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Open innovation in nascent ventures: Does openness influence the speed of reaching critical milestones?

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ABSTRACT

Research on open innovation (OI) has demonstrated the benefits of openness for firm innovation processes, but studies have mostly offered cross-sectional insights on incumbent firms. This study offers a more dynamic perspective on the relevance of OI for nascent ventures. Combining entrepreneurship and OI theories, we argue that it is key for resource-scarce nascent ventures to achieve critical venture-creation milestones. While OI can help these ventures to leverage salient external partnerships, we argue that it affects their speed of reaching these milestones. We test our hypotheses on a longitudinal sample focusing on external collaboration practices of nascent ventures in the renewable energy or information and communications technology industries. Our results show that, while engaging in R&D collaborations slows down nascent ventures' product development and sustainable profit generation activities, joining industry associations does not have a slow-down effect. Our results complement the OI literature by warning about the downsides of openness for nascent ventures, particularly during the venture creation phase, where speed is a high priority.

1. Introduction

Forming relationships with external partners, through supply chain or R&D collaborations, has been shown to be beneficial for new product development and firm profits (Rothaermel and Deeds, 2004; Shi and Prescott, 2011; Singh et al., 2018; Stettner and Lavie, 2014). In recent years, the idea of open innovation (OI) has complemented these insights by calling for more open approaches to innovation in general (Chesbrough, 2003; Chesbrough and Bogers, 2014). Resources are known to play a critical role for firms (Barney, 1991; Galbreath, 2005) and firm openness toward external inputs is one way to acquire them. Accordingly, OI scholars argue that, if firms want to expand their resource base in order to be innovative, they can do so by engaging with actors located outside their organizational boundaries and combining their inputs with internal resources (Laursen and Salter, 2006).

The majority of the literature on the effect of OI on firm performance focuses on incumbents or already established firms. This calls for more research on nascent ventures as it is unclear whether these ventures benefit from OI in the same way as established firms. In fact, nascent ventures differ considerably from established firms, especially in the amount of resources they possess (Baker and Nelson, 2005; Das and He, 2006; Mosakowski, 2002) and, accordingly, in their sheer ability to form linkages to external collaboration partners (Gimenez-Fernandez and Beukel, 2017; Herrmann et al., 2020). In the context of new venture creation, resources play a recurring role because of their importance in the venture development process (Vogel, 2017). Due to nascent ventures' lack of resources, they are more prone to failure than established firms. This so-called 'liability of newness' (Freeman et al., 1983) could also affect how and to what extent nascent ventures can benefit from OI (Usman and Vanhaverbeke, 2017). Importantly, OI is not only associated with positive effects but can also lead to costs for the initiating firm (Bogers et al., 2017; Greco et al., 2019). As we will argue, these costs may affect nascent ventures more negatively than incumbent firms.

So far, research on the role of OI for nascent ventures mostly adopts a static perspective and observes one timepoint during the venture creation phase (e.g., Huggins and Thompson, 2017; Stam and Elfring, 2008). The few qualitative studies adopting a dynamic perspective show that nascent ventures strategically engage in collaborations with external

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partners when they realize that they are missing resources which can be acquired externally (Di Pietro et al., 2018; Eftekhari and Bogers, 2015). Quantitative work in this area is rather limited and mostly based on cross-sectional data – sometimes with a lagged dependent variable – studying a snapshot of the venture creation process. This work demonstrates that OI is associated with several benefits for nascent ventures, such as introducing incremental or radical innovations (Antolín-López et al., 2015; Huggins and Thompson, 2017; Rothaermel, 2001), venture survival and success (Marullo et al., 2018), higher quality of innovation output (Michelino et al., 2017), and a higher percentage of turnover from new or improved products/services (Neyens et al., 2010).

However, such studies only deliver an incomplete picture of the role of OI for nascent ventures. Since many nascent ventures are destined to failure (Brüderl and Schüssler, 1990), a swift completion of product development as well as generating sustainable profits is crucial for successful venture creation. Because most existing studies with a static perspective contribute little to the understanding of process related outcomes, it is necessary to study nascent ventures' external collaborations from a dynamic perspective. Such a perspective allows us to uncover the effects of OI in a context where speed is of critical importance. The entrepreneurship literature teaches us that it is vital and, hence, a key objective for nascent ventures to quickly reach critical milestones to ensure viable venture performance (Kessler and Chakrabarti, 1996; Shan et al., 2016), thereby increasing the likelihood of venture survival (Delmar et al., 2013; Schoonhoven et al., 1990). Moreover, swift milestone achievement has advantages for product development (Onyemah et al., 2013) and contributes to nascent venture's competitive advantage (Stalk, 1988; Stalk Jr and Hout, 1990). Additionally, when engaging in external partnerships, nascent ventures can rely on speed advantages to protect their intellectual property rather than acquiring patents, which is a resource-intensive process (Leiponen and Byma, 2009). It is therefore relevant to specifically investigate how OI in the form of external partnerships might influence the ability of these firms to quickly reach their milestones.

In sum, the role that external partnerships play for nascent ventures' performance during the venture creation process remains unclear and requires further investigation, especially from a dynamic perspective. To address this gap, we ask: **Does open innovation through external partnerships influence the speed of reaching critical milestones during the venture creation process?**

We address this research question by developing hypotheses on how two, particularly salient, types of OI partnerships (namely joint R&D collaborations and joining industry associations) influence the time to reach critical milestones. We then test our hypotheses in an empirical study of the venture creation processes of 870 nascent ventures active in the renewable energy or information and communications technology industries in Germany, Italy, the Netherlands, the UK, and the USA. These industries are particularly relevant for our interest because they are both highly dynamic industries where product and technological innovation play a key role (Burke and Hanley, 2009) and rely extensively on external collaborations (Bigliardi et al., 2012; Lacerda & van den Bergh, 2020). We use Cox's proportional hazard regression models (Cox, 1972) to test how R&D collaboration and industry association membership is associated with the speed of achieving critical milestones. Regarding the latter, we examine two critical milestones during the venture creation process, namely the completion of product development and the generation of sustainable profits, whereby we focus on the speed with which nascent ventures achieve these milestones.

Complementing the more static insights on OI in established firms, we show that the speed of reaching two critical milestones in the venture creation process, i.e., the development of a new product and the generation of sustainable profits, differs for the two types of OI. While participation in a joint R&D collaboration is significantly associated with a slow-down in the achievement of both milestones, joining an industry association is not, for either of the two milestones.

