

# Unlocking Startup Funding: The Role of Alliances, Patenting, and Network in Entrepreneurial Support Ecosystems

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**Abstract:** This study explores critical determinants influencing startups' equity financing outcomes, focusing particularly on the roles of strategic alliances, patenting activities, and network dynamics generated within incubators, which constitute a specific form of Entrepreneurial Support Organizations. Leveraging an extensive dataset of 238 startups incubated at European Space Agency Business Incubation Centres (ESA BICs), we apply probit regression and Weibull Accelerated Failure Time (AFT) models. Findings reveal that R&D alliances established during incubation markedly enhance both the likelihood and timing of securing equity investments by effectively signalling innovation capability to investors. Conversely, commercial alliances display negligible impact, underscoring their limited signalling potential in technology-focused environments. Interestingly, patenting activities undertaken during incubation negatively affect equity financing prospects. This intriguingly result contributes to existing debates by highlighting that while patents may initially serve as valuable signals, their influence can diminish over time as information asymmetries decrease. Additionally, this study empirically substantiates the "Bridging Effect", demonstrating that extensive incubators networks significantly promote alliance formation among incubated startups. These insights hold theoretical significance and practical implications for entrepreneurs, incubator managers and policymakers striving to optimize support structures within entrepreneurial ecosystems.

**Keywords:** Entrepreneurial Ecosystems, Equity Financing, Incubators, Startup Growth, Patenting Activities, Strategic Alliances.

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## 1. Introduction

Startups are increasingly acknowledged as pivotal catalysts for innovation and economic advancement, although their initial growth trajectories are critically influenced by their capacity to attract key resources, obtain financial capital, and forge effective strategic partnerships. Entrepreneurial ecosystems (EEs) profoundly shape these early-stage success factors through a dynamic interplay of supportive policies, developed infrastructure, accessible human capital, and positive cultural attitudes towards entrepreneurship (Spigel, 2017; Stam & Van de Ven, 2021). Within these ecosystems, Entrepreneurial Support Organizations (ESOs), particularly incubators, are increasingly recognized as pivotal facilitators of startup success, notably through their support in securing equity financing (Bergman & McMullen, 2022). Central to this process are strategic alliances and patenting activities, which significantly influence investor perceptions (Ozmel et al., 2013). Although incubators are recognized for providing essential resources, networks, and credibility, there is significant opportunity to deepen our understanding of how startups' strategic alliances and patenting activities established during incubation specifically influence their equity financing. Given the mixed evidence on the impact of different alliance types and the ambiguous outcomes associated with patent activities, exploring these mechanisms in greater detail within incubator environments represents valuable theoretical and practical opportunities. Theoretically, this analysis enhances our understanding of entrepreneurial ecosystems by shedding light on how startup-specific strategic behaviours, particularly alliance formation and patenting activities, influence resource acquisition dynamics, capability signalling, and ultimately equity financing outcomes, as well as clarifying the facilitating role played by entrepreneurial support organizations within these dynamics. Practically, enhanced insights enable incubator managers and entrepreneurs to strategically select and manage partnerships and intellectual property, thereby maximizing startup attractiveness to investors. The space economy, characterized by substantial capital needs, technological complexity, and extensive collaboration requirements, provides an ideal empirical setting for addressing these research opportunities (Colombo & Delmastro, 2002). In particular, the European Space Agency Business Incubation Centres (ESA BICs), specialized incubators dedicated to supporting startups in the space sector, offer a highly relevant context for examining how incubator-specific networks and structured support mechanisms impact startup equity financing outcomes. This study empirically investigates 238 startups incubated within ESA BICs between 2016 and 2022, employing probit regression and Weibull

