



# Knowledge, innovation and NTBF short- and long-term performance

Antonia Mercedes García-Cabrera<sup>1</sup>  · María Gracia García-Soto<sup>1</sup>  · Julia Nieves<sup>1</sup> 

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## Abstract

The purpose of this paper is to analyse the effect of knowledge resources stemming from the founding team's human capital and the access to external sources of knowledge available at or near the NTBF's inception on the venture's short- and long-term performance. Whether innovation is a vehicle through which knowledge resources have an impact on results is also studied. While previous studies have often focused on one dimension of performance, we cover complementary indicators of short-term performance (i.e., foreign market performance, total market performance and superior financial outcomes) and one indicator of long-term performance (TBF survival). Thus, the current research contributes to a wider understanding of the effect of knowledge resources at or near a venture's inception and innovation on the performance of NTBFs. A sample consisting of 175 Spanish NTBFs allows these relationships to be analysed. Results indicate that NTBFs' knowledge resources available at or near inception are of relevance to firms' innovations and to different dimensions of performance. Several knowledge resources have different positive and negative effects on different dimensions of short- and long-term performance, so those that can be good at one stage of a NTBF's life cycle can be bad at others times (e.g., founding teams with more members in the early years of the NTBF may be positive for the results, but in the long term, fewer people is better). Innovation mediates the effect of some knowledge resources on total market performance.

**Keywords** Technology-based firms · Entrepreneurship · Knowledge · Innovation · Performance · Survival

## Introduction

New technology-based firms (NTBFs) must bring forth innovations in order to successfully enter the market (Nuscheler et al. 2019; Löffsten 2016b). However, innovation

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✉ Antonia Mercedes García-Cabrera  
antonia.garcia@ulpgc.es

represents a challenge for these new, small and independent firms given their limitations in economic and knowledge resources (Atuahene-Gima et al. 2006). Previous literature offers evidences of the positive impact of firms' innovations on generating competitive advantages and their performance, but there is still no consensus on what effect innovation has on performance when technology start-ups are considered, either positive, none or even negative (Löfsten 2016b). Therefore, for these firms, it is of interest to understand the factors that condition innovation, in case those factors affect the development of innovations able to increase or decrease venture performance. Among the factors that condition firms' innovation, we are interested in knowledge resources, since knowledge is critical for innovation (García-Martínez et al. 2019), one of the most valuable resources that generates sustainable competitive advantage (Cristo-Andrade and Ferreira 2018), and a limited resource for NTBFs (Atuahene-Gima et al. 2006). In addition, small independent ventures find it more difficult to develop innovations because of the costs of integrating knowledge or accessing external knowledge (Löfsten 2016a). In this respect, there is much debate about the effect the use of knowledge resources from the NTBF's founding team's human capital and from external sources of knowledge has on the innovations NTBFs produce, and particularly on their performance. Thus, it is of special interest in the case of NTBFs to discover whether innovation is a vehicle through which the founding team's human capital and the use of external sources of knowledge affect venture performance and the direction of such influence, either positive or negative.

Previous studies have provided mixed evidence of the effect of NTBFs' human capital and the access to external sources of knowledge on different dimensions of venture performance –e.g., García-Cabrera et al. (2019) and Yang et al. (2017) discuss it in depth–, as well as on the innovation-NTBF performance relationship (e.g., Colombelli et al. 2016; Hyytinen et al. 2015; Löfsten 2016b). Thus, new research is still needed in order to understand the effect of knowledge resources available within the firm or sourced from external sources and of innovation on NTBFs' performances.

In relation to NTBFs' performances, and looking separately at the short- and long-term performance, the question of the possible relevance of the knowledge resources and innovation at or near the NTBF's inception in providing the new venture with a solid base able to condition the initial market and financial performances, and venture's future survival, is pending an answer. Similarly, the mediator role of innovation in the effect of knowledge resources on NTBFs performance from these short- and long-term approaches have not been studied. Yet the issue of whether or not the conditions into which a firm is born have an effect on its survival is pertinent and relevant, as Geroski et al. (2010) demonstrated such an effect regarding *employee* human capital in a sample of Portuguese firms that included businesses regardless of their industry, size or legal form. For NTBFs, only Löfsten has studied the long-lasting effects of firms' conditions at inception, and he found the following as relevant for venture survival: the business plans and patents (Löfsten 2016a), the CEO's business experience (Löfsten 2016b), and the access to consultants from the incubator the NTBF locates (Löfsten 2016c). This author focuses on Swedish NTBFs located in a selected and outstanding group of incubators that have more resources than other incubators in the same country. Thus, their sample of NTBFs are better equipped with external (and proximal) knowledge resources than other NTBFs in Sweden.

On the base of the above, we contribute to literature on technology-based entrepreneurship by analysing the effect of knowledge resources stemming from the founding team's human capital and the access to external sources of knowledge available at or near the NTBF's inception on the venture's short- and long-term performance. We also study whether innovation is a vehicle through which knowledge resources have an impact on short- and long-term results. This research objective is pertinent and of interest because, when studying the performance of NTBFs, it is of huge importance to consider both short-term performance (in terms of both market and financial performance) and long-term performance (in terms of venture survival). First, NTBFs are typically started-up by a founding team on the base of a single product idea and with the hope of exploiting it and reaching enough sales (i.e., market performance) to achieve profits (i.e., financial performance) (Kazanjian 1988). However, products like this often quickly become obsolete because of the great dynamism of the high tech industries where these firms operate (Storey and Tether 1998). Thus, we propose that only those NTBFs that are started-up on a solid knowledge base and have access to the appropriate external sources of knowledge may have the knowledge resources necessary to generate further innovations and so survive as an independent firm in the short and long term. Second, since NTBFs make a large investment in R&D and require time to introduce new products into the market and reach profits (Hyytinen et al. 2015), short-term performance can be insufficient for studying NTBF performance. Since previous studies have often focused on one dimension of performance, and because we cover several indicators of short-term performance (i.e., foreign market performance, total market performance and superior financial outcomes) and one indicator of long-term performance (TBF survival), the current research may offer a wider understanding of the effect of knowledge resources at or near a venture's inception and innovation on the performance of NTBFs.

A longitudinal study of a sample made up of 175 Spanish NTBFs, which uses data from 2008, 2009 and 2014 that was collected from two sources of information and at two moments of time (from the founding entrepreneurs in 2009 and from SABI database in 2016), allows these relationships to be analysed. The current work finds that knowledge resources have different positive and negative effects on different dimensions of short- and long-term performance, so those that can be good at one stage of a NTBF's life cycle can be bad at others times. In addition, innovation mediates the effect of some knowledge resources on total market performance.

