Ciencias Administrativas Teoría y Praxis
Núm. 1 Año 18, Enero-Junio 2022, pp. 15-34
DOI: https://doi.org/10.46443/catyp.v21i3.490

Intellectual Capital in Global Accelerator Programs: An Empirical Analysis of Survival Probabilities in Emerging Countries

Capital Intelectual en Programas de Aceleración Global: Un Análisis Empírico de las Probabilidades de Supervivencia en Países Emergentes.

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Resumen

Esta investigación analiza cómo el Capital Intelectual (CI) inicial influye en la supervivencia de startups en programas de aceleración en países emergentes. Se confirma que los activos de CI benefician la fase inicial de estas empresas. A diferencia de estudios centrados en economías avanzadas, este trabajo destaca la relevancia del CI en mercados emergentes. Los hallazgos indican que la acumulación de conocimientos aplicables mejora la supervivencia, incluso al considerar factores internos, externos y heterogeneidad no observada. Además, los programas de aceleración con currículos estructurados y enfoque estratégico refuerzan esta ventaja. El entorno económico también desempeña un papel clave, sugiriendo la necesidad de estudios adicionales sobre la operatividad de startups y aceleradoras en distintos contextos. La investigación abre nuevas líneas para explorar los efectos mediadores y moderadores de los componentes del CI en el rendimiento, con especial atención al capital humano y las restricciones financieras. Así, se contribuye a la comprensión de los determinantes de la supervivencia de startups en economías emergentes y se abordan vacíos en la literatura existente.

Palabras Clave: *Programas Aceleradores, Desempeño de Nuevos Emprendimientos en economías emergentes, Dimensiones del Capital Intelectual.*

Abstract

This research examines the influence of initial Intellectual Capital (IC) on the survival probabilities of new ventures in accelerator programs operating in emerging countries. It confirms the beneficial impact of IC assets on startup survival during the pre-performance phase. While most existing studies focus on advanced economies, this research highlights the significance of IC for startups in emerging markets. Our findings show that IC accumulations, encompassing useful and applicable knowledge, enhance survival prospects even after accounting for potential unobserved heterogeneity and considering both external and internal influences. The study also underscores the critical role of accelerator programs with well-structured curricula, particularly those focusing on specific impact areas, in enhancing startup survival. The wider economic environment significantly influences survival

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Artículo Recibido: 15 de agosto de 2024
Artículo Aceptado: 19 de marzo de 2025

probabilities, suggesting the need for future research on the operational dynamics of startups and accelerators across different country groups. This research opens avenues for further studies on the mediating and moderating effects of IC components on performance, particularly in the context of human capital and financial constraints, thereby addressing gaps in the literature and expanding our understanding of startup survival determinants in emerging economies.

Keywords: *Accelerator Programs, For-Profit New Venture in emerging markets, Intellectual Capital Dimensions*

JEL CODE: L26, O34, C250

Introduction

The Object of Study

The importance of new businesses for regional and economic growth has been recognized since Joseph Schumpeter's 1934 work, "The Theory of Economic Development" (Del Sarto et al., 2020). Scholars, practitioners, and policymakers acknowledge that startups significantly contribute to economic expansion, job creation, and societal prosperity (Audretsch et al., 2006; Pradhan et al., 2020).

These nascent ventures face operational, competitive, resource, and planning challenges that threaten their long-term survival. Startups are especially prone to failure in their early years, with a 30% failure rate within the first two years (Santisteban & Mauricio, 2017; Picken, 2017). This risk diminishes over time (Yang & Aldrich, 2017), but factors like inexperienced management, low trust and legitimacy, and inconsistent strategy make them vulnerable in the early stages (Noboa, 2022).

The survival of new firms can be examined through three main factors: personal attributes, firm-specific characteristics, and the external environment (Brüderl et al., 1992). Various elements often challenge survival, including limited financial resources (Smilor, 1997) and an inexperienced founding team (Gruber et al., 2008).

While the existing literature on startup survival is ample, it is often limited to a single theoretical perspective, region, or industry (Andreeva & Garanina, 2016; Cressy, 1996; Gimmon & Levie, 2010; Baum & Silverman, 2004). Most studies have been conducted in advanced economies like Europe, North America, and Asia, focusing less on emerging economies (Azeem & Khanna, 2023). Empirical research primarily uses regression-based models, especially Logistic Regression Models (LR), to examine the relationship between various antecedents and outcomes, often considering internal resources and non-financial performance measures.

Given the limited scope of past research, future studies should prioritize cross-country analyses and the impact of initial conditions entrepreneurs face in emerging markets. The rise of startups in these economies and the growing body of research on startup survival present numerous opportunities for new investigations. These studies can explore the interplay between internal and external factors affecting startup survival in emerging markets. Therefore, it is essential to include emerging countries in such research endeavors.

The Impact of Initial Conditions on the Companies' Performance

Predicting new venture performance based on initial observable factors is a key interest for entrepreneurship researchers, as it can optimize resource allocation and benefit both entrepreneurs and society (Dahlqvist et al., 2000).

Startup survival has been extensively studied from various theoretical perspectives. Azeem & Khanna (2023) highlight the Resource-Based View (RBV) as the most frequently cited perspective, which serves as the basis for our study. RBV posits that a company's unique, valuable, difficult-to-replicate, and irreplaceable resources and capabilities confer a competitive edge and enhance performance (Wernerfelt, 1984; Barney, 1991). Among these resources, Intellectual Capital (IC) is particularly crucial, as it is an intangible asset closely linked to a company's strategy and longevity (Rossi et al., 2016).

Our research, grounded in Barney et al., (2001) RBV and Human Capital Theory (Becker, 1964; Mincer, 1974), emphasizes the pivotal role of individual expertise and abilities in driving economic productivity.

Consistent with Cooper et al. (1994), we argue that a company's initial financial resources and human capital are fundamental to its survival, especially for nascent enterprises (Van Praag, 2003). This perspective underscores the critical contribution of both tangible and intangible resources possessed by founding teams to the success of a startup (Strotmann, 2007).