With these results, we contribute to the OI literature in two ways. On a theoretical level, we show that the benefits of OI for firms depend on the type of firm. Our results highlight that engaging in a joint R&D collaboration might come at the expense of other organizational activities and, as a result, is associated with a slow-down effect for very young and thus resource scarce firms. Thereby, we respond to the call for a longitudinal assessment of new venture creation (Vogel, 2017) and add to the growing empirical entrepreneurship literature that goes beyond static investigations of venture creation processes (Capelleras and Greene, 2008; Capelleras et al., 2010; Qin et al., 2017; Tian et al., 2019). On a methodological level, our research underlines the importance of examining external collaborations from a longitudinal, dynamic perspective. While existing quantitative research on OI during the venture creation phase has adopted a cross-sectional perspective (Huggins and Thompson, 2017; Marullo et al., 2018; Michelino et al., 2017; Neyens et al., 2010), our article is, to our best knowledge, the first to quantitatively investigate speed to milestone achievement (Knudsen and Mortensen, 2011; Van Criekingen, 2020; Zhu et al., 2019). With these two contributions, we help to develop a more nuanced perspective on the effects of OI in general and in nascent ventures, in particular.

2. Theoretical background and hypotheses development

2.1. Milestone achievement during venture creation

The literature on venture creation has shown that speed is often key to ensure venture success. Swift milestone completion improves overall venture performance (Kessler and Chakrabarti, 1996; Shan et al., 2016) and increases the likelihood of venture survival (Delmar et al., 2013; Schoonhoven et al., 1990). The swift development of a product/service has the advantage of generating early customer feedback with the potential to improve future versions (Onyemah et al., 2013). Moreover, a shorter time period of reaching critical milestones acts as a form of competitive advantage for nascent ventures (Stalk, 1988; Stalk Jr and Hout, 1990). In this regard, several multi-stage venture creation frameworks stress the importance of two particular milestones (Bhave, 1994; Gaimon and Bailey, 2013; Kazanjian, 1988; Reynolds and Miller, 1992): namely (1) the completion of the venture's new product and (2) the product's market launch, which leads to generating sustainable profits.

More precisely, this literature highlights that the achievement of these two milestones is particularly important for the success of nascent ventures. The first milestone is defined as the moment when a nascent venture completes its product development (Stalk, 1988; Vesey, 1991). The time span from venture creation to the moment in which product development is finalized with a prototype is also known as innovation speed (Kessler and Chakrabarti, 1996) and represents a core phase in the venture creation process (Bhave, 1994). The second milestone is defined as the moment when a nascent venture generates sustainable profits. Adopting Carland and colleagues' reasoning, "(…) the principal goals of an entrepreneurial venture are profitability and growth" (Carland et al., 1984, p. 358). The moment of reaching profitability marks the completion of the entrepreneurial cycle (Bhave, 1994), is a strong indication of foreseeable venture survival and growth (Delmar et al., 2013), and acts a positive signal to future collaboration partners.

2.2. Different types of open innovation partnerships

The OI literature distinguishes between different types of external innovation partnerships (Baum et al., 2000; Du et al., 2014; Faems et al., 2010). Importantly, the concept of OI reflects a continuum with varying degrees and forms of openness (Dahlander and Gann, 2010; Huizingh, 2011). Accordingly, researchers have developed typologies to identify different OI practices in terms of who the external partners are, what the purpose of the OI is, and how collaboration is established (Huizingh, 2011). Previous studies emphasize the distinction between research-based and market-based partnerships (Baum et al., 2000; Du et al., 2014). We utilize this distinction and study whether nascent ventures engage in a joint R&D collaboration or join an industry association.

R&D collaborations are used to conduct joint research projects with external partners and to access specialized knowledge. Such activities are characterized by a high degree of exploration and experimentation with new technologies (Cockburn and Henderson, 1998), coupled with little monitoring and control (Du et al., 2014). As a result, acquiring specialized knowledge from such research-intensive innovation partnerships involves moderate to high levels of uncertainty and risk (Eisenhardt and Tabrizi, 1995). Moreover, R&D collaborations represent a concrete type of OI with external partners known ex-ante.

Industry associations enable firms to engage with external partners that have a close link to the industry and are thus a vehicle to access industry-wide knowledge. Industry associations are characterized by informal relationships among the various participating stakeholders, who are loosely connected by membership but exhibit a strong convergence of common goals and interests (Fichter, 2009; West and Lakhani, 2008). They offer firms the opportunity to interact with previously unknown actors who can provide general market and industry related knowledge (Fukugawa, 2006). As such, industry associations represent a loose type of OI that have the potential to provide access to external partners, information, markets, and customers, but without guaranteeing it.

Drawing on the distinction between research-based and market-based partnerships, the existing literature highlights that – of all collaboration options – R&D collaborations and industry associations are particularly long-standing and therefore prominent ways in which nascent ventures can engage in OI through external collaborations to gain research or market related knowledge. R&D collaborations are one of the key practices to engage with external actors to perform joint research activities. Industry associations are less explored but allow nascent ventures to collaborate with external actors to gain market related insights. These two particularly pervasive OI practices allow nascent ventures to access distinct types of resources and require different resource investments.

2.3. Effects of open innovation on speed of milestone achievement

Studies investigating the impact of OI on the speed of reaching organizational milestones of established firms show that engaging in external collaborations is associated with faster milestone achievement (Knudsen and Mortensen, 2011; Van Criekingen, 2020; Zhu et al., 2019). In particular, this research area builds on the argument that external collaborations are used in the context of time constraints to access new and in-depth knowledge, receive timely information, and generate valuable ideas (Baum et al., 2000; Chen et al., 2010; Sheremata, 2000; Tsai, 2009). Additionally, the literature argues that OI can reduce work pressure and time needed to complete projects by assigning tasks to knowledgeable external partners (Tessarolo, 2007; Zirger and Hartley, 1996).

With regard to nascent ventures, we expect that the costs associated with an engagement in OI may outweigh the benefits noted above. Given the resource constraints of nascent ventures (Baker and Nelson, 2005; Das and He, 2006; Mosakowski, 2002), the challenges associated with an engagement in OI – i.e., the need to identify and integrate external knowledge, negotiate collaboration terms, and protect intellectual property (Bogers et al., 2017; Greco et al., 2019) – are potentially more problematic for small start-up firms. Additional difficulties and time delays are associated with the rigidity and complexity of corporate processes of established partners in R&D collaborations (Das and He, 2006; Jucá and Alves, 2022) and the risk of losing control over the technology on which the nascent ventures are working (Narula, 2004). Combined with the high failure rate of R&D alliances (Kale et al., 2002; Park and Ungson, 2001), these drawbacks could cause nascent ventures to waste much-needed resources and time. Moreover, nascent ventures must invest time to establish their own knowledge base in order to properly identify and capitalize on externally generated knowledge (Cohen and Levinthal, 1990). Lastly, establishing external collaborations involves the ex-ante challenge of determining an external actor's cooperativeness and trustworthiness before information is shared or a resource exchange occurs (Shipilov and Li, 2008; Ter Wal et al., 2016). To overcome these challenges, firms generally need to invest significant time and resources into selecting suitable alliance partners (Das and He, 2006). In contrast to established firms, nascent ventures have to operate their business with limited amounts of resources. Intensive partner selection and subsequent efforts to manage external collaborations tie up some of these valuable resources and slow down other venture creation activities, which may ultimately delay the achievement of important milestones.

