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# A comparative analysis of supply chain management between Portugal and Ireland

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Sérgio Dominique-Ferreira  
*UNIAG - Management Applied Research Unit, Bragança, Portugal and  
Department of Marketing, School of Hospitality and Tourism,  
Polytechnic University of Cavado and Ave, Barcelos, Portugal*

Richard Brophy  
*Department of Marketing, Independent Colleges, Dublin, Ireland, and*

Catherine Prentice  
*University of Southern Queensland, Springfield Campus,  
Springfield, Australia*

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## Abstract

**Purpose** – This study investigates how insurance intermediaries in Portugal and Ireland evaluate supply chain management (SCM) practices within the insurance industry, specifically focusing on potential regional variations in their assessments.

**Design/methodology/approach** – A comparative research design was employed, collecting data through surveys administered to insurance brokers in Portugal and Ireland. These countries were chosen due to their well-developed intermediary-based insurance markets.

**Findings** – The results show that some dimensions of supply chain management are significantly different between Portugal and Ireland. Nevertheless, the insurance brokers from the two countries also share similar views on key aspects of supply chain management.

**Practical implications** – This study offers valuable insights for insurance industry management, particularly regarding the dynamics of the insurer-intermediary relationship and the importance of catering to intermediary needs. The findings also highlight potential areas for European Union policy consideration, such as addressing potential asymmetries within the insurance sector across member states.

**Social implications** – Improved relationships and collaboration within the insurance supply chain can lead to enhanced access to insurance products and more tailored services for consumers.

**Originality/value** – This research addresses two key gaps in the literature. Firstly, it examines the insurer-intermediary relationship from the intermediary perspective, a viewpoint often neglected in prior research. Secondly, the study investigates and confirms the existence of regional variations in insurance SCM practices across two European countries.

**Keywords** Supply chain management, Financial services, Insurance retail, Partner's alignment, Information and communication technology, Trust, Culture

**Paper type** Research paper

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## Introduction

The insurance industry is a key sector in the global economy. Scenarios of supply chain disruptions, caused by national and international warlike conflicts (e.g. the recent Russia-Ukraine conflict and the fossil fuel exports supply disruption) or international political conflicts (e.g. Taiwan conflict and the chip/semiconductor supply issues) highlight the importance of the insurance sector in market stability (Craighead *et al.*, 2007).

Insurance plays a vital role for individuals and businesses within the financial services landscape (Gara, 2021). Distribution methods for insurance products vary widely across lines and countries, influenced by economic rationales, relationships, remuneration structures, and regulations (Hilliard *et al.*, 2013). These distribution channels have evolved significantly since the 18th century, shaped by advancements in technology, financial services diversification, and regulatory changes (Mao and Ostaszewki, 2023; Brophy, 2015). Consequently, the dynamics of insurance supply chains (SCs) have become increasingly complex.

While distinct from traditional product or service supply chains (Leiria *et al.*, 2020), effective SCM practices remain crucial for insurers to deliver high-quality services to customers. Key functions include claims management, cost control, risk mitigation, regulatory compliance, and customer satisfaction (Prentice *et al.*, 2023; Ahmed *et al.*, 2022; Leiria *et al.*, 2020; Dominique-Ferreira, 2017).

The European Union (EU) has a highly internationalized insurance market with multinational insurers and cross-border trade (Brophy, 2017). However, this openness is countered by the persistent idiosyncrasies of national regulations, creating complexities within insurance distribution models and their underlying supply chains (Moreno *et al.*, 2022). Efforts toward standardization, exemplified by initiatives from the European Insurance and Occupational Pensions Authority (EIOPA, 2021, 2020) and Law 7/2019 (Belzuz, 2019), were unable to succeed (François and Frezal, 2018).

Research on supply chain management (SCM) practices specifically tailored to the B2B insurance industry, particularly within retail and distribution channels, remains scarce (Dominique-Ferreira, 2018). Furthermore, existing studies fail to consider potential regional variations in how insurance companies manage their supply chains. While the European Union (EU) fosters some cultural similarities among member states, significant differences in business practices persist across these countries (Samaha *et al.*, 2014; Engelen and Brettel, 2011; Hofstede, 1980, 1991). These variations potentially influenced by cultural factors, point to a critical research gap: the need to investigate potential discrepancies in insurance supply chain management practices across regions.