Research Purpose

Our study focuses on startups, which are catalysts of innovation and economic growth. We aim to explore the impact of initial financial resources and Intellectual Capital (IC) on startup development during the crucial pre-seed phase. This phase involves setting business goals, identifying challenges, establishing market positioning, and formulating strategic plans (Wong et al., 2005).

Nascent enterprises often turn to accelerator programs for financial backing and expert advice at this stage (Radojevich-K & Hoffman, 2012). Our study examines the correlation between the IC contributed by the founding team—including their skills, knowledge, experience, relationships, and abilities—and the survival rate of budding for-profit ventures (Beckman & Burton, 2008).

In this context, "startups," also known as "nascent for-profit ventures," are organizations created in unstable environments to exploit new market opportunities (Davidsson & Honig, 2003). Our research aims to determine how a founder's initial IC affects these ventures' survival chances in emerging countries.

We seek to answer: In the context of emerging countries, what is the impact of a startup's IC on its economic and financial performance? This question is vital as it underscores the role of IC in determining a startup's future. This study focuses on startups in global accelerator programs, using data from the Entrepreneurship Database Program (EDP) at Emory University, part of the Global Accelerator Learning Initiative (GALI, 2020). The EDP, launched in 2013, studies the causal effects of accelerating impact-oriented ventures. It uses standardized questions that all participating accelerators incorporate in their application processes, enhancing responsiveness and allowing observation of nearly the entire pool of serious applicants. Program managers also track which applicants join their programs (Lall et al., 2020). These programs value the IC of the founders according to their selection criteria (GALI, 2021).

Most studies on startup survival focus on developed countries (Azeem & Khanna, 2023), while startups in emerging countries have not been widely analyzed. Our research addresses this gap by considering geographic and socio-economic diversity. We recognize the lack of comprehensive studies on startups in emerging economies (Andreeva & Garanina, 2016) and aim to rectify this. Our study broadens the scope by investigating the impact of IC—comprising both initial financial resources and intangible knowledge—on the growth of startups worldwide, with a particular emphasis on the pre-seed stage of accelerator programs.

This study uses a Logistic Regression Model to evaluate how different factors influence the survival probabilities of startups in our sample. This model also predicts the likelihood of a startup's success in its early stage. We aim to enhance the understanding of how IC affects the success of pre-seed startups, especially in accelerator programs. This study has implications for various stakeholders. Policymakers could use this knowledge to design policies that promote startup growth by highlighting the value of IC, creating a dynamic and prosperous startup ecosystem. Accelerator programs and venture capitalists could use this knowledge to improve their startup selection and support processes, increasing the success rate of the startups they back. Practitioners, such as startup founders and employees, could use this knowledge to focus on building and improving their IC.

The structure of the remaining sections of the study is as follows: The second section establishes the relevant literature that supports the conceptual framework and hypotheses under study. The third section discusses materials and methods, followed by the estimation results and their discussion. The validation of the proposed hypotheses substantiates the next section, and the last section addresses the practical and academic implications of the study and directions for further research.

Literature review and hypotheses statement

Our analysis investigates how a firm's founding conditions affect its performance, particularly its longevity. Various perspectives have examined this topic. Organizational Ecology suggests that firms with superior initial resources are more likely to survive through natural selection (Hannan & Freeman, 1977; Fuertes-Callén et al., 2022; Romanelli, 1989). Other research highlights the enduring impact of strategic choices made at the outset. For instance, Eisenhardt and Schoonhoven (1990) demonstrated that founding teams have a lasting influence on firm performance. Similarly, Cooper et al. (1994) found that initial financial and human capital are strong predictors of firm performance and survival. Kimberly (1979) also argued that environmental conditions, the founder's personality, and initial strategic choices significantly shape organizational behavior.

The Entrepreneurial Context

Entrepreneurship is a dynamic process involving team formation and adaptation to meet customer demands. Salamzadeh and Kesim (2015) liken business development to a life cycle, encompassing idea conception, prototype development, market entry, product sales, and job creation. Wong et al. (2005) identify the preparation for the start-up stage as the initial phase of defining emerging ventures. Bruderl and Schussler (1990) suggest that early survival signifies success, while sustained endurance indicates adaptability in later stages.

The impact of initial conditions on companies´ performance

The Resource-Based View (RBV) posits that a founder's attributes and circumstances significantly impact venture performance. Dencker et al. (2009) found that knowledge positively influences startup survival in Germany, with founders' cumulative experience enhancing knowledge integration. Research shows a varied positive correlation between talent and performance, depending on a country's macroeconomic development (Furlan, 2019; Mayer-Haug et al., 2013). Studies also demonstrate a differentiated positive impact of talent across entrepreneurial stages and economic contexts (Kerrin et al., 2017). However, these effects can be non-linear, contingent on factors like business development stages, survival duration, administrative maturity, technological orientation, funding sources, performance measures, and specific country and sector conditions (Delmar & Shane, 2006).

Human Capital Theory suggests that an individual's human capital—education, work experience, and job training—is vital for achieving organizational goals, securing a competitive edge, and enhancing financial performance (Becker, 1994; Unger et al., 2011). Gimmon and Levie (2010) applied this theory to examine how founder qualities affect the ability to attract external investment and ensure the survival of new high-tech firms. Their research underscores that a founder's managerial experience and academic credentials are more critical in attracting external investment than technological expertise.

Cooper et al. (1994) distinguished four types of initial capital: general human capital, management expertise, industry-specific knowledge, and financial capital. General human capital includes knowledge that increases productivity and access to network resources. Management expertise is tacit knowledge from previous general management experience. Industry-specific expertise, also tacit, is essential for understanding the context of suppliers, competitors, and customers. Financial capital serves as a cushion and allows strategic flexibility.

This study leverages RBV and Human Capital Theory, building on Cooper et al.'s findings, to propose that initial allowances of financial and human capital are reliable predictors of new venture survival (Van Praag, 2003).