Accelerated Failure Time models. The findings significantly contribute to entrepreneurial ecosystem literature by confirming the pivotal role of R&D alliances in enhancing both the likelihood and speed of securing equity financing, underscoring their essential signalling value to investors. Conversely, commercial alliances are found to lack consistent significance, suggesting a comparatively lower signalling value in investment decisions. Moreover, this research empirically validates the "bridging effect", illustrating how the breadth and robustness of an incubator's network enhance the likelihood of alliance formation among incubated startups, emphasizing the importance of network scale. Surprisingly, concerning the contribution of patenting activities, this study finds a negative impact on the likelihood of obtaining equity financing. This result aligns with Hoenen et al. (2014), who suggest that patenting activity significantly influences the first round of financing but not subsequent rounds, as informational asymmetries between investors and startups decrease over time. Thus, it becomes crucial to consider the specific startup context and investor characteristics when evaluating the effectiveness of patents as a tool for attracting financing. Together, these findings provide meaningful theoretical advancements and actionable guidance for entrepreneurs, incubator managers and policymakers committed to fostering robust entrepreneurial ecosystems.

## **2. Theoretical Background**

### **2.1 Entrepreneurial Ecosystems**

Entrepreneurial ecosystems (EEs) encompass interconnected networks of diverse actors, institutions, and processes that collectively promote entrepreneurial activities and startup growth (Isenberg, 2010; Mason & Brown, 2014; Stam & Van de Ven, 2021). These ecosystems are characterized by the presence of various stakeholders, including entrepreneurs, investors, corporations, universities, public sector entities, financial institutions, and support organizations, each playing critical roles to enhance overall ecosystem vibrancy (Autio et al., 2017; Brown & Mason, 2017; Spigel & Harrison, 2017). Crucial dimensions of entrepreneurial ecosystems include financial resources, accessible markets, robust physical infrastructures, supportive regulatory frameworks, skilled human capital, and an entrepreneurial culture that values risk-taking and innovation (Spigel, 2017; Colombo & Piva, 2010; Wurth et al., 2022). Effective entrepreneurial ecosystems are dynamic, adaptable, and resilient, capable of responding to evolving market conditions and technological advancements (Autio et al., 2017; Stam & Van de Ven, 2021).

### **2.2 Entrepreneurial Support Organizations**

Entrepreneurial Support Organizations (ESOs) represent specialized intermediary organizations within Entrepreneurial Ecosystems that offer targeted resources and strategic services aimed at fostering startup growth and enhancing their likelihood of survival. These organizations take various forms, including incubators, accelerators, co-working spaces, business development agencies, and innovation hubs, each providing distinct yet complementary types of support (Hausberg & Korreck, 2020; Hochberg, 2016; Clayton et al., 2018a). ESOs primarily aim to address startups' early-stage vulnerabilities by facilitating mentorship opportunities, structured training programs, and extensive networking activities, alongside providing critical access to both financial and non-financial resources (Clayton et al., 2018a; Hausberg & Korreck, 2020). Through their intervention, ESOs significantly reduce informational asymmetries between startups and external stakeholders, enhance the credibility and perceived legitimacy of young ventures, and contribute directly to the availability and efficient mobilization of key resources within entrepreneurial ecosystems (Hochberg, 2016). Consequently, ESOs play an instrumental role in promoting resilience, adaptability, and sustained growth across Entrepreneurial Ecosystem.

### **2.3 Incubators**

Incubators represent a crucial category of Entrepreneurial Support Organizations (ESOs) designed to nurture early-stage ventures by providing structured resources and tailored support services aimed at overcoming typical startup challenges (Hausberg & Korreck, 2020; Clayton et al., 2018a). Primary objectives of incubators include reducing startup failure rates, facilitating growth, enhancing entrepreneurial skills, and promoting innovation through resource provision and strategic guidance (Mian et al., 2016; Hochberg, 2016). Incubators generally offer physical facilities, mentorship, managerial training, business advisory services, and extensive networks linking startups with investors, industry experts, and potential strategic partners (Clayton et al., 2018a; Grilli & Marzano, 2023). Incubators can be categorized based on their affiliation and objectives. University-based incubators leverage academic knowledge and research capabilities to commercialize innovations and foster academic entrepreneurship (Campbell & Allen, 1987; Mian, 1997). Corporate incubators focus on accelerating

innovation aligned with the strategic objectives of their parent companies, often facilitating collaborations between startups and corporations (Bruneel & Ratinho, 2012). Public incubators generally aim to foster regional economic development, supporting ventures through subsidized resources and specialized programs targeting strategic sectors (Ferreiro-Seoane et al., 2018; Zhdanova & Milyaev, 2016).