Cultural differences can significantly impact supply chain dynamics (Durach and Wiengarten, 2020). Communication styles, trust-building approaches, and decision-making processes can vary considerably across cultures (Yates and de Oliveira, 2016). These variations can lead to communication barriers, delays, and reduced trust between supply chain partners, ultimately hindering supply chain efficiency. Additionally, cultural risk tolerance can influence risk management behaviours within the supply chain (Kumar and Anbanandam, 2019; Chen *et al.*, 2009).

This study takes a unique approach by examining supply chain management (SCM) practices within the insurance distribution sector across different European Union (EU) countries. While these countries share a common regulatory framework and some insurance carriers, the potential impact of cultural variations on SC practices remains unexplored. The Behavioural Theory of the Firm posits that cultural differences significantly influence strategic management, including supply chain practices (Durach and Wiengarten, 2020; Gupta and Gupta, 2019; Goswami *et al.*, 2021). This research addresses this gap by investigating how cultural factors might influence insurance distribution supply chains across the EU.

Furthermore, limited research exists on how insurance brokers evaluate their relationships with insurers and how these relationships differ across regions. This study addresses this gap by examining SCM practices and relationship quality in the insurance distribution sector of two EU countries, Portugal and Ireland. The research focuses on two key questions:

*RQ.1.* What are the perceived differences in SCM performance between Portugal and Ireland from the perspective of insurance brokers?

*RQ.2.* How do insurance brokers' perceptions of relationship quality with insurers differ between these two countries?

This study builds upon the Behavioural Theory of the Firm by demonstrating the impact of culture on insurance SCM practices across two EU countries, Portugal and Ireland. While prior research established the influence of culture on business practices in marketing (Durach and Wiengarten, 2020; Gupta and Gupta, 2019; Goswami *et al.*, 2021), this work extends this concept to the specific domain of insurance supply chains. This research also identifies how insurance intermediaries evaluate specific industry practices within the SCM context. By highlighting key areas for improvement, the study contributes to strengthening synergies between stakeholders such as insurers and brokers.

The following section presents the relevant literature on Supply Chain and the correspondent dimensions, as well as the importance of national culture in management and marketing. The study compares the insurance brokers' perception of these dimensions. The method for data collection is outlined. Discussion of the findings and implications are highlighted for researchers and practitioners.

## Literature review

### *Supply chain management*

Supply Chain Management (SCM) has transcended its logistical roots to become a critical discipline across modern businesses (La Londe and Masters, 1994). This evolution emphasizes integrated management of all value chain stages, from raw materials to customer satisfaction (Danise, 2021). Marketing, in particular, requires seamless collaboration across departments for successful outcomes (Fernando and Wulansari, 2020, b; Liu *et al.*, 2020a, b). This integrated approach ensures value creation throughout the supply chain, encompassing suppliers, producers, and ultimately, the end consumer (Chen and Lai, 2010).

### *Supply chain management dimensions*

Efficient information and communication technology (ICT) management is crucial for successful strategic partnerships (Hänninen *et al.*, 2021; Sharma *et al.*, 2021; Ketchen and Craighead, 2020; Guan *et al.*, 2019; Rita and Krapfel, 2004). These ICT processes ensure not only contract adherence but also improves cooperation and alignment between partners (Hänninen *et al.*, 2021; Attaran, 2020; Backstrand and Fredriksson, 2020). Additionally, effective supply chain management (SCM) relies on both hard skills (technical expertise) and soft skills (human-specific assets and top management support) (Ketchen and Craighead, 2020). Quality information, facilitated by efficient ICT, empowers better decision-making (Ketchen and Craighead, 2020; Schniederjans *et al.*, 2020; Guan *et al.*, 2019). Ultimately, these elements contribute to a successful partnership with interdependence, commitment, trust, and shared vision among partners (Sharma *et al.*, 2021; Wieland, 2021). A detailed exploration of each dimension's role within SCM follows.

*Communication and information management (CIM).* The modern SC faces increasing pressure due to volatile consumer demand, heightened delivery expectations, and faster production cycles (KRC Research, 2013). These trends often exceed the adaptability of existing SC systems, leading to concerns about revenue and profitability. To address these challenges, SC managers prioritize talent development, best practice adoption, data-driven decision-making, and improved visibility for executives (KRC Research, 2013). Additionally, technology platforms, outsourcing, and external consulting services are increasingly utilized. This dynamic environment underscores the need for ongoing research to identify strategies for achieving greater SC efficiency (Banker, 2021a, b; Palsule, 2020; Mazero, 2019).