Given these considerations, nascent ventures face considerable strategic and managerial challenges when engaging in external collaborations. Because nascent ventures are resource-scarce (Baker and Nelson, 2005; Das and He, 2006; Mosakowski, 2002), these time-consuming challenges put additional strain on the venture creation process. Due to the combination of resource scarcity and the range of time-consuming challenges that nascent ventures face when collaborating with incumbents on R&D, we expect that R&D collaborations are likely to delay venture creation activities. Given the uncertain and flexible nature of such collaborations, coupled with the coordination, communication, and strategic challenges outlined above, we expect that nascent ventures engaging in R&D collaborations take more time to reach their milestones compared to nascent ventures that do not engage in R&D collaborations. Accordingly, we expect that.

Hypothesis 1a. Nascent ventures that engage in a joint R&D collaboration require more time to complete their product development than nascent ventures that do not engage in a joint R&D collaboration.

Hypothesis 1b. Nascent ventures that engage in a joint R&D collaboration require more time to generate sustainable profits than nascent ventures that do not engage in a joint R&D collaboration.

Compared to engaging in an R&D collaboration, joining an industry association might be a less time-consuming activity. However, the benefits are highly uncertain even for this type of OI practice. Moreover, nascent ventures still need to invest substantial time and resources in establishing contacts and fruitful collaborations with other industry participants. This valuable time can no longer be invested in other venture creation processes. Consequently, we expect that nascent ventures joining an industry association take more time to reach their milestones compared to nascent ventures that do not join an industry association. More specifically, we expect that.

Hypothesis 2a. Nascent ventures that join an industry association require more time to complete their product development than nascent ventures that do not join an industry association.

Hypothesis 2b. Nascent ventures that join an industry association require more time to generate sustainable profits than nascent ventures that do not join an industry association.

A visual overview of our hypotheses is presented in Fig. 1.

3. Data and methods

3.1. Dataset and sample selection

The present study uses the "perfect timing database", an internationally comparative longitudinal dataset on start-up processes containing a total of 870 nascent ventures, collected in two waves between 2011 and 2018. The data was collected by an international research team covering Germany, Italy, the Netherlands, the UK, and the USA and has already been used in several publications (Bijedić et al., 2020; Held et al., 2018; Herrmann, 2019; Herrmann et al., 2020). To capture a wide

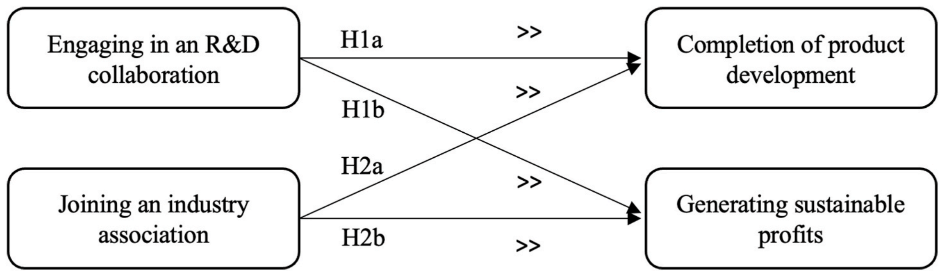

Fig. 1. Relation between engaging in a R&D collaboration or joining an industry association and completion of product development or generating sustainable profits (>> signifies it is speeding up the relation).

range of venture creation processes, the population of interest includes ventures of all legal forms (excluding sole proprietorship) that were registered between 2004 and 2014 in either the renewable energy or information and communications technology industries. Based on corporate information of the ORBIS database of Bureau van Dijk, founders were randomly selected and asked to participate in an interview about their venture creation process until a representative sample of 870 cases had been obtained. Founders were questioned about the activities they undertook between the start and end of venture creation. The moment a founder first discussed the idea of founding the venture with another person signals the start of venture creation. Either the date of the interview or the moment when the venture was merged, acquired, or went bankrupt signals the end of the study period. Given that this dataset covers the date of key events between these two timepoints, it provides dynamic insights into the activities of nascent ventures, which makes it particularly suitable for studying the association between engaging in OI and speed of reaching critical milestones.

For our analysis of OI on time-to-market (i.e., time until completion of product development), we focused on those nascent ventures that worked on an innovative product idea. Next to nascent ventures developing non-innovative product reproductions, we also excluded nascent ventures that did not engage in product development related activities during the venture creation process. Lastly, we excluded one nascent venture where the month of product development completion was unknown. This selection resulted in a final sample of 281 nascent ventures that either developed an incrementally or radically innovative product during their respective venture creation process. In this sample, the shortest venture creation process lasted one month, the longest one 204 months, with a median length of 19 months.

For the analysis of OI on time-to-profitability (i.e., time until generating sustainable profits), we included all nascent ventures that developed an innovative product idea – irrespective of whether this involved actual product development, or whether the product was already completed at the start of venture creation. This led to a final sample of 442 nascent ventures that tried to generate profits. Importantly, this sample is larger than the first sample because there were some nascent ventures whose product was already completed at the start of their venture creation process. Out of these 442 nascent ventures, 357 reached profitability. Out of the remaining 85, the majority were still undergoing the venture creation process at the time of data collection (57), were dissolved (21), acquired (3) or merged (4). In this sample, the shortest venture creation process lasted two months, the longest one 245 months, with a median length of 31 months.

3.2. Measures

3.2.1. Dependent variable

Time-to-market. To test hypotheses H1a and H2a, we examine the relation between an engagement in OI and time-to-market. The dependent variable time-to-market indicates whether a nascent venture reached the market (i.e., completed its product development). The variable is based on the survey question 'When was the development of the new venture's product completed?' with answers providing the month and year when nascent ventures have a working version of the product.[1] It takes the value 1 if a nascent venture reached the market in a given month/year and 0 if it did not reach the market during the venture creation period investigated.

Time-to-profitability. To test hypotheses H1b and H2b, we examine the relation between an engagement in OI and time-to-profitability. The dependent variable time-to-profitability indicates whether a nascent venture reached a profitable state (i.e., generates sustainable profits). The variable is based on two questions 'Has the new venture ever made sustainable profits? In other words, has net monthly revenue generated by the new venture ever exceeded monthly expenses for more than a quarter (three consecutive months)?', and '[if yes] when did monthly revenues exceed monthly expenses for more than a quarter (three consecutive months) for the first time?' with answers to the second question providing the month and year of generating sustainable profits. Accordingly, the profitability variable takes the value 1 if a nascent venture reached a profitable state in a given month/year and 0 if it did not reach profitability during the venture creation period investigated.