## 2.4 Alliances and Patenting

Alliances and patenting activities constitute critical strategic resources that significantly shape startup growth trajectories and long-term sustainability. Specifically, strategic alliances conceptualized as collaborative partnerships established between independent organizations, allow startups to combine complementary assets, distribute risks, and leverage collective expertise effectively (Gulati, 1998; Das & Teng, 2000; Rothaermel & Deeds, 2006). By facilitating rapid innovation processes and accelerating market entry, these alliances grant startups access to crucial external resources, including advanced technologies, specialized industry knowledge, established market channels, and financial support. Consequently, alliances help mitigate inherent resource constraints and expedite developmental cycles, markedly enhancing startups' competitive positioning and market viability. Additionally, strategic alliances serve as critical signals of legitimacy and credibility to external stakeholders, such as investors, customers, and suppliers, thereby further bolstering the startups' potential for sustained growth (Colombo et al., 2006; Ozmel et al., 2013; Stuart et al., 1999; Gulati & Higgins, 2003).

Patenting activities represent another pivotal strategic resource, serving both to secure competitive advantage and to communicate technological capability to external stakeholders. Patents provide legal protection for intellectual property, enabling startups to safeguard their technological advancements from competitors, and facilitating the commercialization of innovations (Cockburn & MacGarvie, 2009; Hsu & Ziedonis, 2013; Mann & Sager, 2007). Beyond their direct economic benefits, patents also function importantly as signalling mechanisms to investors. Specifically, patents reduce informational asymmetries by serving as credible indicators of a startup's potential for technological innovation and market success, particularly in high-tech and knowledge-intensive sectors (Hoenen et al., 2014). However, literature suggests that the signalling strength of patents is not static; rather, it may diminish as investors accumulate information about the startup across successive financing rounds, thereby reducing the patents' incremental value as indicators of firm quality (Hoenen et al., 2014). The signalling effectiveness of patents is particularly pronounced in early investment rounds when informational asymmetries between entrepreneurs and venture capitalists are greatest, yet this effect weakens as these asymmetries lessen over time and investors rely on direct firm observations and monitoring (Hoenen et al., 2014).

## 3. Hypothesis Development

Drawing upon the insights outlined in the previous sections, incubators emerge as pivotal actors within entrepreneurial ecosystems, significantly shaping startups' growth trajectories by providing structured resources, networks, and legitimacy (Spigel, 2017; Bergman & McMullen, 2022). Consistent with existing literature (Colombo et al., 2006; Ozmel et al., 2013), we classify strategic alliances into two categories: R&D alliances, aimed at fostering technological innovation, and commercial alliances, which primarily facilitate market access.

Literature highlights R&D alliances as instrumental in enhancing startups' innovation capabilities and signalling technological competence, factors typically valued by equity investors (Baum et al., 2000; Rothaermel & Thursby, 2005; Ozmel et al., 2013). Given incubators' explicit focus on technology and innovation-driven environments, we posit that R&D alliances formed during incubation periods could further amplify startups' attractiveness to investors, thereby positively influencing their equity financing prospects. Thus, we propose:

**Hypothesis 1a:** *Startups that establish R&D alliances during their incubation period are more likely to attract additional equity financing rounds.*