## Theoretical framework

### Human capital, external sources of knowledge and NTBFs' innovations

Innovation is a complex process in which firms outline and identify problems and, later on, develop new knowledge to solve them (Nonaka 1994). Accordingly, huge amount of literature has offered evidences of innovation benefiting from both the firms' availability of internal knowledge resources and access to knowledge from external sources (Flor et al. 2018).

A significant proportion of the knowledge required to develop innovations is generated outside of any formal R&D activity and resides in human resources – that

is, in an educated workforce and experienced managers (Capozza and Divella 2019). Because of the peculiarities of NTBF –e.g., new, young, not dependent of a business group–, the founding team’s human capital is of relevance (e.g., Storey and Tether 1998). This team is often responsible for all the decisions made and activities developed within the NTBF, among them the ones related to innovation (Nuscheler et al. 2019). To this respect, ventures with high endowments of human capital will be better able to identify their resource base and understand the need to promote the renewal necessary to face a changing environment (Augier and Teece 2009). Accordingly, some empirical works provide evidence of the effect of human capital resources on TBFs’ innovation, (e.g., Custódio et al. 2019).

In addition, critical resources for the innovative performance of a company are also outside the organisation, for example in technical reports, research and patent databases, scientific and trade journals, etc. (Souitaris 2001). Such external sources are a common way of acquiring codified and explicit knowledge that helps the NTBF to link research and technological development. Furthermore, external knowledge resources for innovation can be tacit and be in the hands of stakeholders (Nonaka and Takeuchi 1995) such as suppliers, customers or external experts. The assimilation of this tacit knowledge requires frequent social interactions with stakeholders so that it can be exchanged successfully (Nonaka 1994). In the case of high-technology firms, which require a great amount of relevant knowledge to develop innovation but have limited resources to innovate, they must often look outside their own borders to acquire it (Flor et al. 2018; Atuahene-Gima et al. 2006).

However, empirical works provide mixed evidence with respect to the effect of the firms’ access to external knowledge on innovation. For example, while Flor et al.’s (2018) study of medium and large enterprises in high-technology industries finds no relationship between access to external knowledge and radical innovation, Brunswicker and Vanhaverbeke (2015) found that those SMEs that engage in full-scope external knowledge sourcing improve innovation. Concerning a sample of SMEs and middle-sized firms, Caloghirou et al. (2004) also found that those firms that frequently seek new ideas for innovation through scientific or business journals, as well as by establishing linkages with other organisations, enhance their innovations.

*H1a: The higher the NTBF’s founding team’s human capital, the greater the venture’s level of innovation will be.*

*H1b: The higher the NTBF’s use of external sources of knowledge, the greater the venture’s level of innovation will be.*

## **Human capital, external sources of knowledge and venture performance**

Concerning knowledge resources available within the NTBFs, it has been argued that founders can be a source of competitive advantage because they hold tacit knowledge that is firm-specific (Coff 1997) and so they can contribute to venture performance. To this respect, the relevance of general and specific human capital of the founding team has been highlighted (Siepel et al. 2017). First, general human capital refers to the founding team’s size and managerial education and experience (Colombo and Grilli 2005). It has been suggested that NTBFs require more than one founder to handle the complexity of technology ventures, but founding teams should not be too large to

guarantee positive team dynamics (Wang and Chen 2016), which are necessary in order to share knowledge resources. In addition, managerial knowledge is necessary to successfully introduce new products into the market or to make proper decisions about internationalisation (García-Cabrera et al. 2019). Second, specific human capital refers to technology education, as well as industry experience (Nuscheler et al. 2019). In the case of NTBFs, founders are expected to come from a technical background, which facilitates their abilities to identify opportunities for innovations (Colombo and Grilli 2005).

Previous works provide evidences of the effect of the founding team's human capital on several dimensions the performance of NTBFs. Colombo and Grilli (2005) found such effect on indicators of market performance. Gimeno et al. (1997) found prior managerial experience positively affected new firms' economic performance, but did not influence their survival. Concerning long-term performance, Löfsten (2016b) found that in the case of NTBFs, the founder's business experience at a firm's inception positively conditioned venture survival years after inception. In this respect, Geroski et al. (2010) suggest the existence of a given permanent or structural effect of human capital on firm performance.

*H2a: The higher the NTBF's founding team's human capital at a firm's inception, the greater the venture's performance will be in terms of market performance.*

*H2b: The higher the NTBF's founding team's human capital at a firm's inception, the greater the venture's performance will be in terms of superior financial outcomes.*

*H2c: The higher the NTBF's founding team's human capital at a firm's inception, the greater the venture's performance will be in terms of long-term survival.*

Concerning external sources of knowledge, it has been stated that a firm's skill at scanning external knowledge about seeking new ideas for innovation may be beneficial for the business (Souitaris 2001). For example, the scanning of knowledge included in scientific and business journals may allow the firms to access the results of academic research, as these journals are a mechanism of knowledge diffusion (Caloghirou et al. 2004). In addition, the ability of a firm to establish and effectively manage relationships with suppliers, customers and other organisations positively conditions its competitive advantage and performance –e.g., growth and market share (Sarkar et al. 2001). However, Denicolai et al. (2016) argue that the short-term positive return of spending on externally generated knowledge assets is unlikely to last in the case of large companies, as competitors can also acquire the same technology. When referring to NTBFs and looking at the long term survival, Löfsten (2016c) finds that access to external sources knowledge can be of central importance. In particular, R&D intensity and development of patents are usually higher in the case of NTBFs located in incubators and science parks or when NTBFs cooperate with universities (Lindelöf and Löfsten 2002; Löfsten 2016c). This positive effect occurs because these technological and scientific structures provide NTBFs the opportunity to access network links that are important both to the venture's daily activities and to the improvement of innovation performance (Löfsten 2010). Due to their knowledge constraints, without access to new and diverse knowledge from external sources it is unlikely the NTBF will be able to create innovative technologies and develop new products that meet market's

need and let the venture to successfully compete with incumbents (Wang and Chen 2016).

*H3a: The greater the NTBF's use of external sources of knowledge, the greater the venture's performance will be in terms of market performance.*

*H3b: The greater the NTBF's use of external sources of knowledge, the greater the venture's performance will be in terms of superior financial outcomes.*

*H3c: The greater the NTBF's use of external sources of knowledge, the greater the venture's performance will be in terms of long-term survival.*

### **The mediator effect of innovation on the relationship between human capital, external sources of knowledge and NTBF performance**

We have previously reasoned about the influence of NTBFs founding teams' human capital and use of external sources of knowledge on innovation and on NTBF performance. We now propose that these relationships may be better described through a mediation model. The NTBF's founding team's human capital and access to external sources of knowledge could have both a direct and an indirect effect on venture performance. The indirect effect would be due to the influence of the founding team's human capital and their access to external sources of knowledge on the NTBF's level of innovation, because innovation provides the basis for the success of firms in favouring their competitiveness and expansion into new business areas and markets (Rhee et al. 2010).

