

Research Article

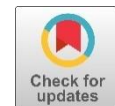
# Forms of capital, innovation capability and innovation in nascent ventures

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## Abstract

**Objective:** Investigate the impact of human, social, and financial capital on the variation of innovation capability of nascent ventures over time. **Methodology/design:** Quantitative research, developed using a longitudinal secondary database (Panel Study of Entrepreneurship Dynamics 2 - PSED 2). Multiple linear regression technique was used to test the research hypothesis. **Main results:** Among all types of capital analyzed in the study, level of education, personal finances, and physical social capital were determinant of the nascent ventures' capability of developing innovation over time. Innovation capability influenced the creation of innovation, as well. **Theoretical/methodological contributions:** Considering the longitudinal design, the research presents which types of capital are relevant along time for nascent ventures to develop innovation capabilities. **Relevance/originality:** From the methodological perspective, the research has a longitudinal design, as suggested by entrepreneurship and innovation capability scholars since both phenomena are process oriented. It also differentiates innovation and innovation capability, which are two constructs used interchangeably by research, although being different. **Social/management contributions:** The results contribute to qualify which resources of a company in its initial phase have greater potential for generating long-term innovation.

**Keywords:** Resources; Innovation Capability; Innovation; Entrepreneurship; PSED.

## Resumo

**Objetivo:** Investigar o impacto do capital humano, social e financeiro na variação de capacidade inovadora de empresas nascentes ao longo do tempo. **Metodologia/abordagem:** A pesquisa se caracteriza como quantitativa e foi desenvolvida usando uma base de dados secundários longitudinal (Panel Study of Entrepreneurship Dynamics 2 - PSED 2). A técnica de regressão linear múltipla foi utilizada para testar as hipóteses da pesquisa. **Principais resultados:** Dentre os tipos de capital analisados no estudo, escolaridade, finanças pessoais e capital social físico foram determinantes para o desenvolvimento de capacidade inovadora de empresas nascentes ao longo do tempo. **Contribuições teóricas/metodológicas:** Considerando a abordagem longitudinal, a pesquisa apresenta quais tipos de capital são relevantes ao longo de um período de cinco anos para o desenvolvimento de capacidade inovadora em empresas nascentes. **Relevância/originalidade:** Sob uma perspectiva metodológica, a pesquisa possui um desenho longitudinal, o que tem sido indicado por teóricos de empreendedorismo e de capacidade inovadora, uma vez que ambos fenômenos possuem uma orientação por processos. Além disso, a pesquisa apresenta uma diferenciação entre inovação e capacidade inovadora, conceitos usados de modo intercambiável por pesquisas, apesar de serem diferentes. **Contribuições sociais/gerenciais:** Os resultados contribuem para qualificar quais recursos de uma empresa nos momentos iniciais contribuem para gerar inovação em longo prazo.

**Palavras-chave:** Recursos; Capacidade Inovadora; Inovação; Empreendedorismo; PSED.

## INTRODUCTION

Data from the US Bureau of Labor Statistics (2016) show that approximately half of American nascent ventures do not survive their first five years. These figures reflect the natural conditions that entrepreneurs face when starting a business, such as scarcity of resources and an ever-changing environment (Park *et al.*, 2018). To overcome these obstacles, nascent ventures shall endeavor to innovate, based on the rearrangement of their internal resources, and the way of dealing with the environment (Vasconcelos *et al.*, 2021).

This ability of adjusting to internal and external conditions to create new products, services for the benefit of customers and stakeholders is known as innovation capability (Lawson & Samson, 2001; Saunila, 2020). In the recent years an increasing number of studies about it have been produced; however, the comprehension of the construct among small or nascent ventures is still incipient, although they account for an important portion of a country's economy (Saunila, 2020).

Despite recent advancements in this context, some gaps still need to be further explored, including the impact of different types of network and managers' characteristics on innovation capability (Mendoza-Silva, 2020). Once innovation capability and business creation have a process approach, research should also address these phenomena under a longitudinal design (Protogerou *et al.*, 2017; Vasconcelos *et al.*, 2021). This brings about the following research question: what is the impact of different forms of resources on nascent ventures' innovation capability and innovation along time?

This research aims to investigate the impact of determinants – represented by human, social, and financial capital – on innovation capability, and its effect on innovation of nascent ventures. To reach this goal, data from the Panel Study of Entrepreneurial Dynamics II (PSED) were used. PSED is a research program that provides data of nationally representative early-stage ventures from USA. It is a six-wave panel dataset from 2006 to 2011. The PSED team conducted interviews each year to collect detailed information about entrepreneurs, and the process of setting up a business (Reynolds & Curtin, 2007). Recent research on entrepreneurship applied the PSED to analyze topics like entrepreneurial finance (Hechavarría *et al.*, 2016), social capital (Semrau & Hopp, 2016), human capital (Semrau & Hopp, 2016; Cerqueti *et al.*, 2020), marketing (Camargo Filho & Borges, 2019), and entrepreneurial behavior (Laffineur *et al.*, 2020).