Conversely, commercial alliances primarily emphasize immediate market access and revenue generation rather than technological innovation and long-term competitive advantage (Colombo et al., 2006; Rothaermel & Deeds, 2006). Due to this inherent focus, commercial alliances likely provide weaker signals regarding startups' innovative capabilities and growth potential, attributes particularly valued by equity investors. Accordingly, we suggest:

**Hypothesis 1b:** *Startups that establish commercial alliances during their incubation period do not exhibit an increased likelihood of attracting additional equity financing rounds.*

Strategic alliances influence not only the likelihood but also the timing of equity financing. Specifically, the explicit signalling of innovation capabilities inherent in R&D alliances can considerably reduce investors' perceived risk, leading to faster investment decision-making processes (Baum et al., 2000; Rothaermel & Thursby, 2005). Consequently, we hypothesize:

**Hypothesis 2a:** *Startups that establish R&D alliances during their incubation period experience accelerated timing of equity financing rounds.*

Given that commercial alliances inherently focus on market-oriented goals rather than technological advancement, they may offer weaker signals of innovation potential and thus have limited capacity to reduce investor uncertainty or expedite equity investment decisions. Consequently, we hypothesize:

**Hypothesis 2b:** *Startups that establish commercial alliances during their incubation period do not experience accelerated timing of equity financing rounds.*

Additionally, incubators support startups in establishing robust patent portfolios, which offer legally protected evidence of technological strength and innovation capability, significantly reducing investor uncertainty (Hsu & Ziedonis, 2013; Cockburn & MacGarvie, 2009). Given the structured intellectual property support typically provided by incubators, we anticipate patenting activities during incubation to positively influence equity investment prospects. Hence, we formulate:

**Hypothesis 3:** *Startups that develop extensive patent portfolios during their incubation period are more likely to attract additional equity financing rounds.*

Finally, the effectiveness of alliance formation is also dependent on the composition and size of incubator networks. According to the principle of network externalities, denser and broader networks offer enhanced resource availability, foster credibility, and facilitate knowledge spillovers, thus increasing alliance opportunities for startups (Baum et al., 2000; Ozmel et al., 2013). Therefore, we posit:

**Hypothesis 4:** *The number of startup alliances is positively correlated with the number of incubator partners.*

## 4. Methodology

### 4.1 Data Collection

The dataset constructed for this study encompasses 238 startups incubated within the European Space Agency Business Incubation Centres (ESA BICs) between 2016 and 2022. Initial data collection involved extracting startup details from the official ESA BIC website, integrating comprehensive information on equity funding rounds sourced from PitchBook, and incorporating industry-level data from Eurostat. To ensure accuracy and completeness, extensive cross-verification and manual validation were performed, involving checking startup legal names, websites, and official announcements from ESA BICs. Additional variables such as patent filings, startup age, presence of local space clusters, and characteristics of ESA BIC partners were meticulously gathered through startup websites, Wayback Machine archives, official news sources, and other credible databases.

### 4.2 Econometric Models

The empirical investigation employs three econometric models, each targeting a specific dimension of startup equity financing dynamics and network interactions within incubation contexts. Before running the models, we conducted standard diagnostic checks, including tests for multicollinearity, homoscedasticity, and normality of residuals, ensuring the robustness of our analysis. The following sections elaborate on each model's methodological framework, clearly delineating dependent variables, independent variables, control variables, and robustness checks.

#### 4.2.1 Model 1: Likelihood of Obtaining Equity Financing

The first model employs a probit regression to assess the probability of startups obtaining subsequent equity financing rounds after incubation. Probit regression model is particularly suitable for binary dependent variables, modelling the probability of an event occurring based on a set of explanatory variables. The primary objective of this model is to identify the strategic and contextual factors that significantly influence a startup's probability of obtaining follow-on equity investments.