Intellectual Capital

Intellectual Capital (IC), a concept widely acknowledged despite its lack of a precise definition (Bontis, 1998), gained prominence with the rise of knowledge-based assets. Initially, IC was quantified as the difference between market and accounting values (Brennan & Connell, 2000). The modernization of the Human Capital (HC) concept by Gary Becker in 1993 reignited academic interest in HC (Nyberg & Wright, 2015). The RBV paradigm signals a shift from physical and financial resources to intangible assets

(Spender, 1996; Abeysekera, 2021), positioning IC as a strategic resource for emerging technological ventures (Juma & McGee, 2006).

This study defines IC as an organization's intangible assets, based on Stewart's (1997) concept of IC as "packaged useful knowledge". These assets include employee knowledge, adaptability, customer and supplier relationships, brands, intellectual property, product trade names, internal processes, and R&D capabilities. These assets are not in traditional financial statements, but they create future value and competitive advantage. IC, as intangibles in financial statements, often shows values three to four times higher than their book values (Edvinsson & Malone, 1997).

The Three Dimensions of Intellectual Capital in Entrepreneurship

Bontis (1998) suggests a research framework with three dimensions of Intellectual Capital (IC): Human, Social, and Structural. This framework, which views IC as valuable interconnected elements, explains IC's dimensions (Marr & Moustaghfir, 2005). It also enables the empirical examination of IC components' impact on performance (Felício, et al., 2014).

Human capital (HC) attributes, such as education and experience, are associated with small business success (Baptista et al., 2014). Financial intermediaries and venture capital firms value entrepreneurial experience highly when assessing startups, using managerial skills and experience as primary selection criteria (Piva & Rossi-Lamastra, 2018). HC is crucial in knowledge-based companies (Bosma et al., 2004), and the value of specific human capital is evident in new business founders' entrepreneurial experience, especially among habitual entrepreneurs who have previously founded at least one business (Baptista et al., 2014).

Relational Capital (RC), or Social Capital (SC), is an intangible asset that values relationships. It involves cultivating, preserving, and enhancing quality relationships with entities such as individuals, organizations, or groups that can impact business performance (Welbourne & Pardo-del-Val, 2009).

RC encompasses the knowledge derived from relationships with stakeholders like customers, suppliers, and industry associations. This knowledge influences the organization, adds value, and strengthens its operations. These relational networks serve as crucial business resources, enabling entrepreneurs to tap into resources otherwise unavailable within their venture (Bandera & Thomas, 2018; Burt, 2017).

A significant aspect of SC is the reputation, experience, and contacts facilitating entrepreneurs' financing access (Baum & Silverman, 2004). New ventures can improve their financing conditions through effective communication with investors and customers (Gardner & Avolio, 1998).

Structural Capital (STC) is recognized in the literature as the company's internalized knowledge. It pertains to the organizational structure and systems that bolster employee productivity (Edvinsson & Malone, 1997). It encompasses all non-human intangible assets of an organization. This includes culture, philosophy, internal processes, information systems, databases, organizational charts, process manuals, software, planning, strategies, routines, technology, and intellectual property rights such as patents, trademarks, and copyrights. The value of these assets to the company surpasses their material worth (Abdulaali, 2018). Intellectual property is often the only source of competitive advantage for knowledge-based companies McGee & Dowling, 1994). Structural capital focuses on organizational efficiency and its value derives from internal infrastructure, processes, and culture on the one hand and from the adaptative and development strategies adopted by the company on the other (Brennan & Connell, 2000).

Impact of intellectual capital on the performance of start-ups. Empirical evidence.

The Resource-Based View (RBV) theory highlights Human Capital (HC) as a crucial determinant of firm performance (Barney et al., 2001). HC, characterized by knowledge, is both valuable and challenging to replicate. Studies have demonstrated a positive correlation between knowledge-based intangibles and performance (Kellermanns et al., 2016; Davidsson & Honig, 2003).

Coff (1997) provided moderate evidence supporting HC as a strategic resource. Contradictory findings could be due to factors such as path dependence, the inability of cross-sectional studies to capture delayed effects, and the efficiency of the labor market for specific forms of HC (Coff, 1997).

Both general and specific forms of human capital have been identified as influential in a startup's performance (Cressy, 1996; Gimmon & Levie, 2010). Bosma et al. (2004) found that investments in general, industry-specific, and entrepreneurship-specific human capital significantly enhance startup survival, profitability, and employment.

Research is scarce on the impact of initial intellectual capital on the performance and survival of new ventures in emerging countries, particularly during the pre-seed phase and within high-impact acceleration programs. Most existing studies focus on startups in developed countries and specific industries (Azeem & Khanna, 2023). This gap necessitates further validation across a broader spectrum of startups, highlighting the importance of our study.

Intellectual capital, comprising knowledge, skills, and experience, is vital to a startup's success, especially during the pivotal pre-seed phase. Current research insufficiently covers this aspect, particularly for high-impact startups and those in acceleration programs. Most studies center on startups in developed countries, creating a knowledge void about startups in diverse geographical contexts. They also tend to focus on specific sectors, failing to capture the broader startup ecosystem (Andreeva & Garanina, 2016). Therefore, it's crucial to broaden the research scope to include startups from various locations, sectors, and development stages for a holistic understanding of intellectual capital's impact on startup performance and longevity.

The nature of the problem under study

Our research focuses on startups, the drivers of innovation and economic growth. We aim to investigate the impact of a startup's initial financial resources and intangible assets, collectively known as Intellectual Capital (IC), on its development during the crucial pre-seed phase. This phase involves founders setting business objectives, identifying potential hurdles, establishing market positions, and devising strategic plans.

We particularly examine new ventures in emerging markets that seek financial aid and expert advice through accelerator programs. Our goal is to explore the correlation between IC—encompassing the founding team's skills, knowledge, experience, relationships, and capabilities—and the survival rate of nascent for-profit ventures.