*CIM* plays a critical role in the efficiency of SCM (Fatorachian and Kazemi, 2020; Guan *et al.*, 2019). Furthermore, cooperation and information sharing between the different partners optimise physical and human resources, reducing time consumption (Chiu *et al.*, 2021). As Gunasekaran and Ngai (2004) emphasize, successful SCM prioritizes the long-term benefits of all stakeholders through cooperation and open communication.

*Contract.* Contracts play a vital role in establishing stable relationships within the supply chain (SC) (Hong *et al.*, 2014). They explicitly define inter-organizational agreements, improving trust between partners (Perrigot *et al.*, 2019; Li *et al.*, 2010). While trust is crucial for long-term success (Weissman, 2017), contracts provide a legal framework for enforcing agreed-upon principles. This ensures stability throughout the SC, both upstream (suppliers) and downstream (distributors and retailers).

*Asset investment and human-specific assets.* Several studies emphasize the importance of investment in human assets to achieve successful partnerships within the supply chain (Hong *et al.*, 2014). By developing inter-firm strategic human-asset specificity, partners can enhance communication, alignment, and overall integration (Hong *et al.*, 2014). Furthermore, skilled human resources play a critical role in delivering high-quality service, ultimately influencing customer satisfaction and loyalty (Dominique-Ferreira *et al.*, 2021; Shamim *et al.*, 2019). For instance, research suggests that Portuguese insurance intermediaries were more adept at adapting digital platforms and employee skillsets in response to the COVID-19 pandemic compared to their Irish counterparts (Fernandes, 2020; PwC and Insurance Ireland Leaders, 2020). This highlights the potential competitive advantage gained through a skilled and adaptable workforce. These findings align with broader research acknowledging the importance of digital touchpoints in the modern insurance industry (Alt *et al.*, 2021).

*Cooperation and alignment.* Extensive research underscores the critical role of cooperation and strategic alignment between insurance industry partners in achieving a sustainable supply chain (Backstrand and Fredriksson, 2020; Pettit *et al.*, 2019). These collaborative efforts optimize the insurance SC by facilitating joint forecasting and material management practices. Ultimately, this collaborative approach enhances return on working capital for both insurers and intermediaries (Attaran, 2020; Hong *et al.*, 2014). Furthermore, a highly aligned partnership strengthens overall organizational efficiency across the supply chain (d'Avolio *et al.*, 2015; Hong *et al.*, 2014; Castelli and Brun, 2010).

*Top manager support.* Research emphasizes the critical role of top management commitment in developing successful supply chain management (SCM) practices (Mazero, 2019; Banker, 2021b). Top managers play a crucial role in promoting information sharing across the supply chain, recognizing its benefits for overall performance (Hong *et al.*, 2014). Furthermore, strong leadership leads to a supportive work environment for employees, which is particularly important within the insurance industry (PwC Ireland and Insurance Ireland Leaders, 2020).

*Information quality.* Information and communication technologies (ICTs) play a vital role in supply chain (SC) management by enabling interaction between partners (Hänninen *et al.*, 2021; Attaran, 2020; Fatorachian and Kazemi, 2020). However, the quality of information exchanged remains a critical element in successful SC collaboration (Prajogo and Olhager, 2012).

Hong *et al.* (2014) posit that real-time information sharing among all SC stakeholders is essential for seamless operations. This approach fosters improved information flow, leading to enhanced efficiency and effectiveness within the SC.

*Interdependence, commitment, trust, and shared vision.* Interdependence, commitment, trust, and shared vision are all part of a mindset and play a critical role in improving the relationship between retailers and distributors, and therefore, optimising the SC performance (Sharma *et al.*, 2021; Attaran, 2020; Nowicka, 2018; Bigné and Blesa, 2003). The lack of trust is one of the leading business challenges/risks facing the insurance sector (PwC and Insurance Ireland Leaders, 2020). Additionally, quality, commitment, and trust play an important role in businesses (Tang *et al.*, 2014; Twing-Kwong *et al.*, 2013; Prajogo and Olhager, 2012; Lin and Wu, 2011).

#### *The importance of supply chain management in insurance industry*

The financial services sector has undergone significant transformations driven by corporate restructuring, technological advancements, and competitive forces (Grewal *et al.*, 2021; Shankar *et al.*, 2021). Innovation has shifted from simply delivering new products to enhancing service stability and quality (Das *et al.*, 2018). The rise of fintech further underscores this emphasis on continuous innovation (Clarke and Tooker, 2018).