In the context of NTBFs, where one of the main motivations for starting a venture is to launch innovative projects, increased post-entry performance in terms of growth and export performance –i.e., market performance–, as well as profitability –i.e., financial outcomes– can be expected (Colombelli et al. 2016). Referring to the innovation-firm survival relationship, Hyytinen et al. (2015) found that the survival probability of start-ups engaged in innovativeness is approximately 6-7 percentage points lower than that of other start-ups. Because NTBFs are characterised by being established with the purpose of exploiting technological innovations (Löfsten 2016b), and these uncertain projects can fail, some of these firms will exit the market in the short term (Hyytinen et al. 2015). However, if we focus on the long-term performance, we can consider that innovation efforts near the firms' inception that are successfully introduced into the market may highly benefit NTBFs survival even as much as years later. For example, as these young, small ventures are expected to have greater flexibility (Spencer and Kirchhoff 2006; Hyytinen et al. 2015), they will more easily take advantage of innovation in the sense of learning from feedback, which is useful for subsequent technological developments (Yang et al. 2017), which, in turn, will facilitate their survival in the long term.

*H4a: The higher the NTBF's level of innovation, the greater the venture's performance will be in terms of market performance.*

*H4b: The higher the NTBF's level of innovation, the greater the venture's performance will be in terms of superior financial outcomes.*

*H4c: The higher the NTBF's level of innovation, the greater the venture's performance will be in terms of long-term survival.*

Thus, we can expect that both the founding team's human capital and their access to external sources of knowledge may have an indirect effect on NTBF's performance by conditioning the innovations NTBFs are able to develop. Just as an example, the education of the founding team can cause the founders to become expert at elucidating the reliability of novel information about new products coming onto the markets, for example, if it must be taken into account because it implies radical changes or must be ignored so as not to waste resources (Nuscheler et al. 2019), so conditioning the development of successful innovations able to positively influence the firm's performance.

*H5a: Innovation is a mediator variable in the relationship between the NTBF's founding team's human capital and venture performance.*

*H5b: Innovation is a mediator variable in the relationship between the NTBF's use of external sources of knowledge and venture performance.*

## Method

### Data sources

The database includes information from a sample of Spanish NTBFs. The study is longitudinal and uses data from 2008, 2009 and 2014, which was collected from two sources of information and at two moments of time. To conduct the fieldwork and data collection we proceeded in two phases as follows.

First phase (in 2009). We built an online questionnaire to collect the data and the link to the questionnaire was sent by e-mail to NTBFs' founder-managers. We first used the SABI database for identifying NTBFs using the following criteria: the venture has fewer than 250 employees; is not integrated into a corporate group; operates in a high-technology sector, following the OECD's classification of industries based on technology (<http://www.oecd-ilibrary.org>); and finally, at the time of the fieldwork, the firms would be operational for up to 8 years, and so should be "new" according to Wang and Chen (2016) and Nuscheler et al. (2019), who consider the limit to qualify a firm as new as 10 years. This fieldwork was carried out from January to July 2009. Questions refer to resources available within the NTBF at or near the firm's inception and the venture's performance up to 2008. We obtained 175 valid responses.

Second phase (in 2016). We carried out a new process of information gathering in 2016. We collected data available in the SABI database for those NTBFs participating in the first phase of our study (the ones that had answered the survey in 2009). Specifically, we observed and took data concerning financial outcomes for 2008 and 2009 and survival information for 2014 (five years after the survey was conducted). Because the SABI database (published by Bureau van Dijk) contains information on firms' annual accounts reported to the authorities, a delay exists between the time when companies provide their data, and such data is available to researchers. Specifically, the most up-to-date data on firms available in 2016 refers to 2014.

## Measures

**Dependent variables: NTBF performance** We measured indicators of short-term performance (i.e., market and financial performance) and long-term performance (survival). We detail these measures below.

*Market performance.* It was measured through two indicators, *foreign market performance* and *total market performance*. Both were based on information collected from the participants through the questionnaire. We used a seven-point Likert scale, where 7 means total satisfaction with the market performance achieved by the NTBF. *Foreign market performance* was measured through 4 items adapted from Shrader and Siegel (2007). The items were “Please indicate the extent to which you are satisfied with the following indicators regarding the growth of your firm in comparison with your previous expectations: (1) investment in assets in foreign countries; (2) sales growth in foreign markets (international scale); (3) increase in number of foreign markets (international scope); and (4) commercial expansion toward new foreign markets”. This set of variables was reduced to one hypothetical variable using factor analysis (KMO = 0.685;  $\chi^2 = 322.552^{***}$ ; variance explained of the total variance = 66.71%). Cronbach’s alpha coefficient indicates that the scale used has internal consistency (0.834). Similarly, *total market performance* was measured through 3 items adapted from Spanos and Lioukas (2001). The items were “Please indicate the extent to which you are satisfied with the following indicators regarding the growth of your firm in comparison with your previous expectations: (1) the increase in total market share since start-up; (2) the favourable expectations of the future growth of my firm; and (3) the overall success of the venture to date”. This set of variables was reduced to one hypothetical variable using factor analysis (KMO = 0.653;  $\chi^2 = 134.314^{***}$ ; variance explained of the total variance = 68.04%). Cronbach’s alpha coefficient indicates that the scale used has internal consistency (0.759).

*Financial performance.* We use a dummy indicator as a proxy of *superior financial outcomes*. First, we followed García-Cabrera et al. (2019) and considered the NTBF’s profits (earnings before taxes) as financial indicator of outcome. We obtained information from the SABI database, so this financial information was quantitative and not provided by the surveyed entrepreneurs. Next, based on Wiggins and Ruefli (2002), we calculated the average value for profits of all the NTBFs in the sample and compared each NTBF’s profits with the average value. Finally, and following such authors, the dummy variable took the value of 1 if the NTBF’s profits were higher than the sample average, so indicating *superior financial outcomes* (otherwise, 0). We calculated this variable for times 2008 (the beginning of the period under study) and 2009. While in 2008 we found 28 NTBFs that achieved superior performance (25.2% out of 111 sampling TBFs with available data), in 2009 we found 23 ventures (22.5% out of 102 sampling TBFs with data).