With these dependent variables, time-to-market and time-to-profitability, we examine the time in months that it takes to reach these two milestones. Previous OI research subjectively measured the speed of new product development (Knudsen and Mortensen, 2011; Van Criekingen, 2020; Zhu et al., 2019). To our best knowledge, we are the first to study this relationship with a quantitative approach.

3.2.2. Independent variables

Our key independent variables include whether a nascent venture engaged in a joint R&D collaboration with external partners, and whether it joined an industry association.

R&D collaboration. The variable R&D collaboration takes the value 1 if a nascent venture engaged in a joint R&D collaboration with external partners before reaching a critical milestone (i.e., completing product development or generating sustainable profits) and 0 if does not.

Industry association. The variable industry association takes the value 1 if a nascent venture joined an industry association before reaching a critical milestone and 0 if it does not. Regarding the purpose of joining an industry association, the two most common reasons were: to obtain information or advice about the market, venture creation, competitors, customers, etc. and to encounter potential business partners. Additionally, cases where the reason for joining the industry association was questionable obtained the value 0 – e.g., because joining the industry association was a requirement to enter the market or it was not a conscious choice but included in a prize awarded to the new venture.

[1] Respondents were also given the following instruction with the questions: "Please note that product development is considered to be complete when a prototype – i.e., a functional version of the product – exists that can be shown to the customers targeted by the new venture."

3.2.3. Control variables

Early entrepreneurship research has shown that new venture creation depends on a variety of factors (Gartner, 1985; Vogel, 2017). Therefore, we control for a number of factors that might influence the speed of reaching critical milestones, including characteristics of the founding team, the nascent ventures, as well as their context.

Founder team controls. Regarding the founder team, we control for the number of founders, their level of education, and previous start-up experience. Founder characteristics and founder team size are possible influences on venture creation processes (Capelleras and Greene, 2008; Clarysse and Moray, 2004; Delmar and Shane, 2006) and previous start-up experience can influence the effectiveness and success of starting subsequent ventures (Westhead et al., 2009; Westhead and Wright, 1998). The variable number of founders indicates how many founders have contributed to the venture's creation. To control for outliers, we set the maximum number to five (in the overall sample, it was indicated for only 14 ventures that more than five founders had contributed to their respective creation). The two dummy variables founder's highest degree and previous start-up experience indicate whether at least one founder contributed to venture creation with a master's or a doctoral degree and, similarly, at least one founder with previous start-up experience.

Nascent venture controls. Regarding the nascent venture, we control for the innovativeness of the nascent venture's product (Kessler and Chakrabarti, 1996), whether employees were hired (Sine et al., 2006), the independence of the nascent venture (Clarysse and Moray, 2004), and the financial liquidity (Capelleras and Greene, 2008). These characteristics can influence the performance of nascent ventures. The variable innovativeness indicates the degree of novelty of the nascent venture's product as either an incremental or a radical innovation.[2] The dummy variable employees indicates whether employees were hired during the venture creation process. The variable spin-off indicates whether the nascent venture was independently founded, or whether it was a spin-off from another organization. The dummy variable funds indicates whether any amount of funds was invested in the nascent ventures either from one of the founders, from external providers of loans, or from external sponsors.

Context controls. Regarding the context, we control for the industry and the country a nascent venture is active in. Not all industries are structurally equivalent and might induce nascent ventures to pursue different business models (Sine et al., 2006) and the same holds for countries. The corresponding variable ICT is operationalized as taking the value 1 if a nascent venture is active in the information and communications technology industry, and zero if it is active in the renewable energy industry. The categorical variable country indicates where the nascent venture was registered for the first time.

3.3. Methodology

To test our hypotheses on the relation between engaging in OI and the speed of reaching critical milestones during venture creation, we leverage statistical techniques for survival analysis. Survival analysis is an umbrella term for a collection of statistical approaches for analyzing time-to-event data (Kleinbaum and Klein, 2012). Time-to-event data reflect, for each nascent venture, the time from a specified starting date to a specified endpoint defined by the occurrence of a certain event of interest (reaching a critical milestone). Because in our data the two events of interest are not mutually exclusive, a competing risks analysis is not needed.

Therefore, we run two separate analyses, one for each event of interest. Because not all nascent ventures experience the events of interest, our data is right censored: Some nascent ventures did not (yet) experience the event of interest before the end of the study period was reached, or they were acquired/merged/dissolved and were therefore not investigated beyond the date of acquisition/merger/bankruptcy. A total of 85 nascent ventures are censored in the time-to-profitability analysis. There is no censorship in the time-to-market analysis, as all nascent ventures reach the milestone during the study period. We considered the first moment that one of the founders discussed the idea of venture creation with another person as the start date, because most founders invest substantial time into venture creation from this point onwards (Bijedić et al., 2020; Held et al., 2018).

To assess the simple univariate relationship between engaging in an R&D collaboration or joining an industry association and time-to-market or time-to-profitability respectively, we estimate non-parametric Kaplan-Meier survival estimates (Kleinbaum and Klein, 2012). In our case, survival is an unfavored outcome because it means that nascent ventures do not reach a given milestone. Therefore, we make use of cumulative event curves to facilitate visual representation. These allow us to directly compare the cumulative proportion of nascent ventures experiencing the event by time t, differentiating between nascent ventures that engaged in an R&D collaboration or joined an industry association with nascent ventures that did not (Pocock et al., 2002).

The multivariate models are estimated using the semiparametric Cox's proportional hazard regression models (Cox, 1972; Kleinbaum and Klein, 2012). The model is specified as follows:

$$h(t,\mathbf{X}) = h_0(t)e^{\sum_{i=1}^{p}\beta_i X_i}$$

and makes a prediction about the hazard time of a nascent venture at time t for a given vector of explanatory variables denoted by **X**. The hazard at time t is the product of two quantities: The baseline hazard function defined by $h_0(t)$ and the exponential expression e to the linear sum of the p explanatory X variables. Importantly, the baseline hazard does not involve any of the X's and is solely a function of t. In contrast, the exponential expression does not involve t but only the X's, meaning the X's are time independent. This means that we opt for proportional hazards models.