This study presents some contributions. First, some determinants of innovation capability still need deeper comprehension, including the effect of different types of business networks, and the characteristics of entrepreneurs (*e.g.*, level of education) on innovation capability (Mendoza-Silva, 2020). From a methodological perspective, this research follows a longitudinal approach, which is encouraged both by entrepreneurship scholars – since setting up a venture is a process (Wright & Marlow, 2012; Park *et al.*, 2018) – and innovation capability literature, because this construct has a dynamic and temporal character (Iddris, 2016; Park *et al.*, 2018; Protogerou *et al.*, 2017; Mendoza-Silva, 2020). For entrepreneurs and policy makers this study shows which resources have greater potential to contribute to the building of long-term innovation capability. Thus, both entrepreneurs and policy maker could qualify actions throughout the process of setting up ventures according to resources of greater potential for improving innovative results.

## THEORETICAL FRAMEWORK

This section begins approaching innovation capabilities. Next, it introduces certain key features that contribute to the development of innovation capability.

### Innovation capabilities and determinants

Innovation capability has emerged as a type of dynamic capability (Breznik & Hisrich, 2014) that organizations use to reconfigure their resources and skills to reach the development of innovation (Hii & Neely, 2000; Lawson & Samson, 2001). This construct is known to be evolutionary in nature and is developed from the interaction of organizational resources (Breznik & Hisrich, 2014; Mendoza-Silva, 2020; Park *et al.*, 2018). Both internal and external resources influence the development of innovation capabilities (Mendoza-Silva, 2020; Saunila, 2020), which will be presented in greater detail below.

Nascent ventures are characterized by limited access to financial resources (Jonsson & Lindbergh, 2013). To overcome this difficulty, entrepreneur resort to different sources of investment, such as personal finance, loans, and equity, throughout a venture's cycle, (Colombo & Grilli, 2007). The decision to access each of these sources is based on a variety of factors, including the stage, sector, growth orientation, among others. Traditionally, studies suggest that nascent ventures access financial resources in a sequential manner, going through personal finance, informal investors (family, friends, and fools), bank loans and equity (Murzacheva & Levie, 2020), respectively.

While personal finance investors allow entrepreneurs to keep control over their own business, loans and equity introduce other actors that require some type of return. Banks charge interest for the money borrowed from loans, whilst in equity, part of the business is transferred to an investor who will also own part of it (Hechavarría *et al.*, 2016; Murzacheva & Levie, 2020).

Previous studies have suggested a negative effect of bank lending on the quantity of innovation, especially in resource-constrained scenarios (Wang *et al.*, 2019), which is common among nascent ventures. Boyer and Blazy (2013) noted that banking finance does not lead to an increase in the survival rates of innovative business. Due to the inexistent reputation of nascent ventures, funding via bank loans is usually costly and unattractive for them (Chavis *et al.*, 2011; Moro *et al.*, 2012; Zhang *et al.*, 2019). In case the loan is approved, entrepreneurs commit themselves to future payments as interest, which is one additional formal obligation for a while (Boyer & Blazy, 2013; Chavis *et al.*, 2011).

Businesses may also access equity financing, which might be a better option than banks, since it is more tolerant to the risk of small business innovation (Zhang *et al.*, 2019). Equity investment supposes a counterpart in company shares for investors. In addition to financial resources, management support and an extension of the investor's relationship networks are also provided. However, this agreement may generate overcontrol, divergence of interests, and a sense of injustice, as well as further demotivation on entrepreneur (Khanin & Turel, 2015). These factors may reduce the business' capability to innovate. Moreover, according to Arvanitis and Stucki (2012), investors are not the main responsible for the success, as they select businesses that already have high growth potential.

Kou *et al.* (2020) compared the impact of governmental subsidies and equity finance on R&D (an innovation capability dimension). Both sources are positive. Governmental subsidies, however, tend to be more effective at early stages, such as the process of idea generation. Equity tends to be more relevant at later phases of the innovation chain since, in addition to investment, business support is provided to successfully launch the product into market.

The construction of this set of hypotheses also responds to assumptions of the effectuation theory, which describes entrepreneurs' regular behavior (Sarasvathy, 2001). Entrepreneurs generally use resources that are at hand in the early stages of starting a business. They also apply the principle of acceptable loss, which presumes that certain resources used in entrepreneurial action may be lost (Sarasvathy, 2001). These arguments support the hypotheses by suggesting that before resorting to external financial resources (which generate higher costs for uncertain returns), it is preferable to use personal finance since they entail lower costs. The following hypotheses are suggested:

- H1:** Access to personal finance has a positive relationship with variation in the innovation capability of nascent ventures.
- H2:** Access to financial resources from bank loans has a negative relationship with variation in the innovation capability of nascent ventures.
- H3:** Access to financial resources from investors has a negative relationship with variation in the innovation capability of nascent ventures.

Human capital is understood as an economic factor based on people's knowledge and skills. Human capital is one of the first resources that guide the entrepreneurial action, as personal traits, knowledge, and skills are elements garnered primarily from entrepreneurs' reflections about who they are, and what they know (Sarasvathy, 2001).

Cao and Im (2018) suggest that unlike established firms where business routines are already established, founders' human capital at nascent ventures are important determinants of research and development (R&D) intensity. Given that new businesses are attempting to create added-value solutions, and do not have established innovation process, the level of education, same-industry experience, and prior entrepreneurial experience are positive determinants of nascent ventures' R&D intensity.

The ability to come up with innovation is associated with mastery of tools and processes of a given field of knowledge. This suggests that people with higher level of education have greater capability for innovation (Marvel & Lumpkin, 2007; Samuelsson & Davidsson, 2009b; Bayon *et al.*, 2016), as they tend to identify opportunities because of technological changes (McKelvie & Davidson, 2009), invest more in R&D (Cao & Im, 2018), and seek training more often to compensate for knowledge gaps (Whittaker *et al.*, 2016).