*Long-term survival.* We followed previous authors and used a dummy indicator that takes value 1 if the NTBF is active during the observation period and 0 otherwise (e.g., Löfsten 2016a, b; Siepel et al. 2017; Yang et al. 2017). We built this dummy from the SABI database. We assumed the NTBF had exited the market if it had discontinued reporting its annual accounts to the authorities for two or more years (Geroski et al. 2010; Yang et al. 2017). To prevent false identification of exits, we built the dummy indicator in 2016 and observed the period of 2009 to 2014. Although we had a sample

of 175 NTBFs, only 150 were rightly identified, so we stemmed from this last figure to check the long-term survival. We found 110 ‘survival NTBFs’ (73.3% of 150 identified NTBFs).

**Independent variables** *The founding team’s human capital.* We use a number of forms of general and specific human capital. Except for the team size, we asked participants to specify the training and experience of the founding team using a five-point scale, where 1 means that the fraction equals 0 (e.g., none have a Degree), 2 means that the fraction is less than or equal to 25%, 3 means that the fraction is less than or equal to 50%, 4 means that the fraction is less than or equal to 75%, and 5 means that the fraction is 100% (e.g., all the founders have a Degree). We used the responses in the ranked order and included the variables in our model, treating them as interval variables (numeric). Regarding general human capital, we used three indicators: the size of the founding team (Colombo and Grilli 2005; Siepel et al. 2017), the fraction of founders that have a degree in business administration or economics (Colombo and Grilli 2005; Nuscheler et al. 2019), and the fraction of founders that have previous work experience in management in a large firm (Colombo and Grilli 2005). For founders’ specific human capital, we used two indicators: the fraction of founders that have a Master’s in science or technology (Colombo and Grilli 2005; Nuscheler et al. 2019) and the fraction of founders that have previous commercial work experience in the same sector as the NTBF belongs to (Nuscheler et al. 2019).

*External sources of knowledge.* We followed Souitaris (2001) to include two categories of sources. The first category includes 4 items similar to the ones used by Brunswicker and Vanhaverbeke (2015): 1) I try to maintain dialogue with clients about existing market needs, 2) I stay in direct contact with suppliers, 3) I hold regular meetings with partners/employees to seek new business ideas, and 4) I monitor the opinions of experts in the sector and/or consult them directly. The second category includes 3 items similar to the ones used by Caloghirou et al. (2004): 1) I read a lot of newspapers, 2) I read a lot of magazines, trade publications, industry reports, etc., and 3) I read a lot of digital publications, blogs, etc. For each external source, founders were asked to indicate the frequency with which they used it to get ideas using a seven-point Likert scale. The scale was reduced to two hypothetical variables using factor analysis. After applying the varimax rotation method, the variance explained by Factor 1 and Factor 2 is 31.11% and 30.83% of the total variance, respectively ( $KMO = 0.736$ ;  $\chi^2 = 318.563^{***}$ ). Cronbach’s alpha coefficient indicates that the scale used has internal consistency (0.756). The first factor loads high on variables dealing with regular interactions with different potential partners in innovation (it is called *tacit external sources of knowledge*, 4 items,  $\alpha = 0.731$ ), while the second factor loads high on variables dealing with scanning external information (it is called *explicit external sources of knowledge*, 3 items,  $\alpha = 0.749$ ).

**Mediator variable** We measured *innovation* with three items indicating whether the NTBF emphasises R&D and continuous technological development (Caloghirou et al. 2004), uses innovation as a weapon to reach a differentiation positioning in the market (Shrader and Siegel 2007), and the relationship between the actual and expected number of patents granted since the firm’s founding, because patents have been used as a proxy of both firms’ innovation (Löfsten 2016a). Each item was measured on a

seven-point scale, where 1 means totally disagree and 7 means totally agree, and they were reduced to one hypothetical variable using factor analysis (KMO = 0.577; Bartlett's Test of Sphericity = 95.787\*\*\*), providing one factor that explained 60.05% of the variance and a Cronbach's alpha of 0.633.

**Control variables** Following previous literature (e.g., Colombelli et al. 2016; Yang et al. 2017; García-Martínez et al. 2019), we controlled for three variables: *firm size* (the log of the number of employees, founders included); *firm age* (number of years since founding); and *knowledge intensive business* –the founders' assessments of the following statement: "My firm fits the category of technology-based firm", for which there are three possible answers: 1) To some extent, 2) To a great extent, and 3) Unquestionably.

## Descriptive statistics

Table 1 presents the descriptive statistics for all the variables that we use in the empirical analysis. We provide statistics for the full sample (175 participant NTBFs in the survey of 2009) and for the survival sample (110 TBFs still alive in 2014 according to data available in the SABI database in 2016). The difference between full sample and survival sample corresponds to firms that have discontinued reporting their annual accounts to the authorities for two or more years. So, according to Geroski et al. (2010) and Yang et al. (2017), we can consider such firms as having not survived as independent firms (i.e., they have exited the market because of venture failure via mergers and acquisitions or for other reasons). In addition, as Table 1 shows the mean and standard deviation values concerning data from 2008 and 2009, both for the group of total NTBFs in the sample and for the group of those that survived in 2014, such statistics provide information referring to a time at or near the venture's inception.

Concerning the NTBFs size at founding, they have on average 19.33 employees, higher than the group of TBFs that reaches survival (14.15). Sampling NTBFs are on average 7.04 years old and are businesses quite intensive in terms of knowledge (2.46), the survival group being slightly older (7.19) and slightly more knowledge intensive (2.48).

With regard to the founding team's human capital, while the NTBFs in the full sample are somewhat larger regarding the size of the founding team (2.71 vs 2.54) and higher in the fraction of founders that have a Master's in science or technology (1.96 vs. 1.93) than the TBFs that survived, the latter group is higher in the fraction of founders that have a degree in business administration (2.29 vs 2.33), experience in management (1.54 vs 1.60) and experience in the same sector (2.77 vs 2.91).

Referring to each external source of knowledge, we appreciated that, on average, these sources show higher frequency of use for NTBFs in the sample than for survival TBFs, with the exception of suppliers (5.19 in the full sample vs 5.25 in the survival sample). Differences are especially relevant for partners/employees, experts and magazines, trade publications, and industry reports.

In addition, and with respect to innovation – albeit efforts to innovate seem to be slightly higher in the full sample than in the survival sample (emphasis on R&D scores, 5.23 vs. 5.20, and the use of innovation as a way to reach differentiation scores 5.67 vs.