4. Results

4.1. Descriptive statistics

Table 1 presents the descriptive statistics for the time-to-market and time-to-profitability samples separately. Regarding our independent variables of interest, the percentage of nascent ventures engaging in R&D collaborations is rather similar in the two samples, around 25%, but fewer nascent ventures join an industry association in the time-to-market sample (17% vs. 24%). Concerning the founder team, nascent venture characteristics, and the venture creation context, the two samples are quite similar. The largest difference between the two samples is whether internal or external stakeholders invested any amount of funds into the nascent venture. In the time-to-market sample 43% of nascent ventures received funding, while in the time-to-profitability sample 53%

[2] The question posed in the interview was: How would you describe the degree of novelty of the new venture's product/s? Possible answer categories were: 1) Radically new INNOVATION: The product has never been available to potential customers before. 2) Partly new IMPROVEMENT: Only less sophisticated versions of the product have been available to potential customers beforehand. 3) Traditional REPRODUCTION: Similar versions of the product have been available to potential customers beforehand. As mentioned earlier, we took out nascent ventures that worked on a reproduction of an already existing product.

Table 1
Descriptive statistics of time-to-market and time-to-profitability samples.

	Variable description	Time-to-market sample (N = 281)	Time-to-profitability sample (N = 442)
		Count	Count
R&D collaboration	Dummy (1 = engage in R&D collab.)	64	112
Industry association	Dummy (1 = join industry assoc.)	45	102
Number of founders	Ordinal[a]		
1		73	119
2		93	149
3		58	97
4		25	39
≥5		32	38
Founder's highest degree	Dummy (1 = master's degree or PhD)	123	208
Previous start-up experience	Dummy (1 = previous start-up experience)	111	196
Innovativeness	Dummy (1 = radical)	76	106
Employees	Dummy (1 = employees were hired)	143	220
Spin-off	Dummy (1 = spin-off)	34	59
Funds	Dummy (1 = funds were invested)	208	342
ICT	Dummy (1 = ICT industry)	210	325
Country	Nominal		
Germany	Reference category	102	157
Italy		30	65
Netherlands		26	29
United Kingdom		48	71
United States of America		75	120

Note.
[a] Number of founders was treated as a continuous variable in the analysis.

of nascent ventures received funding. In sum, these descriptive statistics indicate that there are no major differences between our two samples.[3]

Tables 2 and 3 show the correlation matrix of the variables in our two samples. As indicated by the weak correlation between engaging in an R&D collaboration and joining an industry association in both samples, nascent ventures see these two activities as distinct types of OI. This means that nascent ventures either engage in an R&D collaboration or join an industry association, with only very few ventures doing both. The only moderate correlations which might warrant caution exist between the two variables founder's highest degree and previous start-up experience. We therefore calculated the variance inflation factor for each explanatory variable to detect possible multicollinearity issues (Allison, 1999, p. 142). The results did not show any signs of multicollinearity as no variance inflation factor was larger than two.

Figs. 2–5 present the cumulative event curves for our time-to-market and time-to-profitability samples. These figures show a significant difference in event occurrence patterns between nascent ventures that engage in OI and nascent ventures that do not in terms of time-to-market and, respectively, profitability achievement. In general, nascent ventures that do engage in OI are slower in reaching these milestones. This is confirmed by a log-rank test for both types of openness in both samples. Engaging in an R&D collaboration has a chi-square value of 10.4, which is significant at the 1% level, for completion of product development and a chi-square value of 8.6, which is significant at the 1% level, for generating sustainable profits. Joining an industry association has a chi-square value of 5.6, which is significant at the 5% level, for completion of product development and a chi-square value of 3.7, which is significant at the 10% level, for generating sustainable profits.

4.2. *Results of Cox's proportional hazard regression models*

We estimate the role of an engagement in OI on time-to-market and time-to-profitability using proportional hazards models. Table 4 provides the results of the Cox proportional hazards regression models for the relation between OI (i.e., engaging in an R&D collaboration or joining and industry association) and milestone achievement (i.e., completing product development or generating sustainable profits). Negative coefficients indicate that an explanatory variable is negatively related to the likelihood of milestone achievement. Positive coefficients indicate that an explanatory variable is positively related to the likelihood of milestone achievement. To facilitate the interpretation, we also present hazard ratios which are point estimates and indicate whether a given explanatory variable is associated with increased (i.e., faster) or decreased (i.e., slower) hazard of milestone achievement. If the hazard ratio is equal to one, and thus insignificant, its corresponding explanatory variable is not significantly related to the hazard of milestone achievement. If the hazard ratio is significantly larger than one, higher values of the corresponding explanatory variable are positively related to the hazard of milestone achievement. If the hazard ratio is significantly smaller than one, higher values of the corresponding explanatory variable are negatively associated with the hazard of milestone achievement. In addition, we conduct likelihood ratio tests to determine whether adding our main explanatory variables significantly improves model fit over the control model. This is the case as the full model always significantly improves model fit over the control model.

Regarding our first set of hypotheses studying the relation between R&D collaboration and milestone achievement, hypothesis 1a is supported by the evidence. Engaging in an R&D collaboration is negatively associated with nascent ventures' hazard of completing product development. This means that nascent ventures that engage in an R&D collaboration, compared to nascent ventures that do not, finish their product development at a later point in time. To quantify this effect: at any time, 0.71 times as many nascent ventures that engage in an R&D collaboration finish their product compared to nascent ventures that do not engage in an R&D collaboration. Furthermore, our results support hypothesis 1b. Engaging in an R&D collaboration is negatively associated with nascent ventures' hazard of generating sustainable profits. This means that nascent ventures that engage in an R&D collaboration, compared to nascent ventures that do not, generate sustainable profits at a later point in time. To quantify this effect: at any time, 0.75 times as many nascent ventures that engage in an R&D collaboration generate sustainable profits compared to nascent ventures that do not engage in an R&D collaboration

Regarding our second set of hypotheses studying the relation between industry association and milestone achievement, neither hypothesis H2a nor hypothesis H2b is supported by the evidence. There is no difference between nascent ventures that join an industry association and nascent ventures that do not in terms of finishing their product development. Moreover, there is no difference between nascent ventures that join an industry association and nascent ventures that do not in terms of the speed at which sustainable profits are generated.

Concerning the control variables, having at least one founder with a master's degree or doctoral degree, as well as investing or acquiring funds is associated with slowing down the completion of product development, which is consistent with previous research on venture creation speed (Capelleras and Greene, 2008). Additionally, being active

[3] There is a perfect overlap between the two samples. All 281 nascent ventures of the time-to-market sample are also present in the time-to-profitability sample.