Within financial services, the insurance industry possesses distinct characteristics compared to banking, due in part to its regulatory framework and product complexity. However, some financial giants operate across both sectors (Brophy, 2013). Information asymmetry between consumers and insurers has led to the rise of intermediaries, such as insurance brokers, who bridge this gap and play a crucial role in matchmaking between insurance suppliers and consumers (Eckardt and R athke-D oppner, 2010; Dominique-Ferreira, 2018).

While agencies remain a primary distribution channel for insurers, various other channels have emerged (Hu and Tracogna, 2020), increasing the complexity of insurance supply chain management (SCM). This complexity is further amplified by the need for effective communication and collaboration across these diverse channels (Alt *et al.*, 2021).

Research on SCM practices within the B2B insurance industry, particularly regarding retail and distribution channels, remains limited (Dominique-Ferreira, 2018). This study aims to address this gap by investigating insurance SCM practices from the perspective of insurance brokers, the intermediaries who play a critical role in navigating this complex ecosystem.

## **Methodology**

### *Sample and procedure*

The study was conducted within the Portuguese and Irish insurance markets, chosen for their general operational similarities. Data were collected through surveys administered to 86 insurance intermediaries (46 Portuguese, 40 Irish).

As noted by Leiria *et al.* (2022), insurance companies are often reluctant to share customer data, even in anonymized forms, for academic research. To overcome this limitation, the study focused on data collection from intermediaries. The sample size ( $\pm 9\%$  margin of error,  $p = q = 50$ , confidence level 90%,  $k = 2$  sigma) falls within acceptable limits for exploratory studies (Daniel, 2012).

To ensure the appropriateness of the survey instrument, construct validity measures were implemented. Following Tanner (2018), detailed discussions were held with Portuguese and Irish insurance business experts to confirm the relevance and clarity of the dimensions and items used in the survey. Additionally, a pilot test involving six randomly selected insurance

intermediaries was conducted to assess both construct validity and face validity (Tabachnick *et al.*, 2007). The pilot test also confirmed that the survey could be completed in less than 15 min, minimizing respondent fatigue.

#### *Survey instrument and hypotheses*

The survey utilized a five-point Likert scale, ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). All survey items were adapted from Hong *et al.* (2014).

### **Analysis and results**

#### *Confirmatory factor analysis*

Prior to address the research questions, confirmatory analysis was performed as the study adopted existing items to measure SCM. The results show that the model had acceptable fit indices:  $\chi^2$  (2184.812) = 701,  $p < 0.01$ . The composite reliabilities for all factors were acceptable, and the average variance extracted (AVE) for each factor was approximately or over 0.50, indicative of adequate convergence. In addition, the items have acceptable loadings to each dimension with good compositive reliability (CR) and average variance extracted (AVE) (see Table 1), supporting convergent validity. Specifically, loadings were above 0.6, Cronbach’s alpha and composite reliability (CR) were above 0.6, and average variance extracted was above 0.05, supporting convergent validity. Discriminant validity is also supported because the square root of AVE for a certain construct is higher than correlations between that construct and others (see Table 2).

#### *Results to address research questions*

To assess the normality of data, researchers employed the Shapiro-Wilk test. Since the data did not meet the normality assumptions, a (non-parametric) Mann-Whitney  $U$  test was used (Table 3). Statistical differences between the two countries (culture effect) were found in all items (Table 3).

*Insurance broker assessment of SCM practices.* The survey results reveal a generally positive assessment of supply chain management (SCM) practices by insurance brokers in both Portugal and Ireland. However, a more detailed analysis by dimension uncovers some interesting variations.

*Communication (CO) and information management (IM).* While information exchange appears satisfactory (3.85 in Ireland, 3.41 in Portugal), a key discrepancy emerges in conflict resolution. Portuguese brokers reported lower agreement (2.90) with the statement “we can always resolve conflicts through communication with our partners” compared to their Irish counterparts (3.78).

- (1) We exchange information with our partners completely (3.85 in Ireland and 3.41 in Portugal).
- (2) It would be difficult to find a new partner if we lose this business (4.35 in Ireland and 2.43 in Portugal).
- (3) Our partners and intermediary always try to keep each other’s promises (3.50 in Ireland and 4.05 in Portugal).

#### *Agency agreement*

In this dimension, there are considerable differences in two of the three items:

- (1) We consider the agency agreement to be an essential way to do business with our partners (3.63 in Ireland and 4.00 in Portugal).