**Table 1** Descriptive statistics for the NTBFs: full and survival samples

Variables in the study	Full Sample N = 175		Survival sample N = 110		Scale
	Mean	SD	Mean	SD	
<i>Dependent variables</i>					
<i>Short-term performance</i>					
Foreign market performance	0.00	0.99	-0.25	1.00	Hypothetical variable*
Investment in assets in foreign countries	2.47	1.77	2.31	1.67	7-point Likert
Sales growth in foreign markets	3.08	1.96	3.10	1.98	7-point Likert
Increase in number of foreign markets	2.61	1.91	2.66	1.95	7-point Likert
Commercial expansion toward new foreign markets	3.57	2.23	3.49	2.22	7-point Likert
Total market performance	0.00	0.97	0.08	0.93	Hypothetical variable*
The increase in total market share since start-up	4.43	1.62	4.56	1.66	7-point Likert
The favourable expectations of the future growth of my firm	5.32	1.38	5.38	1.30	7-point Likert
The overall success of the venture to date	5.23	1.38	5.35	1.28	7-point Likert
Superior financial outcome 2008	0.25	0.44	0.29	0.45	Dummy 0/1
Superior financial outcome 2009	0.23	0.42	0.24	0.43	Dummy 0/1
<i>Long-term survival</i>					
TBF survival 2014	0.73	0.44	-	-	Dummy 0/1
<i>Independent variables</i>					
<i>Founding team human capital</i>					
Size of the founding team	2.72	1.61	2.54	1.23	Ordinal
Degree in business administration	2.29	1.48	2.33	1.44	5-point scale
Experience in management	1.54	1.09	1.60	1.18	5-point scale
Master's in science or technology	1.96	1.38	1.93	1.31	5-point scale
Experience in the same sector	2.77	1.52	2.91	1.57	5-point scale
<i>External sources of knowledge</i>					
Tacit external sources	0.00	1.00	0.01	1.07	Hypothetical variable*
I try to maintain dialogue with clients about existing market needs	5.56	1.32	5.55	1.41	7-point Likert
I keep in direct contact with suppliers	5.19	1.55	5.25	1.60	7-point Likert
I hold regular meetings with partners/employees to seek new business ideas	4.85	1.56	4.38	1.68	7-point Likert
I monitor the opinions of experts in the sector and/or consult them directly	4.50	1.63	4.36	1.62	7-point Likert
Explicit external sources	0.00	1.00	-0.13	1.01	Hypothetical variable*
I read a lot of newspapers	4.14	1.59	4.01	1.52	7-point Likert
I read a lot of magazines, trade publications, industry reports, etc.	4.37	1.54	4.17	1.60	7-point Likert
I read a lot of digital publications, blogs, etc.	4.47	1.60	4.34	1.66	7-point Likert

**Table 1** (continued)

Variables in the study	Full Sample N = 175		Survival sample N = 110		Scale
	Mean	SD	Mean	SD	
<i>Mediating variable</i>					
Innovation	0.00	0.99	-0.01	0.98	Hypothetical variable*
Emphasises R&D and continuous technological development	5.23	1.81	5.20	1.87	7-point Likert
Uses innovation as a weapon to reach a differentiation positioning in the market	5.67	1.41	5.66	1.40	7-point Likert
Relationship between actual and expected number of patents granted since the firm's founding	3.21	1.92	3.24	1.93	7-point Likert
<i>Control variables</i>					
Firm's size (in terms of employees)	19.33	89.91	14.15	34.42	Number
Firm's age (in years)	7.04	4.68	7.19	5.17	Number
Knowledge intensive business	2.46	0.70	2.48	0.70	3-point scale

\*Hypothetical variables from factor analysis

5.66) – innovation performance in terms of patents is higher in the survival sample (3.24) than in the full sample (3.21).

Finally, we will refer to the short-term performance of NTBFs. Here, except for the investment in assets in foreign countries and commercial expansion toward new foreign markets, for all the performance indicators, survival NTBFs reach higher scores. It catches our attention that sales growth in foreign markets and the increase in the number of foreign markets entered are higher for the survival TBFs, but not investments abroad or the commercial expansion into new countries, denoting that although internationalisation can be positive for NTBs, the strategy chosen for entering other countries can be a challenge (e.g., becoming involved in foreign direct investments).

## Data analysis

The data analysis was conducted in three steps. We first ran correlations (Table 2), which we then checked between independent variables to determine the possibility of multicollinearity. The highest correlation is between the control variable *Knowledge intensive business* and the mediating variable *Innovation* ( $r = 0.321^{***}$ ). Thus, multicollinearity should not be a problem because the general rule of thumb indicates that correlations between independent variables should not exceed 0.75 (Tsui et al. 1995). Second, as we have dependent variables that are both scales (i.e., foreign market performance and total market performance) and binary (superior financial outcomes and long-term survival), we tested the hypotheses using lineal regression estimations and logistic estimations, respectively. In order to control for potential regression coefficient instability, we also conducted collinearity diagnostics in the linear regressions through the condition number and the VIF (variance inflation factor).

**Table 2** Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Innovation	1											
2. Foreign market performance	0.390***	1										
3. Total market performance	0.219***	0.316***	1									
4. Firm's size	0.074	0.176**	0.366***	1								
5. Firm's age	-0.018	-0.020	0.068	0.266***	1							
6. Knowledge intensive business	0.321***	0.108	0.139*	0.090	-0.224***	1						
7. Size of the founding team	-0.006	0.224***	0.087	0.164**	-0.073	0.136*	1					
8. Degree in business administration	0.186**	0.137*	0.109	0.199**	0.070	0.196**	0.098	1				
9. Experience in management	0.143*	0.158**	-0.085	0.259***	0.000	0.060	0.010	0.320***	1			
10. Master in science or technology	0.125	0.065	0.060	0.143*	0.019	-0.075	0.198**	0.094	0.057	1		
11. Experience in the same sector	0.083	0.019	-0.045	-0.056	-0.012	0.041	-0.116	0.175**	0.145*	-0.085	1	
12. Tacit external sources of knowledge	0.280***	0.104	0.191**	0.067	0.020	0.180**	-0.021	0.085	-0.037	-0.006	0.086	1
13. Explicit external sources of knowledge	0.131*	0.179**	0.158**	0.118	0.105	0.082	0.120	0.308***	0.020	0.053	0.127	0.000

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

**Note:** superior financial outcome and TBF survival are not included as they are dummies

## Results

Table 3 shows the results of the estimated hierarchical linear regressions for the mediating variable *Innovation* (Model 1) and for two market performance indicators: *Foreign market performance* (Model 2) and *Total market performance* (Model 3). Table 4 shows the results of logistic estimations for other three performance indicators: *Superior financial outcome* in 2008 and 2009 (Models 4 and 5, respectively) and *Long-term survival* (Model 6).

Model 1 (step 3) shows the results that test hypotheses H1. Whereas no indicator of *Generic human capital* at venture's inception influences *Innovation*, results show that the *Specific human capital* (i.e., the proportion of the founding team members with a Master's in science or technology) has a positive and significant impact on *Innovation*. So, H1a finds partial support. Concerning the use of *External sources of knowledge*, results show that *Tacit external sources of knowledge* have a positive and significant impact on *Innovation*, but not the *Explicit external sources*. Hence, H1b also finds partial support.