#### 4.2.2 Dependent Variable

To assess whether startups are able to secure further financial resources after completing incubation, this model uses a binary dependent variable (*dummy\_equity\_after*) that takes the value 1 if the startup obtained an equity investment following its ESA BIC incubation, and 0 otherwise. This variable reflects the firm's ability to continue attracting external investors, often considered a signal of credibility and scalability. In the context of incubated startups, follow-on funding represents a tangible sign of validation from the market, and its occurrence may depend not only on firm-internal factors but also on network-related and ecosystem-level dynamics.

#### 4.2.3 Independent Variables

The main explanatory variables include the presence of R&D alliances (*dummy\_R&D\_alliances*), commercial alliances (*dummy\_commercial\_alliances*), and alliances with actors belonging to the ESA BIC network (*dummy\_alliances\_same\_ESABIC*). Moreover, the number of patents filed during incubation (*patents\_during*) is used to capture innovation outputs generated through the incubation process. These variables allow the model to test whether engagement in collaborative innovation or knowledge-sharing activities impacts startups' fundraising outcomes.

#### 4.2.4 Control Variables

The model includes a comprehensive set of control variables that account for prior startup conditions, incubation characteristics, and broader contextual elements. These include prior financing before incubation (*dummy\_financing*), additional incubation experiences (*dummy\_extra\_incubator*), startup age at the beginning of the ESA BIC program (*age\_startup*), and the ESA BIC's maturity (*age\_ESABIC*). Incubation duration (*year\_incubation*) is also included. The model controls for pre-existing technological capabilities through the number of patents filed before incubation (*patents\_before*). Network characteristics are captured via the number of ESA BIC partners (*alliances\_ESABIC*) and partner type composition (universities, public bodies, and industrial firms). The presence of a local space cluster (*dummy\_space\_cluster*) is added to account for spatial proximity to specialized knowledge and market actors.

#### 4.2.5 Robustness Checks

To ensure the robustness of the findings, additional probit regressions with robust standard errors were estimated. The models were also rerun after winsorizing the variables at different thresholds (1%, 5%, and 10%) and removing potentially collinear or context-specific predictors. Cross-validation techniques were employed to test model generalizability.

#### 4.2.6 Model 2: Timing of Equity Financing

The second model employs the Weibull Accelerated Failure Time (AFT) to examine factors influencing how rapidly startups secure equity funding after incubation. The Weibull AFT model is advantageous for modelling durations, particularly where the timing of events is a crucial aspect of the investigation. This approach allows estimation of whether specific factors accelerate or delay the occurrence of equity financing events, thus providing strategic insights into funding dynamics.

#### 4.2.7 Dependent Variable

The dependent variable (*time\_equity\_after*) represents the duration, measured in months, from the start of the incubation period until the first subsequent equity financing event. This measurement effectively captures the temporal dimension of funding acquisition, offering insights into the strategic and operational efficiency of startups in attracting investment.

#### 4.2.8 Independent Variables

The key independent variables in this model include the number of R&D alliances (*R&D\_alliances*) and commercial alliances (*commercial\_alliances*) formed during incubation. These variables aim to capture different strategic partnership types, reflecting how various collaborative interactions influence the visibility, perceived value, and investment readiness of startups.

#### 4.2.9 Control Variables

A consistent set of control variables is introduced, capturing both startup-specific and ecosystem-level characteristics. These include prior funding (*dummy\_financing*), participation in other incubators (*extra\_incubators*), startup age at entry (*age\_startup*), and ESA BIC maturity (*age\_ESABIC*). The length of the incubation period (*year\_incubation*) and the number of ESA BIC partners (*alliances\_ESABIC*) are also considered. To capture pre-incubation financial momentum, the time since the last equity round before incubation (*time\_equity\_before\_shifted*) is included. Lastly, macroeconomic context is controlled using industry-country GVA growth rates (*GVA\_CAGR\_industry\_country*).

#### 4.2.10 Robustness Checks

Model robustness was confirmed by evaluating alternative distributions against the Weibull distribution, examining pseudo-residuals, and testing alternative specifications for key alliance and patent variables.