In this study, we define "start-ups" and "nascent for-profit ventures" as organizations formed in volatile environments to exploit new market opportunities. Our main objective is to determine how a founder's IC affects these ventures' survival prospects.

Our key research question is: "How does a start-up's intellectual capital stock influence its economic and financial performance in emerging countries?" Answering this question is vital, as it underscores the critical role of IC in shaping a start-up's future.

Hypothesis Statement

Our research focuses on startups in accelerator programs within the EDP sample, emphasizing the role of Intellectual Capital (IC) provided by founders. We particularly examine emerging markets, hypothesizing that this initial IC—primarily intangible assets—enhances startups' survival probabilities during the pre-performance phase. This IC is believed to offer a competitive edge, facilitating business navigation, investment acquisition, and overall survival. The findings aim to guide founders, investors, and policymakers in creating effective support programs for emerging ventures.

To validate our hypothesis, we utilize a Logistic Regression Model. This model quantifies the impact of several factors on the survival probabilities of startups in our sample and predicts their success likelihood during the critical pre-performance phase.

We aim to deepen the understanding of Intellectual Capital (IC) in driving startup success, particularly within accelerator programs in diverse geographical and socio-demographic contexts of emerging markets. The findings could significantly impact founders, investors, and policymakers, aiding in the design of programs that effectively support and nurture emerging ventures.

By ensuring startups are equipped with the necessary resources and enriched with appropriate skills and knowledge from the outset, we can significantly enhance their chances of success and longevity in the competitive business landscape.

Materials and methods

This study examines the impact of initial Intellectual Capital (IC) intangibles on the survival of startups in emerging countries during their pre-performance phase. For this purpose, the startups analyzed were part of a subset that applied to accelerator programs and were sourced from the Entrepreneurship Database Program (EDP) using survey data.

The Sample

EDP Characteristics

This study analyzes data from a global cohort of entrepreneurs who applied to impact-focused accelerators between 2013 and 2019. The data, collected by Emory University's Entrepreneurship Database Program (EDP), includes application details and biannual follow-up survey results. After removing duplicates and incomplete surveys, the EDP compiled a dataset of 14,457 new for-profit ventures. These ventures applied to approximately 370 programs run by over 130 organizations, with half being based in the United States, Mexico, India, and Kenya. For this study, we focus on a subset of 4,106 ventures (28.4% of the total) that operate in countries classified as upper-middle-income by the World Bank, which we define as emerging countries.

The EDP collected data at the application stage and a year later from both successful and unsuccessful applicants. The surveys, split into two sections, contain 91 questions. The initial section includes contact information, entrepreneurship details, impact metrics, operating model, financing, founding partners' characteristics, and understanding of new venture accelerators' benefits. The follow-up section gathers information about entrepreneurship goals, impacts, financial and operational details, financing, and involvement in new venture accelerator programs. The application data offers preliminary insights into the ventures, founding teams, and pre-program performance.

Key issues for ventures in the initial EDP sample

Our analysis of the EDP sample, which includes 14,457 for-profit ventures from 164 countries, reveals a strong social orientation and success biases. Ventures that have been operational for at least three years show a survival rate of 31% at the time of application, with over half generating revenue and 78% expanding their workforce beyond the founding members. Notably, 58% of these companies operate on proprietary technology.

About one-third of these ventures have secured external equity investment, while a quarter have taken on debt for startup expenses. Philanthropic contributions support a larger portion. Ventures led by female founders are less likely to secure equity investments but have a higher likelihood of having positive revenues in the preceding year. Over 10% of the ventures in the sample are directed by women.

Ventures led by experienced entrepreneurs or those with previous company founding experience tend to attract more equity investments and report revenues and employees in the preceding year. Similarly, ventures with founders who hold patents, copyrights, or trademarks also show a higher tendency to attract equity investments and report revenues and employees in the preceding year.

However, as expected, the sample may exhibit a selection bias, as program selectors often favor ventures with more established records (Hallen et al., 2020). Participants in these programs are significantly more likely to report revenues in the preceding year (GALI, 2020; GALI, 2021).

Procedures, variables, and models

We performed an Exploratory Factor Analysis (EFA) to examine the initial operational conditions of startups in our dataset. This analysis accounted for both country and startup conditions. We aimed to understand the interplay between specific economic conditions, the venture's operations, and the initial distribution of founders' intangible intellectual capital. Following the work of Bontis (1998) we sought to identify these factors in our dataset and evaluate their impact on the startups' survival probabilities.

We chose thirteen variables from two primary sources: the World Bank Development Indicators (WDI) and the Entrepreneurship Data Program at Emory University (EDP). The WDI supplied four variables that mirror the economic conditions of each country, including broadband subscriptions, control of corruption, rule of law, and internet usage as a percentage of the population (World Bank, 2023). The EDP provided nine variables associated with the initial allocation of founders' intellectual capital intangibles. These variables included factors like the founders' previous for-profit experience, the venture's social media presence, and ownership of patents, inventions, copyrights, and trademarks. Table 1 presents the descriptive statistics for these variables.

Table 1

Descriptive Statistics for Variables in the Principal Components Calculations

Factorable Variables	Type	Mean	Std. Deviation
Hast Twitter Account (Y/N)	Binomial	0.40	0.49
Has LinkedIn Page (Y/N)	Binomial	0.31	0.46
Invention Based Model (Y/N)	Binomial	0.58	0.49
Has Patents (Y/N)	Binomial	0.14	0.35
Has Copyrights (Y/N)	Binomial	0.14	0.34
Has Trademarks (Y/N)	Binomial	0.34	0.47
Broadband subscriptions (per 100 people)	Numeric	14.27	13.01
Rule Law	Numeric	0.21	0.94
Corruption	Numeric	0.03	0.97
Internet (% population using the Internet)	Numeric	54.87	27.75
F1FPEXP (Has FP Experience)	Binomial	0.69	0.46
F2FPEXP (Has FP Experience)	Binomial	0.57	0.50
F3FPEXP (Has FP Experience)	Binomial	0.55	0.50

Notes: N: 14,457. Source: Own Elaboration

The analysis identified five primary factors (Table 2): F1 Country Context (economic, infrastructure, and legal conditions), F2 Specific Human Capital (founders' entrepreneurial experience), F3 Social Capital (social networks), F4 Structural Capital (patents or invention-based models), and F5 Market Rights (trademarks or copyrights). While product innovation often results in patents and copyrights, the analysis initially differentiated between Structural Capital and Market Rights. However, these two components can be associated with Organizational Capital, which includes copyrights, patents, procedures, rules, and decision-making aids (Abdulaali, 2018).