Models 2 to 6 (Step 3) allow us to test H2. Results show that different indicators of *Generic human capital* at firms' inception have opposite effects on indicators to short-term *Market performance*. Specifically, whereas the *Size of the founding team* positively conditions *Foreign market performance*, the founding team's *Experience in management* decreases *Total market performance*. Therefore, H2a only receives partial support. With respect to financial performance, results show that the founding teams' *Experience in management* increases *Superior financial outcomes* at 2009, so H2b also finds partial support. Finally, whereas the *Size of the founding team* has a negative and significant influence on *Long-term survival*, *Specific human capital* (i.e., the proportion of the founding team members with *Experience in the same sector* at commercialising) has a positive and significant impact on *Long-term survival*. So H2c is partially supported.

Concerning the *External sources of knowledge*, Models 2 to 6 (Step 3) show the results that test H3. The use of these sources increases *Market performance*. Specifically, *Explicit external sources of knowledge* increase *Foreign market performance* and *Tacit external sources* increase *Total market performance*. Accordingly, H3a finds support. However, the use of any *External sources of knowledge* influences *Superior financial outcomes*, hence H3b is not supported. And finally, the use of *Explicit external sources of knowledge* negatively affects *Long-term survival*, so H3c does not find support.

Step 4 in Models 2 to 6 shows the results that test hypotheses H4. According to estimated standardised beta, *Innovation* has a positive and significant influence on *Market performance* when considering both *Foreign market performance* (Model 2) and *Total market performance* (Model 3), so H4a finds support. *Innovation* also positively conditions NTBFs' *Superior financial performance* in 2008 (Model 4), but not in 2009 (Model 5), so H4b is partially supported. Finally, estimations do not find any effect of *Innovation* on *Long-term survival* (Model 6), so H4c does not find support.

Finally, H5 proposes a mediating effect of *Innovation*. Specifically, concerning H5a, results do not find that *Innovation* mediates in the relationship between the NTBFs' *Founding teams' human capital* and any indicator of venture performance considered.

**Table 3** Lineal regression estimation of Innovation and NTBF market performance

Variables	Innovation 2008	Market performance	
	Model 1	Foreign market 2008	Total market 2008
	Standardized $\beta$	Model 2	Model 3
		Standardized $\beta$	Standardized $\beta$
<i>Step 1: Controls</i>			
Firm's size	0.032	<b>0.180**</b>	<b>0.357***</b>
Firm's age	0.047	-0.049	-0.004
Knowledge intensive business	<b>0.326***</b>	0.080	0.106
$R^2$	10.5%	4.1%	14.5%
$F$	6.721***	2.435*	9.698***
<i>Step 2: Controls + founding team's human capital</i>			
Firm's size	-0.010	0.109	<b>0.400***</b>
Firm's age	0.046	-0.027	-0.023
Knowledge intensive business	<b>0.330***</b>	0.049	0.097
Size of the founding team	-0.078	<b>0.191**</b>	-0.004
Degree in business administration	0.078	0.052	0.085
Experience in management	0.085	0.105	<b>-0.217***</b>
Master in science or technology	<b>0.156**</b>	0.008	0.017
Experience in the same sector	0.048	0.020	-0.010
$\Delta R^2$	4.8%	5.1%	4.1%
$\Delta F$	1.896*	1.858	1.690
<i>Step 3: Controls + founding team's human capital + external sources of knowledge</i>			
Firm's size	-0.030	0.096	<b>0.385***</b>
Firm's age	0.030	-0.043	-0.038
Knowledge intensive business	<b>0.286***</b>	0.027	0.067
Size of the founding team	-0.075	<b>0.182**</b>	-0.007
Degree in business administration	0.040	0.005	0.047
Experience in management	0.116	0.129	<b>-0.193**</b>
Master's in science or technology	<b>0.151**</b>	0.004	0.013
Experience in the same sector	0.019	-0.003	-0.033
Tacit external sources of knowledge	<b>0.230***</b>	0.102	<b>0.146**</b>
Explicit external sources of knowledge	0.093	<b>0.145*</b>	0.106
$\Delta R^2$	5.6%	2.7%	2.9%
$\Delta F$	5.757***	2.499*	2.993*
<i>Step 4: Controls + founding team's human capital + external sources of knowledge + Innovation (mediator)</i>			
Firm's size		0.107	<b>0.390***</b>
Firm's age		-0.054	-0.043
Knowledge intensive business		-0.084	0.019
Size of the founding team		<b>0.212***</b>	0.006
Degree in business administration		-0.010	0.040
Experience in management		0.084	<b>-0.212***</b>
Master's in science or technology		-0.055	-0.013

**Table 3** (continued)

Variables	Innovation 2008 Model 1	Market performance	
		Foreign market 2008 Model 2	Total market 2008 Model 3
	Standardized $\beta$	Standardized $\beta$	Standardized $\beta$
Experience in the same sector		-0.011	-0.036
Tacit external sources of knowledge		0.013	0.107
Explicit external sources of knowledge		0.109	0.090
Innovation		<b>0.389***</b>	<b>0.169**</b>
$\Delta R^2$		11.9%	2.3%
$\Delta F$		25.545***	4.826**
Final adjusted $R^2$	16.1%	18.7%	18.7%
Durbin-Watson	2.031	1.992	1.959
$F$	4.341***	4.630***	4.628***
Condition number	17.628	18.427	18.427
VIF (min/max)	1.075–1.254	1.058–1.316	1.058–1.318
Number	175	175	175

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Specifically, human capital variables that affect innovation do not condition any indicator of venture performance, so the mediating effect is not verified and H5a does not find support. With respect to the firms' use of *External sources of knowledge*, we only found that *Innovation* fully mediates in the effect of *Tacit external sources of knowledge* on *Total market performance*. So, H5b is marginally supported.