Prior experiences – either in business creation or in the same industry – are sources of entrepreneurial learning (Minniti & Bygrave, 2001). Whether from successful or failed situations, experience can lead to new insights, and change assumptions about how to handle new situations more appropriately (Funken *et al.*, 2020).

Entrepreneurs with previous experience of setting up a business are more risk-oriented (Stewart Jr. & Roth, 2001). Their decision-making is characterized by greater confidence and agility (Busenitz & Barney, 1997), which makes identification of opportunities for innovation more efficient (Ucbasaran *et al.*, 2009). Such attributes assist entrepreneurial innovation (Koellinger, 2008; Fuentelsaz *et al.*, 2018), suggesting a positive relationship between prior experience in setting up a business and the variation of nascent ventures' innovation capability.

Results are inconclusive as regards the influence of previous experience in the same industry on the ability to innovate. Some studies support that experience in the same industry may speed up the process of learning how to act in similar circumstances (Cao & Im, 2018; Colombo & Grilli, 2005), while others show that such a relationship is negative (Kato *et al.*, 2015), as greater familiarity with customers, market and development patterns may restrict the creation of disruptive solutions (Marvel & Lumpkin, 2007). The following hypotheses are suggested:

- H4:** An entrepreneur's level of education is positively related to variation in the innovation capability of nascent ventures.
- H5:** An entrepreneur's prior experience in the industry is positively related to variation in innovation capability of nascent ventures.
- H6:** The number of businesses previously set up by an entrepreneur is positively related to variation in innovation capability of nascent ventures.

Sarasvathy (2001) argues that the decision for setting up a business is also guided by who entrepreneurs know. Relationship networks are determinants of exploitation of opportunities and innovation capability, since they can provide resources by external actors, such as partners, suppliers, and institutions (Akhavan & Hosseini, 2016; Dziallas & Blind, 2019; Whittaker *et al.*, 2016; Yeşil & Doğan, 2019).

There are multiple ways to operationalize and measure social capital. Some explore dimensions of a network (*e.g.*, structural, cognitive, relational) (Nahapiet & Ghoshal, 1998), strength of the network ties (Evald *et al.*, 2006) and the types of resources accessed by the network (Semrau & Hopp, 2016). This research follows the last approach where social capital is measured according to the type of resource provided by key non-owners along the process of business creation, following the same procedures adopted by Semrau & Hopp (2016). Three resources are analyzed: information, finance, and infrastructure (physical).

Hermann *et al.* (2020) evaluated the path that nascent ventures follow during new product development. Most of the businesses tend to create products exclusively in-house. Research-oriented businesses, however, were more likely to establish networks. Either incrementally or radically innovative ventures tend to access external linkages. These results were also dependent on industry since more technology intensive businesses are more likely to keep external linkages than less intensive firms. Social capital is, thus, another important asset to improve the innovation capability of ventures.

Weber and Heidenreich (2018) tested the effect of different networks – institutional (*e.g.*, universities and research centers), vertical (*e.g.*, supplier or customer), horizontal (*e.g.*,

competitors) – on cooperation intensity along three stages of the innovation process: concept development, product development, and implementation. According to the study, university contact was the best predictor of cooperation intensity throughout all innovation phases. Businesses benefit from this relationship because, at first, these institutions can provide advanced know-how, information, and facilities. Universities' goal is to improve knowledge, meaning that businesses are unlikely to have potential competitors emerging from this context, compared to other types of cooperation (e.g., competitors, suppliers, customers).

The authors also tested the effect of the cooperation intensity on business' innovation capability for each stage. Cooperation is positively related to innovation capability during concept and product development phases. The last stage – implementation – is dedicated to products commercialization. Therefore, cooperation does not sum up to innovation as much as in early stages (Weber & Heidenreich, 2018).

Networks may be used to access financial resources as well, since finance is a key resource for the innovation implementation quality (Djoumessi et al., 2019). Either formal or informal sources of external finance entail some level of future obligation. The former brings formal and contractual debts while the latter creates social obligation toward family and friends (Gartner et al., 2012). The following hypotheses are suggested:

- H7:** The amount of financial social capital mobilized has a negative relationship with variation in innovation capability of nascent ventures.
- H8:** The amount of physical social capital mobilized has a positive relationship with variation in innovation capability of nascent ventures.
- H9:** The amount of informational social capital mobilized has a positive relationship with variation in innovation capability of nascent ventures.

### Innovation capability and innovation

Innovation is a central element for business' competitiveness (Colombelli et al., 2016). For this, firms shall seek the development of organizational capabilities supportive to innovation. Based on this assumption and anchored on theoretical lenses of dynamic capabilities, organizational learning and innovation, the construct of innovation capability emerged as an attempt to understand the potential for creating or adopting manageable innovation, resulting in continuous transformations that create value (Mendoza-Silva, 2020).

Innovation capability and innovation have usually been studied in an interchangeable way, either conceptually or operationally (Mendoza-Silva, 2020). This is evident regarding measurement, where research applies R&D metrics as innovation capability and innovation (Guo & Zhou, 2016; Wang et al., 2008).