The test results confirm the suitability of the factor analysis. The Composite Reliability Indices exceed the recommended threshold of 0.7. The Kaiser-Meyer-Olkin measure, which evaluates the sample's adequacy, achieved a value of 0.70, surpassing the suggested minimum of 0.6. This suggests that the sample is appropriate for factor analysis. Bartlett's test for sphericity was statistically significant, with a p-value less than 0.001. The five components extracted, detailed in Table 2, account for 70% of the total variance. Notably, Factors 2 through 5 align with the IC classification criteria according to existing literature.

Table 2

Exploratory factor analysis (N=14,457)

Source	Label/explanation	F1 Country Context	F2 HCS	F3 SC	F4 STC	F5 Market Rights
WB	Broadband subscriptions (per 100 people)	0.95				
WB	Control of corruption (WB estimate)	0.95				
WB	Rule of Law (WB estimate)	0.94				
WB	Internet (% population using the Internet)	0.89				
Emory	Founder 1 For Profit Experience (Y/N)		0.80			
Emory	Founder 2 For Profit Experience (Y/N)		0.73			
Emory	Founder 3 For Profit Experience (Y/N)		0.72			
Emory	Venture has a LinkedIn Page (Y/N)			0.84		
Emory	Venture has Twitter Acct (Y/N)			0.83		
Emory	Venture has Patents (Y/N)				0.80	
Emory	Venture has an Invention-Based Model (Y/N)				0.77	
Emory	Venture has Copyrights (Y/N)					0.81
Emory	The venture has Trademarks (Y/N)					0.73
	Eigenvalues	3.72	1.90	1.38	1.21	1.01
	Variance	28.49	14.62	10.60	9.31	7.70
	Cumulative Variance	28.49	42.87	53.47	62.78	70.48
	Composite Reliability Index	0.96	0.80	0.82	0.76	0.75

Notes: For interpretative purposes, variables with factor loadings below 0.5 were not included in the report. Extraction method: Principal component analysis. Rotation Method: Varimax with Kaiser normalization. Source: WB = World Bank Development Indicators; Emory = Emory Entrepreneurship Database Applications Surveys. Source: Own Elaboration

Variables in the Logistic Regression Model

The two most frequently used non-financial startup performance measures are survival (Brüderl, 1998; Mas-Verdú et al., 2015; Wamba et al., 2017; Adams et al., 2019), and growth (Haeussler et al., 2019; Vanderstraeten et al., 2016). To provide empirical validation for our research question and working hypotheses, we selected Survival as our dependent variable (DV), a binomial variable that takes the value 1 if the startup remains in operation three years after its inception and zero otherwise (Hyytinen et al., 2015).

Regarding our predictive variables, we focus on the influence of the founding teams' IC intangibles on the startups' likelihood of survival, as categorized by three types: human capital, organizational or structural capital, and social capital (Bontis, 1998; Wang & Chang, 2005; Yang & Lin, 2009).

Our Logistic Regression model integrates the initial Intellectual Capital endowments, utilizing principal components extracted from an Exploratory Factor Analysis (Aguilera et al., 2006). The resulting variables are "F2 SHC Experience", which reflects the founding team's for-profit venture experience; "F3 SC Media Presence" (Bandera & Thomas, 2018), indicating the entrepreneur's network via LinkedIn and Twitter (Song & Vinig, 2012), and two components, "F4 STC Innovation" and "F5 Market Rights" (Alvarez-Salazar &

Seclen-Luna, 2023), related to the venture's Structural or Organizational Capital, covering aspects like intellectual assets, databases, organizational culture, structure, patents, and trademarks (Abdulaali, 2018).

New business survival depends on three key categories: personal, business-specific, and environmental factors (Brüderl et al., 1992). To study the impact of a venture's initial Intellectual Capital (IC) endowment, we consider the inclusion of various factors such as external economic conditions, team dynamics, and venture specifics. Recognizing their influence on survival probability, we include these factors as control variables in our analysis.

The "F1 Country Context" factor includes country-specific variables (Economic Context) derived from World Bank Indicators (WBI). These variables reflect the national economic environment faced by startups.

To examine the impact of alleviating financial constraints, which indirectly reflects the quality of the founder's team on survival probabilities (Fuertes-Callén et al., 2022; Lee & Zhang, 2011; Wamba et al., 2017), we include the categorical variable "Has Debt." This variable is coded as follows: 0 indicates that the venture did not receive any debt financing; 1 indicates that the venture obtained debt financing either at its inception or in the year following the application; and 2 signifies that the venture secured financing on both occasions. The "Has Debt" variable is crucial for understanding how financial constraints and access to debt financing impact the survival probabilities of startups. The presence of debt financing can indicate a startup's financial health and its ability to secure external funding, which positively influences survival probabilities. Access to debt financing provides necessary resources for growth, operational costs, and financial challenges, enhancing survival chances, especially in early stages. It also indirectly reflects the quality and credibility of the founder's team, as lenders typically assess the team's experience, skills, and business plan before extending credit. Additionally, debt financing offers operational flexibility, allowing startups to make strategic investments and respond to market changes more effectively, which is crucial for long-term survival and success.