Table 2
Correlation matrix time-to-market sample (N = 281).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) R&D collaboration	1									
(2) Industry association	0.16***	1								
(3) Number of founders	0.11	−0.07	1							
(4) Founder's highest degree	−0.05	−0.01	0.11*	1						
(5) Previous start-up experience	−0.07	0.02	0.05	0.49***	1					
(6) Innovativeness	0.20***	−0.05	0.09	0.08	0.08	1				
(7) Employees	0.08	0.06	0.25***	−0.04	0.01	0.04	1			
(8) Spin-off	0.03	−0.01	0.13**	0.02	0.12**	0.04	0.15**	1		
(9) Funds	0.15**	0.26***	−0.02	−0.02	0.04	0.01	0.16***	0.00	1	
(10) ICT	−0.25***	−0.15**	−0.04	0.03	0.00	−0.16***	−0.13**	0.04	−0.05	1

Note: We use Spearman correlation coefficients. ***p < .01, **p < .05, *p < .1.

Table 3
Correlation matrix time-to-profitability sample (N = 442).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) R&D collaboration	1									
(2) Industry association	0.14***	1								
(3) Number of founders	0.08	0.02	1							
(4) Founder's highest degree	−0.03	−0.10**	0.16***	1						
(5) Previous start-up experience	−0.04	0.00	0.02	0.42***	1					
(6) Innovativeness	0.16***	0.06	0.03	0.08	0.09*	1				
(7) Employees	0.12**	0.17***	0.17***	−0.06	0.06	0.03	1			
(8) Spin-off	0.05	0.01	0.13***	0.03	0.08	0.03	0.14***	1		
(9) Funds	−0.08*	−0.06	−0.04	0.01	0.00	−0.23***	−0.02*	0.09*	1	
(10) ICT	−0.19***	−0.13***	−0.04	−0.06	−0.07	−0.10**	−0.11**	0.05	0.25***	1

Note: We use Spearman correlation coefficients. ***p < .01, **p < .05, *p < .1.

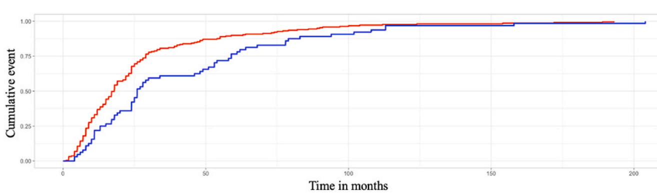

Fig. 2. Cumulative event curves for nascent ventures that engage in an R&D collaboration (blue) and nascent ventures that do not (red) in the time-to-market sample.

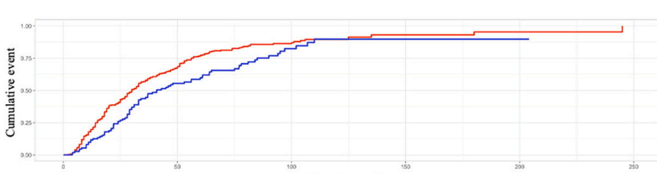

Fig. 3. Cumulative event curves for nascent ventures that engage in an R&D collaboration (blue) and nascent ventures that do not (red) in the time-to-profitability sample.

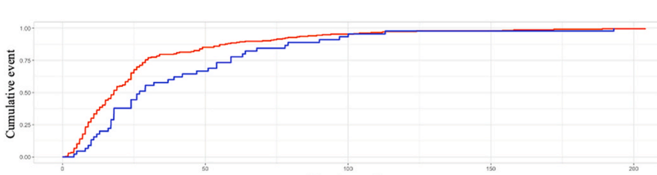

Fig. 4. Cumulative event curves for nascent ventures that join an industry association (blue) and nascent ventures that do not (red) in the time-to-market sample.

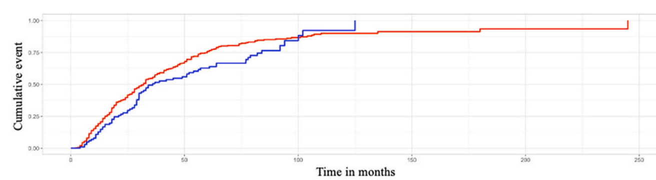

Fig. 5. Cumulative event curves for nascent ventures that join an industry association (blue) and nascent ventures that do not (red) in the time-to-profitability sample.

or intending to be active in the ICT sector is related to speeding up the completion of product development – possibly because these products can be developed and released more quickly. Furthermore, the hiring of many founders and employees is associated with slowing down the generation of sustainable profits. This is possible due to the administrative tasks involved in hiring which slow down venture creation. Additionally, nascent ventures that acquire any amount of funds generate sustainable profits more quickly. Lastly, nascent ventures first registered in Germany generate sustainable profits faster than nascent ventures first registered in Italy or the USA.

4.3. Robustness checks

A strong assumption in Cox proportional hazards regression models is the proportional hazards assumption. It implies that the hazard ratio remains constant over time with different predictor levels (Kleinbaum and Klein, 2012, p. 165). If violated, the simple Cox model is invalid. We test this assumption by correlating the Schoenfeld residuals and survival times (function cox.zph in R) for all predictors in both of our analyses (Grambsch and Therneau, 1994). Table A in the appendix displays the Chi-square test statistics and p-values for our predictors. In the time-to-market analysis, the predictors whether any employees were hired, and funds acquired do not satisfy the proportional hazards assumption. In the time-to-profitability analysis, the predictors number of founders, whether employees were hired, and funding acquisition do

Table 4
Cox proportional hazard estimates for milestone achievement.

	Time-to-market analysis				Time-to-profitability analysis			
	Control model		Full model		Control model		Full model	
	Coefficient [se]	Hazard ratio	Coefficient [se]	Hazard ratio	Coefficient [se]	Hazard ratio	Coefficient [se]	Hazard ratio
R&D collaboration			−0.343** [0.156]	0.710**			−0.286** [0.131]	0.752**
Industry association			−0.227 [0.178]	0.797			−0.149 [0.136]	0.862
Number of founders	−0.056 [0.050]	0.946	−0.056 [0.050]	0.946	−0.159*** [0.046]	0.853***	−0.152*** [0.046]	0.859***
Founder's highest degree	−0.378** [0.153]	0.685**	−0.398*** [0.152]	0.671***	−0.059 [0.121]	0.933	−0.073 [0.120]	0.930
Previous start-up experience	0.068 [0.150]	1.071	0.043 [0.152]	1.044	−0.116 [0.124]	1.123	−0.102 [0.123]	1.107
Innovativeness	−0.117 [0.143]	0.889	−0.124 [0.146]	0.883	−0.145 [0.145]	0.865	−0.127 [0.144]	0.881
Employees	0.115 [0.137]	1.122	0.132 [0.137]	1.142	−0.462*** [0.111]	0.630***	−0.434*** [0.111]	0.648***
Spin-off	0.255 [0.199]	1.290	0.286 [0.199]	1.332	0.218 [0.162]	1.244	0.193 [0.162]	1.213
Funds	−0.491*** [0.153]	0.612***	−0.434*** [0.159]	0.648***	2.833*** [0.293]	17.004***	2.867*** [0.294]	17.576***
ICT	0.393** [0.153]	1.482**	0.331** [0.154]	1.393**	0.239* [0.136]	1.270*	0.180 [0.139]	1.198
Country (ref. Germany)								
Italy	−0.151 [0.213]	0.860	−0.082 [0.217]	0.921	−0.270* [0.161]	0.763*	−0.273* [0.162]	0.761*
Netherlands	−0.248 [0.255]	0.780	−0.178 [0.256]	0.837	0.111 [0.262]	1.117	0.077 [0.262]	1.080
United Kingdom	0.143 [0.182]	1.154	0.136 [0.183]	1.145	−0.114 [0.158]	0.892	−0.115 [0.159]	0.891
United States of America	−0.237 [0.172]	0.789	−0.211 [0.175]	0.810	−0.358** [0.146]	0.699**	−0.361** [0.151]	0.697**
Log likelihood	−1287.845		−1284.049		−1750.662		−1747.378	
LR chi-square	38.542***		7.592**		296.23***		6.568**	
N	281		281		442		442	