Innovation capability is comprehended as the "ability to institutionalize, implement and stimulate innovation leading to increased innovation output and organizational performance" (Djoumessi et al., 2019, p. 23). Three elements are present in this construct: 1) institutionalization, which concerns the creation of an environment that values innovation and drives actions toward the launch of products in the market; 2) implementation, which

involves making resources and means available for sharing information and knowledge; 3) stimulus, which represents the creation of systems to encourage innovative actions.

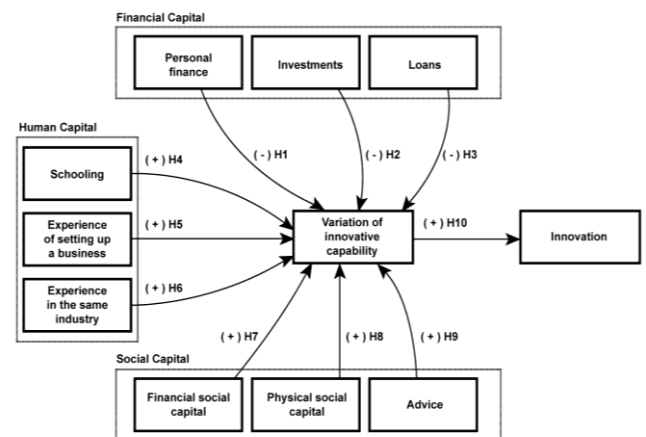
The combination of the elements above contributes to innovation once it creates an innovation-oriented environment, provides resources – tangible and intangible –, and constantly supports innovation (Djoumessi et al., 2019). According to these arguments, innovation capability is a conversion mean of culture, strategy, environment, and processes of the enterprise which leads to the development or improvement of products and services (Hurley & Hult, 1998; Lawson & Samson, 2001; Prajogo & Ahmed, 2006; Rajapathirana & Hui, 2018; Yeşil & Doğan, 2019). This sustains the last research hypothesis.

- H10:** The variation in innovation capability is positively related with the development of innovation.

Innovation capability is a relevant ability for nascent ventures survival and performance (Calantone et al., 2002), especially because early phases are marked by product and service development and a constant reconfiguration of the business assets, according to internal and external conditions (Sarasvathy, 2001).

The development of innovation capability is influenced by interorganizational (i.e. networks) and intraorganizational (i.e. entrepreneur's human capital) elements (Mendoza-Silva, 2020). Also, according to Djoumessi et al. (2019), the implementation of actions for innovation is dependent on the availability of finance: "availability of financial resources is a key predictor of the quality of an organization's implementation policies and practices" (Djoumessi et al., 2019, p. 22).

This research explores some determinants of innovation capability presented by nascent ventures throughout a five-year period. We seek to understand which sources of human, social and financial capital are most relevant to innovation capability development in the early stages of business set up. The research also aims to understand the relationship between innovation capability and innovation. The relationships described through the hypotheses are translated in Figure 1, which is divided into two complementary models.



**Figure 1**  
Theoretical empirical model of research  
Source: Elaborated by the authors.

## METHODOLOGY

Data from the Panel Study of Entrepreneurial Dynamics (PSED), a representative database of US nascent ventures, was accessed to reach this research's goal. PSED was an effort by American researchers and entrepreneurship centers to collect data which portray the process of setting up a business in the United States. Since it is a panel dataset, the PSED registered the main steps entrepreneurs went through while setting up a new business. Data were collected via annual interviews by phone, from 2006 to 2011.

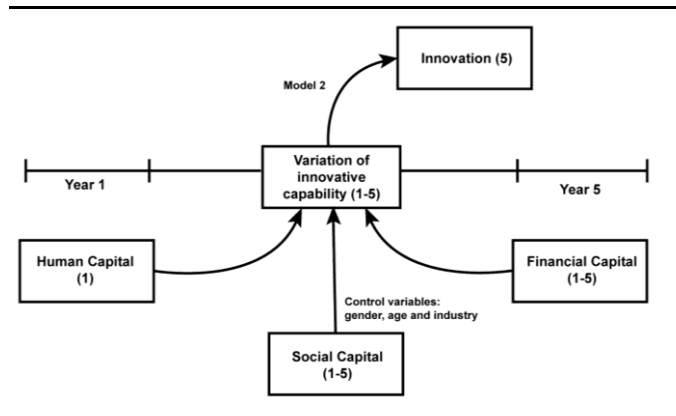
To select the companies to participate in the survey, the PSED researchers screened a total of 31,845 individuals. The interviewers asked the following four questions to find out if the interviewee was in the process of setting up a business: 1) Do you consider yourself involved in the process of setting up a business? 2) Did you engage in starting a business in the last 12 months? 3) Do you hope to be the owner of all or part of a company? 4) Has the initiative not progressed to the point of being considered operative? This screening process resulted in 1,214 cases to participate in the survey. Interviews were then conducted on an annual basis with the same entrepreneurs, throughout waves of questionnaires ranging from A to F (2006 to 2011, respectively) to monitor the business situation (Reynolds & Curtin, 2007).

PSED is one of the main global efforts to collect data from a nationally representative sample of nascent ventures. The dataset captures the entire entrepreneurial process, covering a variety of aspects such as marketing, finance, founder's characteristics, internationalization, innovation, and other subjects. PSED is well-documented, providing full comprehension of the dataset. It has been explored by many entrepreneurship publications and discussed in entrepreneurship conferences. The PSED also has some limitations, however. At first it presents only an American context. A second limitation is the reduction of the sample along time, due to enterprise mortality. Finally, research variables operationalization shall be adapted according to the database possibility, which is an inherent limitation of secondary data.