#### 4.2.11 Model 3: Alliance Formation with ESA BIC Partners

The third model applies probit regression to explore the "bridging effect" assessing specifically how the structural characteristics of ESA BIC networks influence startups' likelihood of forming alliances within their host ESA BIC's partner network. This analysis provides insights into the network-driven dynamics of collaboration and resource access within incubation contexts.

#### 4.2.12 Dependent Variable

The dependent variable (*dummy\_alliances\_same\_ESABIC*) is a binary indicator reflecting whether a startup forms at least one alliance with partners officially affiliated with its ESA BIC. This measure evaluates the effectiveness of incubator networks in fostering internal collaborative ties.

#### 4.2.13 Independent Variables

The independent variables focus on structural characteristics of the ESA BIC partner network, including the total number of partners (*alliances\_ESABIC*) and the presence of specific types of partners such as universities (*dummy\_university\_alliances\_ESABIC*) and public organizations (*dummy\_public\_alliances\_ESABIC*). These variables enable an examination of how both network density and partner diversity influence startups' alliance formation behaviors.

#### 4.2.14 Control Variables

Several startup-specific and incubation-related characteristics are controlled for, including previous equity financing (*dummy\_equity\_before*), previous support from other incubators (*dummy\_extra\_incubator*), and prior funding received (*dummy\_financing*). Age of the startup and the incubator at the moment of entry (*age\_startup*, *age\_ESABIC*), as well as the incubation duration (*year\_incubation*), are included. Patent filings before and during incubation (*patents\_before*, *patents\_during*) account for innovation capacity. A dummy for the presence of local clusters (*dummy\_space\_cluster*) and macroeconomic trends via (*GVA\_CAGR\_industry\_country*) are also included.

#### 4.2.15 Robustness Checks

Robust probit models were employed, and sensitivity checks were conducted by testing different levels of winsorization (5%, 1%) and re-estimating the model after excluding potentially endogenous predictors. These checks confirmed the reliability of the main results.

## 5. Results

The following tables present comprehensive results for the three econometric models described in the previous methodological section. Table 1 summarizes the probit regression analysis examining the likelihood of obtaining additional equity financing rounds. Results highlight significant positive impacts of R&D alliances, additional incubation experiences, alliances with university partners, the presence of a local space cluster, and industry-country growth rates, alongside significant negative associations with patents filed during incubation and startup age. Table 2 details the outcomes of the Weibull Accelerated Failure Time (AFT) model, indicating that forming R&D alliances, obtaining prior financing, additional incubation experiences, higher incubator maturity, longer

incubation periods, and a greater number of ESA BIC partners significantly accelerate the timing of equity funding. Conversely, longer intervals since previous financing rounds delay subsequent funding. Lastly, Table 3 illustrates the probit regression results related to the "bridging effect" revealing that the number of ESA BIC partners, prior financing, additional incubator experiences, and patents filed during incubation positively influence alliance formation with ESA BIC partners, whereas older startup age, higher incubator maturity, and longer incubation periods negatively impact this likelihood.

**Table 1: Model 1 - Probit Regression - Likelihood of Additional Equity Financing.**

Variable	Coefficient	Std. Error	p-value
<i>dummy_R&amp;D_alliances</i>	1.57	0.59	0.008**
<i>dummy_commercial_alliances</i>	0.41	0.50	0.414
<i>patents_during (sqrt)</i>	-1.46	0.66	0.027**
<i>dummy_financing</i>	0.18	0.66	0.780
<i>dummy_extra_incubator</i>	1.50	0.45	0.001**
<i>age_startup (sqrt)</i>	-1.14	0.40	0.004**
<i>age_ESABIC (sqrt)</i>	0.14	0.30	0.648
<i>dummy_space_cluster</i>	1.43	0.63	0.023**
<i>patents_before</i>	-0.44	0.42	0.288
<i>year_incubation</i>	-1.47	1.17	0.206
<i>alliances_ESABIC (sqrt)</i>	-0.30	0.16	0.061*
<i>dummy_university_alliances_ESABIC</i>	1.63	0.68	0.017**
<i>dummy_public_alliances_ESABIC</i>	-0.78	0.53	0.139
<i>GVA_CAGR_industry_country</i>	2.38	0.77	0.002**
Pseudo R-squared: 0.4700			** p-value < 5%
LLR p-value: 0.0004079			*p-value < 10%