Note: ***p < .01, **p < .05, *p < .1.

not satisfy the proportional hazards assumption. If one considers that all datasets violate the proportional hazards assumption to some degree (Stensrud and Hernán, 2020) and that there are only slight violations in our models' control variables, we conclude that our results are not heavily biased by these violations. Nevertheless, we estimated additional models where we stratified the effects of the relevant control variables. These changes did not alter our main results in a substantial way, so that our conclusions regarding our hypotheses remain the same. Table B and C in the appendix show the corresponding results tables.

To check if our results are sensitive to our selected analytical approach, we run additional models using multiple linear regression. To this end, the dependent variables were transformed to indicate the time in months from venture creation to finishing product development and, respectively, to generating sustainable profits. The results regarding our variables of interest remained the same which, in turn, confirms the theoretical conclusions we have drawn from the main analyses presented above .[4]

5. Discussion and conclusions

This study investigated how an engagement in OI through external partnerships, specifically R&D collaborations and industry associations, is related to the speed of reaching critical milestones, namely completing product development and generating sustainable profits, during the venture creation process. By leveraging an internationally comparative longitudinal dataset on founder's decisions and venture creation outcomes in 870 nascent ventures, we contribute a dynamic perspective to the mostly static OI as well as entrepreneurship literature. Based on the entrepreneurship literature, we identified two critical milestones that need to be met quickly in the venture creation process: (1) the completion of product development and (2) the generation of sustainable profits. On the one hand, research on established firms demonstrates that establishing relationships with external actors is a way to acquire key resources, which are helpful in reaching these critical milestones faster. On the other hand, establishing and managing these relationships may slow nascent ventures down, due to resource- and time-consuming coordinative, managerial, and strategic challenges. Because nascent ventures are known to be resource scarce, and because such challenges will put additional strains on the venture creation process, we expected that nascent ventures using R&D collaborations and industry associations to engage in OI are slower in completing their product development and generating sustainable profits compared to nascent ventures that do not engage in OI.

5.1. Relation between open innovation and milestone achievement

Regarding R&D collaborations, our results support our expectations. They show that nascent ventures engaging in R&D collaborations are slower in completing product development and in generating sustainable profits than nascent ventures that do their R&D in-house without external collaboration partners. Because R&D collaborations are characterized by a high degree of uncertainty (Eisenhardt and Tabrizi, 1995) and extensive exploration and experimentation activities (Cockburn and Henderson, 1998), it simply takes time until tangible outcomes, such as new products, emerge. Additionally, these findings support the arguments that research-based collaborations to generate and acquire essential resources come with collaborative (Das and He, 2006; Narula, 2004) and strategic (Jucá and Alves, 2022; Shipilov and Li, 2008; Ter Wal et al., 2016) challenges. These require time to be overcome, which is ultimately linked to a delay in operational processes for nascent ventures. Due to the resource scarcity of nascent ventures (Baker and Nelson, 2005; Das and He, 2006; Mosakowski, 2002), tasks related to establishing and managing R&D collaborations tie up much-needed resources and time, which are then not available for other important venture creation activities. These insights from previous research provide potential explanations for our finding that engaging in R&D collaborations is associated with a slow-down in completing product development and generating sustainable profits during venture creation.

Concerning industry associations, our results do not support our expectations. The results do not show a difference between nascent

[4] The tables reporting these robustness results are available from the corresponding author upon request.

ventures that join an industry association (to get information or advice about the market, venture creation, competitors, and customers, or to meet potential business partners) and nascent ventures that abstain from joining industry associations in terms of completing product development and generating sustainable profits. A potential explanation is that it is less resource- and time-consuming to join an industry association than to engage in R&D collaborations. R&D collaborations represent a well-established and formal way of OI where the involved actors commit to work on an ex-ante defined goal (Hagedoorn, 2002; Radziwon et al., 2017; Santamaria and Surroca, 2011). In contrast, industry associations, consisting of large and open networks of loosely connected actors, allow the involvement in a less formalized way where less commitment is needed from the actors (Aral and Van Alstyne, 2011; Sol et al., 2013). Due to these limited investments, engaging in industry associations is likely to require less time and resources than R&D collaborations do. This might explain why our results show that nascent ventures joining an industry association for OI purposes are not slowed down in reaching critical milestones.

5.2. Theoretical implications

Our findings have two implications for the OI literature. First, we show that the well-established association between an engagement in OI and corporate success is particularly applicable to a cross-sectional framework where success is measured in process outcomes rather than process qualities. Importantly, our results do not challenge the well-established finding that OI is associated with increased value capture potential for established and nascent ventures. Engaging in relationships with established partners might be a successful way to survive in vulnerable strategic positions (Eisenhardt and Schoonhoven, 1996) or if the (knowledge) resources needed cannot be generated internally (Moeen and Mitchell, 2020). Moreover, our results allow no conclusions to be drawn about the long-term effects that an engagement in OI may have for nascent ventures. Instead, our results show that a more dynamic and longitudinal perspective can reveal implications of OI that remain hidden in cross-sectional studies. By looking at nascent ventures and linking corporate success to a process-related measure, such as time to milestone achievement, we provide a more nuanced view regarding the positive impact of some OI practices, such as R&D collaborations. Our results point toward a potential – thus far overlooked – trade-off between the time needed for acquiring resources and making them usable. This is particularly important for nascent ventures with their lack of slack resources which, in turn, are needed to engage in resource acquisition activities through OI.