Some procedures were taken for this research. First, only businesses run by one entrepreneur were kept avoiding biases caused by the inclusion of exit of members (Semrau & Hopp, 2016). Further, each year, questions were asked to verify that the company was operational, and discontinued companies were withdrawn. Missing cases were also eliminated using the listwise criterion, while extreme cases were eliminated through the Mahalanobis distance (Tabachnick & Fidel, 2013). These procedures resulted in a sample of 133 cases of companies with only one entrepreneur at the end of the five-year period.

### Models and variables

To fulfill the study objectives, two complementary models were created. In the first model, the dependent variable was the variation of innovation capability, measured by the difference between the scores of the fifth and first years. The independent variables were human capital (extracted from the first wave of questionnaires only), accumulated financial capital, and accumulated social capital, both considering all waves. Control variables of gender, age, and industry were incorporated into the model. The second model was composed by innovation as dependent variable, and variation of innovation capability as independent variable. Figure 2 presents the models of analysis.



**Figure 2**

Analysis model

Source: Elaborated by the authors.

Given the above, the regression equation of the model 1 is expressed as follows:

$$\begin{aligned} varInnovCap_{(1-5)} = & \beta_0 + \beta_1 Personfinance_{(1-5)} + \\ & \beta_2 loan_{(1-5)} + \beta_3 investment_{(1-5)} + \\ & \beta_4 level\ of\ education_{(1)} + \beta_5 expsetupBus_{(1)} + \\ & \beta_6 expIndustry_{(1)} + \beta_7 FinancSocC_{(1-5)} + \\ & \beta_8 PhysicSocC_{(1-5)} + \beta_9 AdviceSocC_{(1-5)} + \\ & \beta_{10} gender_{(1)} + \beta_{11} age_{(1)} + \beta_{12} trade_{(1)} + \\ & \beta_{13} services_{(1)} + \beta_{14} manufacture_{(1)} + \mu \end{aligned} \quad (1)$$

The regression equation of model 2 is expressed as follows:

$$Innovation_{(6)} = \beta_0 + \beta_1 varInnovCap_{(1-5)} + \mu \quad (2)$$

The variables selected for the study are summarized in Table 1. The third column contains references of studies that used the PSED and applied similar measurements.

## RESULTS

Considering the final sample, descriptive analysis was carried out on some characteristics of the entrepreneurs such as gender, age, industry to which the enterprise is linked, human capital, social capital, and financial capital. The mean age of the sample participants was 47.49 years (SD = 11.93), with prevalence of men (59%). Most enterprises operate in the service industry (78%), followed by commerce (12%) and manufacturing (10%) sectors, respectively.

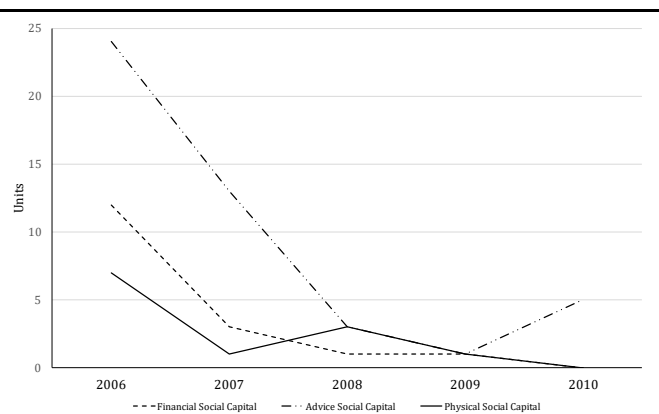
On average, individuals had approximately 14.5 years of formal education (SD = 2.28), which is equivalent to half of a bachelor's degree in the USA. Although most of the entrepreneurs had never started a new business (53%), the average experience in the same industry was 11.76 years (SD = 10.76).

Throughout five years, different agents made a significant contribution to the nascent ventures. Financial, advice and physical resources are some of the supporting categories used. Figure 3 shows the evolution of each type of social capital mobilized over that time horizon.

**Table 1**  
Study variables

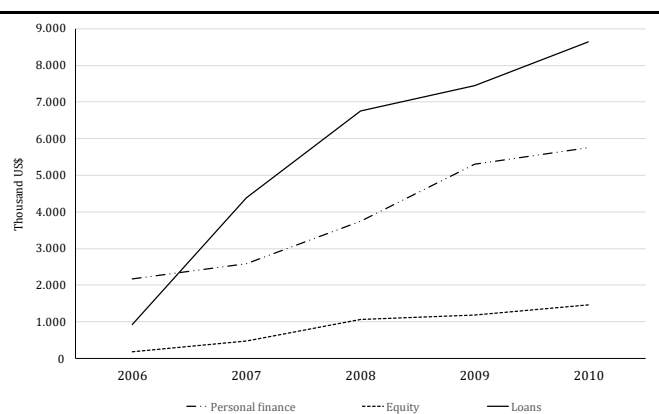
Variable	PSED variable id	Measurements	References
Innovation (wave 5)	xS1, xS2, xD13	Sum of attributes of innovation: product novelty, market competitiveness, patent. These attributes were measured as dummy variables and their sum represents the innovation degree	Samuelsson & Davidsson (2009)
Innovation capability (waves 1 and 5)	xS3, xS4, xS5	Sum of attributes of innovation capability: expenditure on research and development; technological degree of product; degree of procedure updates available for development of new products. These attributes were measured as dummy variables and their sum represents the innovation capability degree	Hechavarría et al. (2016)
Human capital	AH6_1, AH11_1, AH12_1	Level of education in years; prior experience in the same industry in years; number of enterprises already set up	Samuelsson & Davidsson (2009); Semrau & Hopp (2016)
Social capital (accumulated from 1 to 5)	xM13-1-3	Number of external supports that contributed with different types of resources: financial, physical, and informational. Each wave PSED captured key non-owners that provided some resources (e.g., advise, financial, facilities, and other) to the firm. This variable was created based on the number of these three types of resources were raised by the firm.	Semrau & Hopp (2016)
Financial capital (accumulated from 1 to 5)	Q268, Q270, R771, S771, T771, R771, Q12x, Q272, Q274, Q276, Q277, Q279, Q281, Q282, Q286, RT77, Q13, Q284, T770, xR4	Accumulated financial resources, in dollars, from these three sources: own resources, loans, and investments	Hechavarría et al. (2016)
Industry	xB1	Classification of business in three categories: commerce, service, manufacture. There are 16 different categories for types of business which were recoded into three categories: commerce, service and manufacturing	Steffens et al. (2012); Camargo Filho e Borges (2019)
Gender	AH1_1	Dummy variables	-
Age	AH2_1	Years	-