Business accelerators significantly contribute to the facilitation of new venture creation. Start-ups seek top-tier accelerators to expedite their developmental journey (Salamzadeh & Markovic, 2018). These accelerators provide early-stage funding and essential mentorship, driven by their confidence in the startup's potential, personal interest in the concept, or admiration for the entrepreneurial team (Radojevich-Kelley & Hoffman, 2012). The characteristics of accelerator programs are known to influence venture performance. Although we cannot explicitly measure specific accelerator characteristics, we will account for program-specific unobserved heterogeneity in our subsequent analyses, thereby indirectly accommodating program differences.

The EDP examines two key variables related to accelerator program characteristics: participation, which refers to ventures that completed the program (GALI, 2021), and the program impact area, indicating whether the program has a specific impact area (Lall, Chen, & Roberts, 2020). Additionally, the analysis includes the use of an impact measure, specifically the B Lab GIIRS (Global Impact Investing Rating System), which assesses the social and environmental impact of companies and funds. Impact measures, such as the B Lab GIIRS, are crucial for startup survival as they assess the social and environmental impact of companies. These measures help startups attract impact investors, enhance their credibility, and align with sustainable business practices, leading to increased funding opportunities, customer loyalty, and long-term success.

Table 3 presents the descriptive statistics for the variables included in the logistic regression model.

Table 3

Descriptive Statistics for Variables in the LR Model

Source	Variable/Label	Type	Mean	Std. Dev.	Min.	Max
EDP Coded	DV Success (Survival)	Binomial	0.3	0.46	0	1
EDP Factored	F2 SHC (Experience)	Numeric	0.28	1.00	-3.09	1.81
EDP Factored	F3 SC (media presence)	Numeric	-0.19	0.97	-3.61	2.68
EDP Factored	F4 STC (Innovation)	Numeric	0.195	1.00	-2.57	4.50
EDP Factored	F5 (Market Rights)	Numeric	-0.24	0.96	-4.47	2.72
WBI Factored	F1 Country Context	Numeric	-0.04	0.37	-3.48	1.20
EDP Coded	Has Debt	Categorical	0.19	0.54	0	2
EDP Survey	participated# program impact area					
	0 1	Binomial	0.27	0.44	0	1
	1 0		0.14	0.35	0	1
	1 1		0.05	0.23	0	1
EDP Survey	use impact measure	Binomial	0.06	0.25	0	1

Notes: Binomial Variables are assigned a value of 1 when present and 0 when absent. For Debt Presence, the categorical values are assigned as follows: a value of 1 is given if an investment is present either at inception or at the end of the last calendar year, a value of 2 is given if an investment is present at both inception and the end of the last calendar year, and a value of 0 is given in all other cases. Source: Own Elaboration

Estimation Techniques

For the validation of our hypothesis, we use a Logarithmic Regression model (LR) which is considered suitable when the response variable is dichotomous, and the effect of predictors is linear. Our LR Model relies on the reduced form model: $y\_i = \pi\_i + \varepsilon\_i, \quad i = 1, \dots, n$, Where π_i is the expected value of $\mathcal{Y}$ given $(\mathcal{X}\_1 = x\_i1, \ \mathcal{X}\_2 = x\_i2, \dots, \mathcal{X}\_p = x\_ip)$ (Aguilera et al., 2006), In this case $\mathcal{Y}$ is the probability of survival as a function of a set of available information about the ventures. The analysis of the effects of the dimensions of IC over of success as they´re operationalized requires a technique that adequately manages the probabilities of attaining a successful performance. Logistic regression (LR) is the appropriate technique when dealing with the relationship between a dichotomous outcome and a set of explanatory variables. When a LR model estimates a binary response outcome, we assume that its logit transformation has a linear relationship with the predictor variables. Thereby the relationship between the response variable and its covariates is interpreted through the odds ratio from the parameters of the models. Measured in odds ratio (OR), if the parameter in the regression is positive, the OR>1, and if its negative OR<1, indicating the effect of the IV over the chances of survival. The logistic regression model can be written as in equation 1:

$$Log(\pi(X\_1, X\_2, \dots, X\_k)/(1 - \pi(X\_1, X\_2, \dots, X\_k))) = \beta\_0 + \beta\_1 X\_1 + \beta\_2 X\_2 + \dots + \beta\_k X\_k$$

Equation 1: *LR Model*

The binary response variable $\mathcal{Y}$ being either 0 or 1, and $E(\mathcal{Y}\_1 | X\_1i, X\_21, \dots, X\_k1)$.Then $\pi(X\_1, X\_2, \dots, X\_k)$ is interpreted as $P(\mathcal{Y} = 1)$ for a given combination of values of the predictor variables $X\_1, X\_2, \dots, X\_k$. We express the model as: $\mathcal{Y} = \pi(X\_1, X\_2, \dots, X\_k) + \epsilon$, where ϵ, could only assume two values depending on whether $\mathcal{Y}$ is equal to zero or one. The left-hand side of equation (1) is the log

odds ratio, that is, the logarithm of the odds that $\mathcal{Y}$ will equal 1, for a given combination of the predictor variables. Our estimation uses the Maximum Likelihood (ML) method.

The Proposed Model

To validate our hypothesis, the following logistic regression model (LR) is proposed.

$$\Pr(Survival) = b1\text{F2 SHC} + \text{b2F3 SC} + \text{b3F4 STC} + \text{b4F5 Market Rights} + \text{b6F1 Country Context} + \text{b7HasDebt} + \text{b8participated\# program impact area} + \text{b9use imapct measures} + \text{const}$$

Equation 2: *Proposed LR Model*

Results from the LR model and discussion

Academic literature identifies various factors influencing the survival of new companies, operating in emerging markets, in their pre-performance phase (Strotmann, 2007; Santisteban & Mauricio, 2017). Our research focused on understanding the impact of recognized intangible Intellectual Capital (IC) dimensions on this survival. We integrated control variables into our Logistic Regression (LR) model to mitigate potential confounding effects. This method aimed to distinctly assess the influence of IC dimensions on Survival Probabilities, thus facilitating the effective validation of our working hypothesis.

Table 4 shows the results of the Logistic Regression (LR) Model, which we used to test our hypothesis. This hypothesis proposes a positive link between the initial Intellectual Capital of the founding team and the performance of the startups operating in emerging countries in our sample.