Second, our study is also a reminder that OI practices are of different kinds and different relevance for firms. We focused here on two specific OI practices, representing more formal, research-based partnerships and more informal, market-based partnerships. Because of their resource scarcity, an engagement in R&D collaborations seems to entail a trade-off for nascent ventures: The time they need to set-up R&D collaborations cannot be invested into other essential venture creation activities. For established firms with more slack resources this trade-off may be less severe. In this regard, our finding that engaging in OI via participation in industry associations is not related to nascent ventures' speed to milestone achievement, whereas OI via R&D collaborations is, additionally indicates that different OI practices may require different resource investments. In sum, these two contributions help to develop a more nuanced picture of different OI practices and their role in the venture creation process.

5.3. Managerial implications

Our research also has two important managerial implications. First, nascent ventures that consider getting involved in collaborative R&D activities must ensure that they have access to sufficient resources to cope with a longer process to develop their product and to become profitable. Part-time entrepreneurship is one approach to reduce the risk of running out of resources (Folta et al., 2010; Raffiee and Feng, 2014). Another possibility to deal with a lengthy venture creation process is to acquire financial resources and investments (Delmar and Shane, 2004; Hechavarría et al., 2016). For nascent ventures with a high priority to quickly go through the venture creation process, it might not be advisable to engage in external R&D collaborations. Second, if nascent ventures decide to engage in R&D collaborations with external partners, they need appropriate competences to deal with time-consuming coordinative and communicational challenges that come with it. Setting up and managing research-intensive external collaborations requires administrative and managerial competences which are usually not at the core of a creative founding process (Ko and Butler, 2007; Pretorius et al., 2005). Therefore, nascent ventures could scan their networks and look for suitable people who can support them when faced with these time-consuming challenges.

5.4. Limitations and directions for future study

The findings of our study should be interpreted in light of a few limitations that pave the way for future research opportunities. First, there are more OI practices than the ones we accounted for in our study (Baum et al., 2000; Laursen and Salter, 2006). Different types of external partners can be competitors, suppliers, customers, research institutes, governments, or universities. But due to the nature of our data, we could not include more OI partners in our analysis, nor test for non-linear relations. Still, our analyses demonstrate the potential of a longitudinal research design that deviates from the cross-sectional norm of empirical research on OI. Future research relying on larger datasets could examine even more complex relations between various OI practices and dynamic measures of success. Second, our study relied on data from the renewable energy and information communications technology industries. Both are innovative and dynamic industries (Burke and Hanley, 2009) that rely on collaboration with external actors (Bigliardi et al., 2012; Lacerda & van den Bergh, 2020). Future research could explore whether the same findings apply to other industries that are less dynamic.

All in all, this study offers original insights that help to develop a more nuanced picture of OI, by applying a different theoretical focus away from incumbents and a different empirical approach than the ones leading to cross-sectional evidence.

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Declarations of competing interest

None

Data availability

The data that has been used is confidential.

Appendix

Table A
Test for proportional hazards assumption.

	Time-to-market (N = 281)			Time-to-profitability (N = 442)		
	Chi-square test statistic	df	p	Chi-square test statistic	df	p
R&D collaboration	0.823	1	0.364	1.134	1	0.287
Industry association	2.725	1	0.099	0.003	1	0.959
Number of founders	3.677	1	0.055	14.451	1	<0.001
Founder's highest degree	0.273	1	0.601	1.900	1	0.168
Previous start-up experience	0.786	1	0.375	0.404	1	0.525
Innovativeness	0.301	1	0.583	0.223	1	0.637
Employees	6.295	1	0.012	6.613	1	0.010
Spin-off	0.615	1	0.433	0.094	1	0.760
Funds	15.867	1	<0.001	7.719	1	0.005
ICT	2.989	1	0.084	3.244	1	0.072
Country	5.415	4	0.247	1.389	4	0.846
Global test	30.608	14	0.006	35.746	14	0.001

Table B
Cox proportional hazards estimates for time-to-market with stratified effects for employees and funds to adhere to the proportional hazards assumption.

	Coefficient [se]	Hazard ratio
R&D collaboration	−0.336** [0.157]	0.714**
Industry association	−0.276 [0.180]	0.759
Number of founders	−0.061 [0.050]	0.941
Founder's highest degree	−0.417*** [0.153]	0.659***
Previous start-up experience	0.064 [0.153]	1.066
Innovativeness	−0.154 [0.146]	0.857
Spin-off	0.353* [0.200]	1.424*
ICT	0.338** [0.154]	1.402**
Country (ref. Germany)		
Italy	−0.091 [0.218]	0.913
Netherlands	−0.183 [0.256]	0.833
United Kingdom	0.143 [0.184]	1.154
United States of America	−0.162 [0.175]	0.850
Employees: timegroup = 1	−1.055 [0.799]	0.349
Employees: timegroup = 2	0.007 [0.215]	1.007
Employees: timegroup = 3	0.229 [0.172]	1.257
Funds: timegroup = 1	−2.239*** [0.798]	0.107***
Funds: timegroup = 2	−0.750*** [0.226]	0.473***
Funds: timegroup = 3	0.016 [0.228]	1.016

Note. ***$p < .01$, **$p < .05$, *$p < .1$; The effects of employees and funds are stratified at month 4 and 15 to comply with the proportional hazards assumption.

Table C
Cox proportional hazards estimates for time-to-profitability with stratified effects for number of founders, employees, and funds to adhere to the proportional hazards assumption.

	Coefficient [se]	Hazard ratio
R&D collaboration	−0.309** [0.132]	0.734**
Industry association	−0.128 [0.136]	0.880
Founder's highest degree	−0.059 [0.122]	0.943
Previous start-up experience	0.075 [0.125]	1.078
Innovativeness	−0.162 [0.144]	0.851
Spin-off	0.151 [0.164]	1.163
ICT	0.167 [0.139]	1.182
Country (ref. Germany)		
Italy	−0.274* [0.163]	0.761*
Netherlands	0.072 [0.261]	1.075
United Kingdom	−0.126 [0.158]	0.882
United States of America	−0.386** [0.151]	0.680**
Number of founders: timegroup = 1	−0.290*** [0.067]	0.748***
Number of founders: timegroup = 2	−0.061 [0.109]	0.941
Number of founders: timegroup = 3	0.009 [0.079]	1.009
Employees: timegroup = 1	−0.583*** [0.148]	0.558***
Employees: timegroup = 2	−0.423 [0.283]	0.655
Employees: timegroup = 3	−0.124 [0.216]	0.883
Funds: timegroup = 1	2.174*** [0.364]	8.879***
Funds: timegroup = 2	3.337*** [1.011]	28.161***
Funds: timegroup = 3	3.434*** [0.520]	31.012***

Note. ***p < .01, **p < .05, *p < .1; The effects of number of founders, employees, and funds are stratified at month 30 and 41 to comply with the proportional hazards assumption.

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