Source: Elaborated by the authors.

**Figure 3**  
Social capital mobilization along time

Source: Elaborated by the authors.

Figure 4 shows the evolution of accumulated financial resources. In the first year there was a greater use of personal finances, a fact that changes for the second year, when loans became more representative.

**Figure 4**  
Evolution of financial capital

Source: Elaborated by the authors.

In sequence, multiple linear regression was conducted. Assumption tests for the technique – residual normality, absence of multicollinearity, homoscedasticity – were conducted and all requirements were met. To test residual normality, a visual inspection was initially performed and, in sequence, according to Miles and Schevlin (2001), skewness and kurtosis z-scores were calculated, resulting in 0,98 and 1,60, values under a 95% critical p-value. Variance inflation factors (VIF) were calculated to test multicollinearity. All variables resulted in values under 10, and mean VIF was 1,196 (Field, 2009). Finally, Breusch-Pagan test suggested no heteroscedasticity since BP = 0,81 ( $p < 0,05$ ). The stepwise method was used to insert groups of variables.

Results from Model 1 (Table 2) show a 0.1446 of adjusted R2. Personal finance had a positive and significant relationship with variation in innovation capability ( $\beta = 0.00000487$ ,  $p < 0.05$ ), which supports Hypothesis 1. The level of education presented a significant and positive relationship ( $\beta = 0.0644$ ,  $p < 0.05$ ), which supports Hypothesis 4. The physical social capital variable had a significant and positive relationship with the dependent variable ( $\beta = 0.6499$ ,  $p < 0.01$ ), which supports Hypothesis 8. Finally, the control variable industry also presented a significant positive result with the variation in innovation capability ( $\beta = 0.6850$ ,  $p < 0.05$ ).

To test model 2, adjusted values of the variation of innovation capability from model 1 were used as independent variable, and innovation in wave E as dependent variable. Like model 1, assumption tests were performed to apply linear regression. Since there is only one predictor variable, there is no need to assess multicollinearity. The normality of errors expressed a tendency for asymmetric distribution. The Breusch-Pagan found absence of heteroscedasticity. The results of this model are shown in Table 3.

Variation of innovation capability has a significant and positive relationship with innovation ( $\beta = 0.0142$ ,  $p < 0.05$ ), which supports hypothesis 10. Table 4 presents a summary of the results found according to the analyses.

**Table 2**  
Results of model 1

	Model A	Model B	Model C	Model D
Constant	2.5441***	1.7605***	1.7937***	1.5700***
<i>Control variables</i>				
Age	0.0091	0.0040	0.0055	0.0076
Male	0.0048	0.0058	-0.0220	0.0091
Trade	0.1099	0.1765	0.2237	0.1919
Manufacture	0.7404***	0.7469***	0.6653***	0.6850***
<i>Human capital</i>				
Level of education		0.0676**	0.0598*	0.0644**
Industry		0.0040	0.0020	-0.0013
Previous businesses		-0.0101	-0.0075	-0.0205
<i>Financial resources</i>				
Personal finances			0.0000*	0.0000**
Loans			-0.0000	0.0000
Investor			-0.0000	-0.0000
<i>Social capital</i>				
Financial SC				0.0547
Advise SC				0.1090
Physical SC				0.6499***
Adjusted R <sup>2</sup>	0.0537	0.0832	0.0852	0.1446
R <sup>2</sup>	0.0749	0.1242	0.1466	0.2212
Log-likelihood	-158.37	-154.67	-152.92	-146.74
p-value	0.0167	0.0084	0.0157	0.0015
F (12, 132)	3.5329	3.0270	2.3871	2.8889
Akaike criterion	324.757	323.347	325.771	318.679
n	133	133	133	133

Notes : p-value: \*p < 0,10; \*\*p < 0,05; \*\*\*p < 0,01  
Source: Elaborated by the authors.

**Table 3**  
Results of model 2

	Model E
Constant	0.0000***
VarInnovCap	0.0142**
Adjusted R <sup>2</sup>	0.0374
R <sup>2</sup>	0.0447
Log-likelihood	-163.8530
F(1,132)	6.1696
p-value	0.01424
Akaike criterion	329.705
n	133

Notes : p-value: \*p < 0,10; \*\*p < 0,05; \*\*\*p < 0,01  
Source : Elaborated by the authors.