**Table 2: Model 2 - Weibull AFT (Timing of Equity Financing)**

Variable	Coefficient	Std. Error	p-value
<i>R&amp;D_alliances (sqrt)</i>	-0.35	0.11	0.001**
<i>commercial_alliances (sqrt)</i>	0.78	0.87	0.368
<i>time_equity_before_shifted (sqrt)</i>	-0.64	0.21	0.002**
<i>dummy_financing</i>	-0.28	0.08	0.000**
<i>extra_incubators (sqrt)</i>	-0.29	0.13	0.022**
<i>age_startup (sqrt)</i>	-0.17	0.11	0.130
<i>age_ESABIC (sqrt)</i>	0.52	0.14	0.000**
<i>year_incubation (sqrt)</i>	0.31	0.11	0.005**
<i>alliances_ESABIC (sqrt)</i>	0.49	0.21	0.022**
<i>GVA_CAGR_industry_country (sqrt)</i>	0.08	0.15	0.586
Final model C-index: 0.7755			** p-value < 5%
Weibull AFT AIC: 1765.08			*p-value < 10%

**Table 3: Model 3 - Probit Regression (Bridging Effect of ESA BIC Networks)**

Variable	Coefficient	Std. Error	p-value
<i>alliances_ESABIC (sqrt)</i>	0.23	0.11	0.038**
<i>dummy_university_alliances_ESABIC</i>	0.73	0.51	0.147
<i>dummy_public_alliances_ESABIC</i>	-0.10	0.30	0.750
<i>dummy_financing</i>	0.73	0.32	0.021**
<i>dummy_extra_incubator</i>	0.77	0.28	0.005**
<i>dummy_equity_before</i>	-0.19	0.32	0.549
<i>age_startup (sqrt)</i>	-0.48	0.23	0.039**
<i>age_ESABIC(sqrt)</i>	-0.38	0.16	0.021**
<i>dummy_space_cluster</i>	-0.13	0.73	0.860
<i>patents_during (sqrt)</i>	0.30	0.17	0.082*
<i>patents_before (sqrt)</i>	-0.38	0.25	0.118
<i>GVA_CAGR_industry_country (sqrt)</i>	2.55	2.41	0.290
<i>year_incubation(sqrt)</i>	-1.30	0.44	0.003**
<i>Pseudo R-squared: 0.3861</i>			** p-value < 5%
<i>LLR p-value: 2.95E-08</i>			*p-value < 10%