Table 4
LR Model Results for Startups in Emerging Countries

(DV) Survival	Odds Ratio	Robust SE.	z	P>z	[95% Conf	Interval]
IC Components						
F2 SHC (Experience)	1.09	0.04	2.37	0.018**	1.02	1.17
F3 SC (media presence)	1.13	0.05	3.10	0.002**	1.05	1.23
F4 STC (Innovation)	1.31	0.06	6.32	0***	1.20	1.42
F5 (Market Rights)	1.11	0.04	2.73	0.006***	1.03	1.20
Control Variables						
The Business Environment						
F1 Country Context	2.10	0.31	4.96	0***	1.57	2.81
Finances						
Has Debt	2.01	0.13	11.01	0***	1.77	2.27
Program Characteristics						
Interaction Effects						
Participated #Has program impact area						
0 1	1.26	0.11	2.62	0.009***	1.06	1.49
1 0	0.97	0.11	-0.24	0.81	0.78	1.21
1 1	2.19	0.33	5.17	0***	1.62	2.94
use impact measures	1.08	0.17	0.47	0.64	0.79	1.47
constant	0.31	0.02	-21.36	***	0.28	0.35

Notes: ***p < .01, **p < .05, *p < .10; Robust SE = Robust Standard Errors
Source: Own Elaboration

The resulting LR Model

The model's results, expressed in terms of odds ratios (exp[b]), are as follows:

$$\Pr(Survival) = 1.09\text{F2 SHC} + 1.13\text{F3 SC} + 1.31\text{F4 STC} + 1.11\text{F5 Market Rights} + 2.10\text{F1 Country Context} + 2.01\text{Has Debt} + 2.19(1.\text{participated\# 1. program impact area} + 1.26\text{ program with impact area} + \text{const}$$

Equation 3: Estimated LR Model

The logistic regression model demonstrates a good fit with the data, as indicated by the Wald chi2(10) value of 298.93 (p-value = 0.0000), suggesting overall statistical significance. The model explains approximately 7.04% of the variance in the dependent variable (Success), as reflected by the Pseudo R2 value. Key variables significantly impacting startup survival include Has_Debt (Odds Ratio = 2.0074, p-value = 0.000), (F1) Country Context (Odds Ratio = 2.0986, p-value = 0.000), (F2) SHC (Odds Ratio = 1.0911, p-value = 0.018), F3 SC (Odds Ratio = 1.1323, p-value = 0.002), F4 STC (Odds Ratio = 1.3101, p-value = 0.000), and Market Rights (F5), (Odds Ratio = 1.1116, p-value = 0.006). Interaction terms show that participating in a program with a specific impact area significantly increases the odds of success (Odds Ratio = 2.1852, p-value = 0.000).

The analysis of odds ratios reveals several significant variables impacting startup survival. At the 0.01 significance level, Innovation (F4 STC), Market Rights (F5), (F1) Country Context, Has_Debt, and the interaction effect of participating in a program with a specific impact area (1 1) are significant. At the 0.05 significance level, Experience (F2 SHC) and Media Presence (F3 SC) are significant. Additionally, the interaction effect of participating in a program without a specific impact area (0 1) is significant at the 0.01 level. These findings underscore the importance of innovation, market rights, country context, financial health, and targeted accelerator programs in enhancing startup survival.

By employing a Logistic Regression (LR) model, we were able to measure the influence of various independent variables on the survival probabilities of startups in the EDP sample. This also resulted in a predictive model that can be used to determine the likelihood of success for a startup during its pre-performance phase. The model correctly classified 72.4% of the companies that survived. It had a sensitivity of 18.83%, indicating its ability to correctly identify successful startups, and a specificity of 94.97%, reflecting its ability to correctly identify unsuccessful startups. The probability cutoff point was approximately 0.28. The area under the ROC curve (0.6776) indicates a fair level of discrimination between successful and unsuccessful startups

Discussion

Our analysis underscores the pivotal role of project financing in shaping startups' survival probabilities. Specifically, easing financial constraints significantly increases a startup's survival odds in the pre-performance phase. Cooper et al. (1994) demonstrated that the total amount of capital invested by the time of the first sale positively impacts the growth and survival of new ventures. The literature widely acknowledges the significance of startup capital for fledgling firms in their early stages (Cabral & Mata, 2003; Figueroa-Armijos, 2019). Our empirical evidence suggests that the most impactful control factor is the easing of these financial constraints. During the pre-performance phase, ventures that have procured financing through debt agreements (Has Debt) at inception, in the preceding year, or both, demonstrate a 100% increase in survival likelihood (odds ratio 2.1) compared to those constrained by external financing. These results align with other studies that recognize the positive effect of debt financing on longer survival times and higher revenues (Cole, 2018).

Our research highlights the significant role of accelerator programs, particularly those with a well-structured curriculum, in enhancing the survival probabilities of startups. We found a non-linear interaction effect between variables indicating program completion and focus on a specific impact area. Notably, when both indicators are present, the survival probabilities of the venture increase by 119%. This is consistent with the findings of Venâncio and Jorge (2022), who found that accelerated startups have higher external

equity ratios than non-accelerated startups, enhancing their survival and growth probabilities. These findings also relate to the positive effect of the entrepreneurial focus of EDP's participating accelerator programs on high-impact projects (Lall et al., 2020; GALI, 2021). The use of impact measures increases the probabilities of survival by 8%, consistent with the studies of Silva et al. (2022).

The study reveals that the wider economic environment, as measured by WDI variables, increases survival probabilities by 110%. While emerging countries are well-represented in the sample, the EDP primarily reflects the entrepreneurial ecosystem in developed nations, particularly the United States. This finding highlights the significant influence of the overall economic context, suggesting that future research should explore the operational dynamics of startups and accelerators across different country groups.