**Table 4**  
Synthesis of results

	Description of hypothesis	Test
H1	Access to personal finance has a positive relationship with variation in the innovation capability of nascent ventures.	Supported
H2	Access to financial resources from bank loans has a negative relationship with variation in the innovation capability of nascent ventures.	Not supported
H3	Access to financial resources from investors has a negative relationship with variation in the innovation capability of nascent ventures.	Not supported
H4	An entrepreneur's level of education is positively related to variation in the innovation capability of nascent ventures.	Supported
H5	An entrepreneur's prior experience in the industry is positively related to variation in innovation capability.	Not supported
H6	The number of businesses previously set up by an entrepreneur is positively related to variation in innovation capability.	Not supported
H7	The amount of financial capital mobilized has a negative relationship with variation in innovation capability.	Not supported
H8	The amount of physical social capital mobilized has a positive relationship with variation in innovation capability.	Supported
H9	The amount of informational social capital mobilized has a positive relationship with variation in innovation capability.	Not supported
H10	The positive variation in innovation capability is positively related with the development of innovation.	Supported

Source: Elaborated by the authors.

## DISCUSSION

Among financial resources, only personal finance presented a positive and significant relationship. This result confirm past studies which suggest that early-stage ventures prefer using internal sources of finance either to keep full control of the business, or to avoid extra costs (Murzacheva & Levie, 2020). Entrepreneurs with greater innovative orientation tend to focus on embryonic activities, such as idea generation and product development. In terms of funding, the pursuit of financing is deferred and, when it happens, personal finance is the top choice (Boyer & Blazy, 2013).

The hypotheses on bank debts and equity investment were not supported. According to previous studies, bank debts have no effects on innovation (Brown et al., 2017). Innovation-oriented nascent ventures are inherently high-risk projects. Banks avoid investing in this type of project given the high risk of failure. For that reason, contracts tend to be unfavorable for innovation in nascent ventures (Zhang et al., 2019).

Kou et al., (2020) showed that equity may have a positive relationship with innovation capability throughout the innovation process. The effect, however, is more relevant during latter stages (e.g., commercialization) since investor's additional support tends to have greater impact at that moment. This may help explain our results, especially because the measurement of innovation capability in this study did not include elements of commercialization.

Discussions of the theory of effectuation present that entrepreneur generally operate following an acceptable loss approach. Thus, in conditions of uncertainty about the venture's success, it is preferable to use personal reserves that entail lower obligations when compared to loans and investments (Sarasvathy, 2001). This explanation is congruent to the results where only personal savings was significant, but with a low impact on innovation capability. Although it is understood that the availability of financial resources is an important factor for the implementation of innovation (Djoumessi et al., 2019), personal finance generally provide a low value compared to other sources (Gartner et al., 2012), which could be translated into a low impact on innovation capability.

Regarding human capital, level of education was the only variable that presented a positive and significant effect on variation of innovation capability. There are some reasons for this result. First, they generate more innovation due to higher investments in research and development activities (Kato et al., 2015; Protogerou et al., 2017), and their ability to identify more opportunities because of their knowledge and skills (Marvel & Lumpkin, 2007). People with higher level of education tend to participate in training that can fill gaps in building capabilities which lead to innovation (Whittaker et al., 2016).

The impact of prior experience, whether in the industry or in setting up businesses, has shown mixed results in different studies. On the one hand, studies suggest that prior experience may contribute to the development of innovation capabilities, as the entrepreneur has a greater understanding of how to meet market problems, make decisions more efficiently, and is more self-confidence (Ucbasaran et al., 2009; Dimov, 2010; Barnir, 2012). However, research also indicates that prior experience

may be detrimental in a way the entrepreneur would be trapped in creating the same solutions to old problems (Marvel & Lumpkin, 2007).

In our research, neither variable was significant. These results are inconclusive. Some argue that previous experiences can present a negative result, since entrepreneurs tend to follow the same heuristics to solve new problems (Marvel & Lumpkin, 2007). On the other hand, research on previous experiences from failure warns that the variable only impacts innovation in situations where the same strategies are followed. Failure can reinforce or reverse an approach to deal with a specific situation, but this new course of action alone is not enough to guarantee the achievement of greater innovative capability if different strategies are followed (Marzocchi & Ramlogan, 2019).

Other longitudinal studies analyzing the relationship between previous experience and innovation have found significant relationship only at the beginning of the venture creation process (Arvanitis & Stucki, 2012; Samuelsson & Davidsson, 2009). This study adopted a five-year period, thus the importance of prior experience seemed to fade over that time.

Another explanation for these results stems from the operationalization of prior experience. Although previous studies apply number and length of projects in the same industry, the use of these metrics could simplify understanding the influence of this construct on the phenomenon (Marvel et al., 2016). The fact that an individual has already been involved in setting up five ventures is no guarantee that they have been involved in the most relevant experience for building innovation capability. To illustrate these arguments, Protogerou et al. (2017) did not identify significant results in the relationships between previous professional experience and prior experience in the same industry, and radical innovation. However, when they analyzed the types of experience, they found that experience in marketing and techniques was the most relevant for developing more disruptive innovation.

