance of fostering conditions that encourage the creation of innovative startups that employ highly educated individuals.

7. Conclusions

Given the important role that the growth capability of innovative startups plays in economic development, our study aimed to investigate the factors influencing their growth. In response to calls for studies examining drivers of startup growth across factors of different natures (Innocenti and Zampi, 2019), we adopted a multilevel perspective, jointly analyzing factors at three levels: the local context, the firm level, and the individual/entrepreneur level. Our findings supported the hypothesis of a positive association between the number of incubators in the local area and the growth rate of innovative startups, highlighting the importance of these organizations in promoting entrepreneurial activity. The findings also showed a positive relationship between the presence of a highly educated workforce within a startup and its growth rate, underscoring the central role that this intangible asset plays in the early developmental stages of an innovative startup, while other factors, such as patents and R&D investments, did not significantly explain growth within the studied time frame. Moreover, the results supported the hypothesis that innovative startups led by young entrepreneurs demonstrate a greater capacity for growth. They also indicated that the growth performance of firms with a prevalence of women in entrepreneurial teams does not differ significantly from those founded by men, suggesting that the tendency to underperform, which is often attributed to women-led startups, is substantially mitigated in the context of this type of startup.

Although our findings contribute to the understanding of drivers of innovative startup growth, the study has some limitations, which suggest

the need for further research. We analyzed growth over a relatively short period. Therefore, future studies could investigate drivers of long-term growth, which may differ somewhat from those identified within this timeframe, as certain factors, such as R&D investments, may impact firm development over a longer period. Moreover, in this study, we analyzed a sample of firms created before the COVID emergency and investigated the growth path in a period of time that precedes this emergency, in order to have data not affected by this specific event. Future studies may investigate the peculiarities and growth processes of innovative startups created during the pandemic crisis, as well as those created in the post-pandemic period. In this study, we focused on a sample of Italian startups. Future studies could examine the growth of innovative startups in other national contexts or conduct cross-country analyses. They could also expand the set of variables used to explore local, firm-specific, and founder-specific factors simultaneously or employ different research approaches (e.g., qualitative studies) to gain a deeper understanding of the drivers of growth in innovative startups and the mechanisms through which these factors exert their influence.

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