After evaluating the influence of both external and internal variables from the EDP sample, we now turn our attention to the impact of initial IC inventories on startup survival probabilities. These inventories encompass three dimensions: Human Capital, Social Capital, and Structural or Organizational Capital. Our primary focus is to validate, in our sample, the hypothesis that the initial intangible IC assets of founding teams enhance survival probabilities during the pre-performance phase.

According to our estimates, the SC assets identified by the F3 SC (media presence) factor increase survival probabilities by 13%. This result is generally consistent with the studies of Bandera and Thomas (2018) and specifically aligns with the findings of Song and Vinig (2012), who associate positive performance in the initial stages of ventures with expanded social media networks, particularly on LinkedIn and Twitter.

The Structural or Organizational Capital (STC) identified as F4 STC (Innovation) in the EDP sample, as indicated by variables such as patent ownership and the adoption of invention-based models, increases survival probabilities by 31%. This finding aligns with existing studies and the fact that most ventures in the sample (58%) adopt an innovative-based business model (GALI, 2020). It also corresponds with the natural selection bias of acceleration programs in our sample (Radojevich-Kelley & Hoffman, 2012), aligning with the idea that most accelerators want concepts that have large upside potential that can be scaled to meet national or global demand (Hallen et al., 2020).

In line with the F5 factor (Market Rights), owning copyrights and trademarks enhances a venture's survival chances of 11%. This aligns with Abdulaali's (2018) findings, which highlight the positive impact of structural capital components on survival. It also reflects the sample composition, where 33% of the ventures studied possess trademarks and 13% have copyrights.

The founding team's experience in creating previous for-profit ventures significantly influences survival probabilities, increasing them by 9%. Prior studies have highlighted the capabilities that founders bring to a venture due to their previous knowledge and experience, such as education and industry experience (Bosma et al., 2004; Brüderl et al., 1992; Geroski et al., 2010).

After incorporating control variables, empirical evidence validated the general working hypothesis, demonstrating the positive impact of the three dimensions of Intellectual Capital (IC) as recognized in the existing literature and identified in the EDP sample. These dimensions, represented by the intellectual capital assets of the founding teams, significantly influence survival probabilities during the pre-performance phase.

Our findings suggest several implications for accelerator programs. First, accelerators could refine their selection criteria to prioritize startups with strong intellectual capital (IC), enhancing the likelihood of selecting ventures with higher survival rates. Tailored support services, such as specialized training and mentorship, could further develop the IC of participating in startups. Effective resource allocation, focusing on educational workshops, can also be crucial. Additionally, adopting new performance metrics to track the development of founders' skills and knowledge over time could better capture the impact of IC on startup success. Accelerators might also advocate for policies supporting IC development and consider expanding their programs to emerging markets, thereby fostering a more inclusive global startup ecosystem.

Conclusions

This research builds on previous studies to examine the influence of initial Intellectual Capital (IC) on the survival probabilities of new ventures in accelerator programs operating in emerging countries. It confirms the beneficial impact of IC assets on their survival, a crucial success indicator for new ventures in the pre-performance phase, as highlighted in broader contexts by Unger et al. (2011) and Sardo and Serrasqueiro (2019).

While most existing studies on startup survival have been confined to advanced economies and have employed a single theoretical approach (Azeem & Khanna, 2023), this research bridges the gap by highlighting the significance of initial IC for startups in impact accelerator programs in emerging countries. It shows that these IC accumulations, encapsulating useful and applicable knowledge identified in surveys, enhance the survival prospects of startups in the EDP-focused sub-sample. This enhancement remains even after accounting for potential unobserved heterogeneity and considering both external and internal influences on startup operations. By examining the role of initial IC in a diverse range of early-stage ventures in acceleration programs, the research expands our understanding of startup survival determinants and broadens its scope to encompass emerging economies and diverse accelerator programs.

Our findings are not just a result but a starting point for further research. Future studies using the EDP information will analyze the impact of knowledge intangibles on survival probability under specific conditions, including socio-demographic coverage, heterogeneity of acceleration programs, founding team composition, diversity, operational sectors, size, funding source diversity, and differentiated effects. They will also consider the contribution to the development of the countries where they operate, and the innovation processes generated from their operation.

Additionally, there is a significant opportunity for complementing this research. Due to the scarcity of studies analyzing the mediating and moderating effects of IC components on performance, future research will consider these complementary effects (Delmar & Shane, 2006), particularly the relationships between human capital and financial constraints as suggested by the research of authors such as Unger et al. (2011) and Salamzadeh et al. (2023). The lack of interaction studies in this area highlights a gap in the literature, presenting a valuable avenue for future exploration to better understand these dynamics.

Implications of the study

By implementing these practical strategies, startup founders can better navigate the challenges of the initial stages and improve their chances of long-term success. Our study underscores the importance of early recognition and investment in key factors such as Intellectual Capital (IC), financial planning, and participation in accelerator programs for startup founders. By prioritizing the development of IC assets, including the knowledge and skills of the founding team, startups can build a solid foundation for navigating the early stages. Securing diverse funding sources and establishing clear financial goals from the outset can further mitigate financial constraints and improve survival probabilities.

Engaging in well-structured accelerator programs offers valuable resources, mentorship, and networking opportunities, enhancing the startup's resilience and performance. Our research contributes to this understanding by demonstrating that these elements significantly influence startup survival, particularly in diverse and globally oriented contexts. By recognizing and leveraging these critical factors early on, founders can better position their ventures for long-term success and growth, adapting to challenges and capitalizing on opportunities as they arise.

For policymakers and accelerator program developers, our findings provide valuable insights for refining selection processes and program development. Leveraging data from the EDP and the predictive strength of our Logistic Regression (LR) model, we offer preliminary guidance for creating more effective mentoring and support initiatives. The clear distinction between the values of specificity and sensitivity in our LR model indicates that survival and failure probabilities are independent entities, challenging traditional assumptions and uncovering new research opportunities. Further investigation into these factors can enhance the efficacy of support initiatives, benefiting the startup ecosystem by fostering more resilient and successful ventures.

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