According to results, the relationship of financial social capital with variation in innovation capability was not significant. At early-stage innovation-tuned entrepreneurs avoid focusing on supporting activities, such as the pursuit of financing, and prioritize the development of their product. Therefore, financial social capital, for example, is not related to the dependent variable of the study (Boyer & Blazy, 2013).

Regarding other forms of social capital explored in this study (*i.e.* informational, and physical), physical social capital expressed significant relationship with variation of innovation capability. The effect of this variable was the highest among other determinants of the models. Previous studies have shown that infrastructure is a key factor to enhance innovation capability (Romijn; Albaladejo, 2002; Protogerou et al., 2017). Considering Djoumessi et al., (2019) framework, physical social capital helps creating the means to implement the innovation.

The inconclusive result from information social capital may sound counterintuitive at first. However, the simple existence of this relationship is not enough to assume improvement of innovation capability. Beyond information, it is important to analyze other elements of this informational social capital, such as the content, trust, and shared vision (Molina-Morales & Martínez-Fernandez, 2010).

According to model 1, some resources were responsible for generating innovative capabilities. These, in turn, strengthen a set of practices that catalyze the development of innovation, since there is a significant and positive relationship between innovation capability and the results-based innovation of model 2.

Lawson and Samson (2001) warned that companies do not compete for innovation, but for their ability to achieve it. They suggested a framework based on the three interdependent elements - resources, innovation capability and innovation. However further studies were needed to empirically test the relationship. This research tested both relationships. The latter presented a significant and positive relationship between innovation capability and innovation, which is convergent with the literature (Mir et al., 2016; Prajogo & Ahmed, 2006). However, we must comprehend this result with caution, since the variable effect and the explained variance were both low, besides one of linear regression assumption was not met.

## CONCLUSION

The objective of this research was to investigate how human capital, social capital, and financial capital resources impact the variation of innovation capabilities of nascent ventures over time. In this context, entrepreneurs' level of education and personal finances contribute to the development of innovation capability. Externally, relationship networks that foster access to physical resources are responsible for enhancing the innovation capability of nascent ventures. This variable, in turn, influences the emergence of innovation.

There is a solid understanding that at the beginning of the business creation process, entrepreneurs have limited resources – financial, market reputation, knowledge – and generally apply what they have at hand. In this study, personal finance is a good example of a tangible resource available at hand. The variable showed a positive and significant result, but with low impact on innovation capability. Other sources of financing that were not included in this study may eventually have a greater impact on innovation capability development, such as government subsidies and specific credit lines for entrepreneurs, with low interest rates. Both might carry advantages from both internal and external sources of financing, such as possibility of keeping the business' control and low (or no) interest rates. This observation represents a suggestion for future research. On the other hand, even in face of resource constraints, entrepreneurs might use their networks to overcome these barriers. In this sense, physical social capital reinforces this understanding due to the high impact of this variable on the evolution of innovation capability. Thus, access to physical infrastructure through relationship networks is of great importance for nascent ventures' innovation capability. Partnerships with universities, business incubators, laboratories and makerspaces that provide conditions for prototyping products would be a good policy to improve innovation capability of emerging ventures.

We found a positive and significant relationship between innovation capability and innovation, supporting the hypothesis around the second model. However, the independent variable effect was low as well as the explained variance. These results suggest that other variables could affect the relationship such as



contextual elements and internal elements (e.g. leadership, organizational culture).

From a theoretical perspective, this research fills certain gaps, especially in terms of the need to conduct longitudinal studies in the fields of entrepreneurship and innovation. As both fields naturally present dynamic orientation, there is still a need for further long-term studies. It also shed light on two constructs mistakenly used: innovation and innovation capability.

This study has certain limitations. Despite being a longitudinal study, the main reference for analysis was years, and not important milestones in the process of business creation. Businesses completely emerged may present results different from those that are still trying to reach the break even, despite five years of operation, for example. Other limitations are inherent of the use of a secondary database. Certain variables, such as innovation capability, were built from a given set of dimensions, even though its format is recognized as being more complex. This limitation shall be overcome in future studies which apply different metrics and instruments to measure innovation capability and innovation. The study captures the social and financial capital changes along time; however, the same was not possible regarding human capital variables since the database does not register changes for this construct.

For further research, studies can delve into some variables available on PSED, such as measuring previous experience considering the entrepreneurs' last job position. We also suggest the future studies include how changes on team composition can affect innovation capability along time. It is also possible to explore the evolution of innovation capability according to milestones from the business emergence process. Further research can also capture contextual elements, such as macroeconomic conditions. This effort could be reached joining PSED with other economic datasets. New studies should include both operating and discontinued businesses to capture how forms of capital influence innovation capability and innovation in both scenarios. The second model (innovation capability and innovation) must be further explored, including other variable that could help explain the effects of this relationship. In case of primary data collection, further research could test the influence of the variables of this study adopting scales that capture all dimensions from innovation capability and other constructs.

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### Authors' statement of individual contributions

Roles	Contributions by authors			
	Pagoto D. do P.	Borges Junior C. V.	Almeida M. I. S. de	Hoffmann V. E.
Conceptualization	■	■	■	
Methodology	■	■		
Software	■		■	
Validation	■	■		■
Formal analysis	■			
Investigation	■			
Resources			N. A.	
Data Curation			N. A.	
Writing - Original Draft	■	■		■
Writing - Review & Editing	■	■	■	■
Visualization				
Supervision		■		
Project administration			N. A.	
Funding acquisition			N. A.	

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