## Discussion

By considering different dimensions of short- and long- term performance, we reach a wide range understanding of the effect of knowledge resources at or near a venture's inception and innovation on the performance of NTBFs. First, and concerning the relevance of the founding team's human capital, we find that *Generic human capital* at (or near) a venture's inception does not influence *Innovation*, but conditions market performance. In particular, larger founding teams will help NTBFs reach increased international scope for their activities in the short term. It seems that early internationalisation benefit from the strength of a larger group of founders. The larger the group, the more numerous the contacts, and the greater the number of economic and knowledge resources for entering foreign markets. However, according to results, larger founding teams will erode long-term survival as an independent firm. Although the NTBF may initially benefit from those resources individually provided by a larger group of founders, in the long term, and as suggested by previous literature (e.g., Wang and Chen 2016), larger entrepreneurial teams tend to be less cohesive, which increases the probability of controversies and conflicts of interest that may harm the venture and can precipitate their exit from the market. Thus, these results seem to suggest that some

**Table 4** Logistic estimation of NTBF performance (superior financial outcome and long-term survival)

Variables	Superior financial outcome				Long-term survival	
	2008 Model 4		2009 Model 5		2014 Model 6	
	$\beta$	Wald	$\beta$	Wald	$\beta$	Wald
<i>Step 1: Controls</i>						
Constant	<b>-5.196***</b>	12.658	<b>-3.080***</b>	6.646	0.439	0.272
Firm's size	<b>2.854***</b>	18.063	<b>2.116***</b>	12.189	<b>0.849**</b>	4.034
Firm's age	<b>0.010**</b>	5.190	0.004	1.074	0.002	0.262
Knowledge intensive business	0.271	0.405	-0.143	0.130	-0.069	0.059
<i>Step 2: Controls + founding team's human capital</i>						
Constant	<b>-5.012***</b>	7.342	<b>-3.621**</b>	5.228	0.827	0.660
Firm's size	<b>3.350***</b>	16.542	<b>2.430***</b>	9.840	<b>1.227**</b>	6.488
Firm's age	<b>0.010**</b>	5.082	0.006	1.935	0.001	0.065
Knowledge intensive business	0.106	0.052	-0.336	0.561	-0.097	0.099
Size of the founding team	-0.136	0.339	0.151	0.407	<b>-0.262**</b>	3.863
Degree in business administration	-0.174	0.725	-0.028	0.019	-0.032	0.046
Experience in management	0.275	1.103	<b>0.530**</b>	4.441	0.183	0.642
Master's in science or technology	-0.267	1.338	-0.374	2.167	-0.214	2.196
Experience in the same sector	0.198	1.087	0.050	0.066	0.184	1.784
<i>Step 3: Controls + founding team's human capital + external sources of knowledge</i>						
Constant	<b>-4.415**</b>	5.353	<b>-2.910*</b>	3.196	0.278	0.072
Firm's size	<b>3.271***</b>	15.889	<b>2.357***</b>	9.081	<b>1.269***</b>	6.992
Firm's age	<b>0.010**</b>	4.028	0.004	1.014	0.002	0.265
Knowledge intensive business	-0.016	0.001	-0.513	1.187	-0.038	0.014
Size of the founding team	-0.123	0.269	0.189	0.590	<b>-0.250*</b>	3.242
Degree in business administration	-0.220	1.029	-0.077	0.130	0.071	0.211
Experience in management	0.315	1.330	<b>0.602**</b>	5.137	0.112	0.226
Master's in science or technology	-0.275	1.396	-0.369	2.115	-0.201	1.857
Experience in the same sector	0.159	0.641	-0.019	0.009	<b>0.236*</b>	2.714
Tacit external sources of knowledge	0.251	0.610	0.296	0.854	-0.144	0.486
Explicit external sources of knowledge	0.228	0.519	0.300	0.874	<b>-0.554**</b>	6.185
<i>Step 4: Controls + founding team's human capital + external sources of knowledge + Innovation (mediator)</i>						
Constant	<b>-4.793**</b>	5.186	<b>-2.860*</b>	2.984	0.114	0.011
Firm's size	<b>3.442***</b>	16.697	<b>2.363***</b>	9.185	<b>1.277*</b>	6.957
Firm's age	<b>0.011**</b>	4.232	0.004	0.955	0.002	0.274
Knowledge intensive business	-0.029	0.003	-0.528	1.221	0.007	0.000
Size of the founding team	-0.111	0.201	0.196	0.630	<b>-0.257*</b>	3.323
Degree in business administration	-0.244	1.149	-0.079	0.134	0.079	0.256
Experience in management	0.243	0.810	<b>0.583**</b>	4.667	0.124	0.274
Master's in science or technology	-0.250	1.153	-0.371	2.135	-0.190	1.610
Experience in the same sector	0.211	1.030	-0.016	0.006	<b>0.239*</b>	2.761
Tacit external sources of knowledge	0.066	0.040	0.270	0.669	-0.123	0.339

Table 4 (continued)

Variables	Superior financial outcome				Long-term survival	
	2008 Model 4		2009 Model 5		2014 Model 6	
	$\beta$	Wald	$\beta$	Wald	$\beta$	Wald
Explicit external sources of knowledge	0.137	0.181	0.285	0.775	-0.539**	5.765
Innovation	<b>0.605*</b>	3.062	0.096	0.105	-0.105	0.196
<i>Nagelkerke Pseudo R<sup>2</sup></i>	49.5%		36.3%		22.0%	
<i>Model Chi-square</i>	45.292***		27.778***		24.503**	
<i>Hosmer y Lemeshow Chi-square</i>	10.912		6.052		11.902	
<i>Sensitivity</i>	53.6%		34.8%		75.3%	
<i>Percentage correct predictions</i>	84.7%		94.9%		92.7%	
<i>Number</i>	111		102		150	

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

knowledge resources can be initially positive for the NTBF's performance, but turn out to be negative from a long-term perspective.

Concerning *Generic human capital*, we found that *Experience in management in large firms* seems to harm total market performance but benefit superior financial outcomes. Since we measured market performance indicators through the founders' satisfaction with outcomes in comparison with their previous expectations, we consider that a founding team with greater experience managing larger firms may feel unsatisfied with the sales or the market share of a NTBF. However, this kind of experience objectively benefits NTBFs, as new ventures with experienced founders in managing larger firms will reach superior profits compared to those NTBFs with founders less equipped with such experience.

We also studied indicators of the founding team's *Specific human capital* and we discovered that having a technology-based education (i.e., the proportion of the founding team's members with a Master's in science or technology) has a positive and significant impact on *Innovation* but does not affect any indicator of performance. In addition, *Experience in the same sector at commercialising* positively conditions *Long-term survival*. These results suggest that while individuals with high levels of technological knowledge are able to evaluate and assimilate the information to which they are exposed more efficiently, so they can contribute more to the development of new knowledge and, consequently, to the introduction of innovations, at the beginning of the business activity, other knowledge is necessary to sustain the long-term business project as an independent firm. Specifically, previous experience in marketing products in the same sector is what helps the founders to recognise, evaluate and assimilate information from the environment that is critical for adopting those decisions that facilitate the long-term survival of the NTBF as an independent firm.

Concerning the use of knowledge resources from external sources, results identified two different categories: tacit and explicit. From Nonaka and Takeuchi (1995), we distinguish between explicit and tacit knowledge, which is strategically very important since the former can be shared and is easy to imitate, unless it is legally protected.