## 6. Discussion

The empirical analysis provides clear evidence concerning our initial hypotheses and contributes valuable insights to the understanding of startup equity financing dynamics. The hypothesis suggesting that R&D alliances formed during incubation positively influence the likelihood of obtaining additional equity financing (Hypothesis 1a) is supported by our results. The probit regression analysis indicates a significant positive relationship, consistent with existing literature highlighting the strong signalling value of R&D alliances to investors (Baum et al., 2000; Rothaermel & Deeds, 2006). In contrast, the hypothesis proposing that commercial alliances established during incubation do not increase the likelihood of securing further equity financing (Hypothesis 1b) is also supported. The analysis reveals no significant relationship, confirming prior research emphasizing commercial alliances' limited capacity to effectively signal technological innovation and long-term competitive potential to equity investors (Colombo et al., 2006; Rothaermel & Deeds, 2006). Additionally, the hypothesis predicting that R&D alliances accelerate the timing of subsequent equity financing rounds (Hypothesis 2a) is strongly confirmed by the Weibull Accelerated Failure Time analysis, demonstrating significant acceleration effects. This finding aligns with theoretical expectations regarding the role of R&D alliances in reducing investor uncertainty and speeding up investment decisions (Rothaermel & Thursby, 2005; Baum et al., 2000). Conversely, the hypothesis anticipating that commercial alliances would not accelerate equity financing timing (Hypothesis 2b) is confirmed, as no significant impact was found. This result aligns with existing perspectives suggesting commercial alliances offer limited signalling value within contexts of technological innovation (Colombo et al., 2006; Rothaermel & Deeds, 2006). Regarding patents, although the initial hypothesis proposed that patenting activities during incubation positively influence the likelihood of obtaining additional equity financing (Hypothesis 3), our findings indicate a negative effect. Patents developed during incubation negatively influenced the likelihood of securing additional equity financing. This unexpected outcome contributes to the ongoing debate regarding the role of patents, suggesting that after the initial funding round, informational asymmetries between investors and startups substantially decrease. Consequently, the signalling value of patents diminishes as investor uncertainty regarding the startup's technological capabilities and growth potential is reduced (Cockburn & MacGarvie, 2009; Hsu & Ziedonis, 2013). Finally, the hypothesis predicting that a higher number of ESA BIC partners increases the likelihood of startups forming alliances within the ESA BIC network (Hypothesis 4) is confirmed. The probit regression analysis shows a significant positive effect, emphasizing the critical role of a robust and diverse incubator network in promoting valuable partnerships. This aligns well with previous research demonstrating that denser incubator networks enhance resource availability, foster credibility, and facilitate knowledge spillovers, thereby increasing alliance opportunities for startups (Baum et al., 2000; Ozmel et al., 2013).

## 7. Conclusions

This study provides valuable insights into how incubator-facilitated alliances and patent activities influence startups' equity financing outcomes within the entrepreneurial ecosystems of ESA BICs. Specifically, our analysis underscores the significant positive impact of R&D alliances on startups' likelihood of securing equity financing and accelerating the timing of funding rounds, highlighting their strategic role as credible signals of startups' capabilities. In contrast, commercial alliances, despite their practical market-related benefits, demonstrate minimal influence on both the likelihood and timing of equity financing, indicating their relatively lower perceived innovation value among investors. Interestingly, our findings reveal a negative relationship between patenting activities during incubation and the probability of obtaining subsequent equity financing. This result confirms that the signalling value of patents may diminish as informational asymmetries between startups and investors are progressively reduced. Specifically, as investors gain deeper and more comprehensive knowledge about the startups' technological capabilities, growth trajectory, and market potential, the incremental value provided by patents as signals of quality decreases. Furthermore, the analysis empirically validates the critical role of incubator network breadth, showing that extensive and diverse ESA BIC partner networks substantially promote alliance formation among incubated startups, thereby confirming the proposed "bridging effect". From a practical perspective, these insights highlight the necessity for incubator managers and entrepreneurs to actively foster robust R&D collaborations and strategically expand incubator networks to enhance startups' attractiveness to investors. Despite these valuable contributions, the research has several limitations. Firstly, the exclusive focus on ESA BICs may limit the generalizability of findings to other sectors or incubator environments. Secondly, future research could benefit from expanding the sample size, broadening the geographical coverage, and incorporating additional factors such as alliance quality or investor characteristics. Lastly, potential endogeneity concerns, including reverse causality and omitted variable bias, suggest the need for further research employing longitudinal or experimental methodologies to strengthen causal interpretations. Addressing these limitations offers promising avenues for enhancing our understanding of entrepreneurial ecosystems and the effectiveness of incubators in supporting startup growth.

## Ethics and AI Declaration

No ethical clearance was required. AI tools were used for copy editing and proofreading.

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