However, the tacit knowledge is difficult to codify and so competitors deal with difficulties in imitating or replicating it. In line with previous literature, our results show the strategic importance of tacit knowledge sourced beyond NTBFs' boundaries. Specifically, results show that innovation is high if the founding team uses external relationships to access to tacit knowledge. Greater access to tacit knowledge increases the probability of identifying technological changes and responding appropriately to them, which would give companies more capacity to adapt to the environment. Accordingly, if we look at the performance of NTBFs, our work finds that the use of tacit knowledge from external sources increases total market performance. However, it is the use of explicit knowledge sourced beyond NTBFs' boundaries that increases foreign market performance. Due to new ventures' lack of knowledge and contacts with firms in foreign markets, they may turn to official and industry reports about internationalisation to learn the steps that need to be taken in order to commercialise their products abroad. Since there are a lot of programmes and information available to encourage firms to go abroad, those NTBFs that acquire these knowledge resources from such explicit sources enhance their foreign market performance in the short term. However, our results also show that the use of explicit knowledge resources negatively affects long-term survival, which can happen for different reasons. For example, explicit knowledge is available to all firms and an undifferentiated resource is unlikely to become a source of sustainable competitive advantage. In addition, it is not firm-specific, nor built on the base of the NTBF's circumstances, and not all firms are able to understand such explicit knowledge and to rightly apply it to their decisions (e.g., the NTBF may fail in choosing the proper foreign market for their products). Again our results suggest that some knowledge resources that can be positive for the NTBF's performance when considering a short-term approach may turn out negative under a long-term perspective.

Finally, and concerning the role of innovation as a mediator through which knowledge resources condition venture performance, we found this effect only for the influence of *Tacit external sources of knowledge* on *Total market performance*, which is fully mediated by *Innovation*. We consider the main reason this mediating relationship is not generally found for the rest of the resources and dimensions of performance have to do with the fact that for NTBFs, it is quite difficult to empirically test the effect of innovation on the firm's performance (Löfsten 2016b). Indeed, we find this effect only for short-term market and financial performance. Our unexpected results, may find justification in the temporal context in which the study was conducted (2009 and 2014). The cut in resources dedicated to R&D that occurred in Spain after the onset of the crisis in 2008 may have affected access to tacit and explicit updated knowledge.

## Conclusions

The current work shows that NTBFs' knowledge resources available at or near inception are of relevance for firms' innovations and for different dimensions of their short- and long-term performance. Certainly when considering the impact of such resources on performance, it seems hard to predict. After analysing our results, we propose that previous authors, although offering mixed findings, are all right. The key issue is that those resources that can be good at one stage of

a NTBF's life cycle can be bad at others times. NTBFs' resources must evolve and successfully adapt to the different steps and challenges they face while consolidating the venture project. For example, instead of considering that the number of members of the founding team should not be too low or too high to have a positive impact on the venture's performance, our results suggest that having more members in the early years of the NTBF may be positive for its results (they provide knowledge resources, contacts to external sources of knowledge), but that in the long term, fewer people is better for good interaction and sharing of knowledge and ideas in order to make better decisions.

### **Practical implications**

Our findings have relevant implications for NTBFs that seek to improve innovative performance and market and financial performance and, to some extent, survival. First, the study suggests that NTBFs can achieve better results if they invest in developing the human capital of the founding team, especially in regard to training in science and technology (specific human capital), and in the search for external sources of knowledge, specifically sources of tacit knowledge. In addition, entrepreneurs should be aware that, over the years, some decisions taken to make the implementation of the NTBF possible should be reconsidered for the unfavourable effects they may have further down the road, in particular, the use of explicit sources of knowledge and larger founding teams benefit the early internationalisation of these companies but, in the long term, may harm their survival.

Second, the literature indicates that innovative activity encourages economic growth in the territories in which firms operate by increasing employment, consumption and exports (Hausman and Johnston 2014; Madrid-Guijarro et al. 2013). Therefore, the introduction of innovations is a fundamental activity not only for the ventures' performance in terms of the success in the local and foreign markets and the superior financial outcome, as our results show, but also to stimulate the development of a territory. In this sense, both researchers and those responsible for formulating public policies should encourage and incentivise NTBFs' commitment to the development of human capital and external sources of knowledge as an element to promote innovative performance and, consequently, economic growth, job creation and the level of well-being of a territory.

### **Limitations and future research**

Our work has some limitations that, in case of considered by future research, may provide new interesting findings. First, although we have information on the performance of NTBFs based on both the founders' perceptions and secondary databases, and for the years 2008, 2009 and 2014, our data does not have information for the years between these limits nor from the two sources of information (SABI database and the founding entrepreneurs) for each of these three years. Future research should benefit from collecting data panel and use new methodologies to find out and better understand how the influence on performance of resources available at or near the NTBF's inception evolves to eventually condition superior financial performance and ventures'

survival (e.g., panel data analysis, gravity models). Second, our data does not distinguish between the causes as to why NTBFs do not survive as independent firms (e.g., exits because of venture failure, exits via mergers and acquisitions), although such causes might possibly have different determinants. Thus, a fruitful line of research may be to investigate the knowledge resources available at or near the NTBF's inception that specifically cause NTBFs to fail, to sign a merger, or even to be taken over by raiders. In addition, it is of special interest to differentiate between friendly and hostile takeovers in order to study such determinant factors related to knowledge resources.

Finally, from this work also arises additional research lines. Specifically, the literature states that the establishing of relationships with external sources has three dimensions, which are, specifically: the size of the contacts, their diversity, and the strength of the links. Studying these dimensions could provide a more comprehensive understanding of how external relationships improve the outcomes of NTBFs. In addition, qualitative studies can provide data that would considerably improve our understanding of the way innovation processes are produced in NTBFs based on the use of external knowledge sources. Another relevant point is that knowledge resources can behave as complementary or substitute assets. Therefore, future studies could incorporate these systemic effects. Finally, future research could incorporate other knowledge resources not included here, such as organisational knowledge or internal collaboration activities, which could provide greater explanatory power in relation to the performance of NTBFs.

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## Affiliations

Antonia Mercedes García-Cabrera<sup>1</sup> · María Gracia García-Soto<sup>1</sup> · Julia Nieves<sup>1</sup>

María Gracia García-Soto  
gracia.garcia@ulpgc.es

Julia Nieves  
julia.nieves@ulpgc.es

<sup>1</sup> Faculty of Economics, Business and Tourism, Universidad de Las Palmas de Gran Canaria, 35017- Las Palmas de Gran Canaria, Canarias, Spain