Item	Loading	Alpha	CR	AVE
<i>Supply chain partnership management</i>				
<i>Communication</i>				
We meet frequently with our partners	0.85			
We have a formal and flexible communication system with our partners	0.92	0.92	0.95	0.81
We can discuss anything with our partners concerning our mutual benefit	0.92			
We can always resolve conflicts through communication with our partners	0.91			
<i>Information management</i>				
We have an advanced information-exchanging system with our partners	0.88	0.91	0.93	0.73
We and our partners can exchange information easily and safely	0.94			
We and our partners inform each other in advance of changing needs	0.84			
We and our partners are likely to share proprietary information with each other if it can help the other party	0.83			
We and our partners can keep the confidentiality of our mutual propriety information	0.79			
<i>Asset investment</i>				
We have dedicated or reserved equipment to maintain the business relationship with our partners	0.91	0.79	0.90	0.82
We have purchased specialised equipment to maintain the business relationship with our partners	0.90			
<i>Human-specific assets</i>				
We and our partners personnel regularly visit each other's facilities	0.92	0.85	0.93	0.87
We and our partners have built a cooperative team to maintain our relationship	0.95			
<i>Cooperation</i>				
We cooperate with our partners with respect to product design	0.94	0.96	0.97	0.89
We cooperate with our partners with respect to process design	0.95			
We cooperate with our partners with respect to quality management	0.94			
We cooperate with our partners with respect to forecasting and planning	0.94			
<i>Alignment</i>				
Our main partners are our strategically aligned partners	0.80	0.87	0.92	0.80
We allocate profit evenly with our aligned partners	0.92			
We have exclusive strategic partnering alignment with our partners	0.96			
<i>Top management support</i>				
Top management considers the relationship between us and our partners to be important	0.84	0.88	0.93	0.81
Top management supports our collaboration with the resources we need	0.90			
Top management regards SCM as a high-priority item	0.95			
<i>Shared vision</i>				
We and our partners share mutual understanding about our SCM goals	0.89	0.86	0.91	0.78
We and our partners share mutual understanding about the importance of supply chain collaboration	0.87			
We and our partners share mutual understanding about our strategic goals	0.88			

Source(s): Table by authors

**Table 1.**  
Items and loadings

- (2) We signed a relatively long-term agency agreement with our partners (3.61 in Ireland and 3.00 in Portugal).

*Asset investment (AI) and human-specific assets (HSA).* In this dimension, results are very similar in both countries.

*Cooperation (CO), alignment (AL) and top manager support (TMS)*

In this dimension, results are also very similar in both countries. However, low values of these two dimensions should be highlighted.

*Information quality (IQ), interdependence (INT), commitment (COM), trust (T) and shared vision (SV).* Regarding the dimension Information quality, the most significant difference is related to the item we exchange information with our partners completely (3.85 in Ireland and 3.41 in Portugal). The item with the most significant difference appears in the item. It would be difficult to find a new partner if we lose this business (4.35 in Ireland and 2.43 in Portugal).

Regarding Commitment, “our partners and we always try to keep each other’s promises” presents a significant difference (3.50 in Ireland and 4.05 in Portugal). However, no considerable differences are found in trust and shared vision.

*SCM perceptions of insurance brokers in Ireland and Portugal*

Through Figure 1, it is possible to observe that the “partnering relationship quality” presents more discrepancies between both samples (Portuguese and Irish intermediaries) than the “SC partnership management practice”. Furthermore, the highest values are also displayed in the former, e.g. interdependence (3.91, for the Irish intermediaries) and commitment (3.85, for the Portuguese intermediaries). The highest values of the latter are related to the Agency Agreement, i.e. contract (3.67 for the Irish intermediaries) and asset investment (also 3.67). When comparing the results obtained in each dimension with the mean value of all items of the entire sample (Figure 1), it is possible to observe that:

- (1) Communication, information management, cooperation, alignment, and top manager support present values below the mean value. In the case of Portugal, the interdependence value is below the mean.
- (2) Commitment presents a value above the mean in both countries. In the case of Ireland, interdependence also presents a value above the mean.

Although statistically significant differences were found in the results between both countries, the direction of the responses in both countries is consistent, i.e. when results are positive for one of the countries, the same happens in the other country and vice versa (detailed results and statistical differences presented in Table 3).

**Discussion**

SCM success is affected by different dimensions, from SC partnership management practice to partnering relationship quality. The former dimension consists of communication and information management, contract, asset investment and human-specific assets, cooperation and alignment and top manager support (e.g. Banker, 2021b; Atarran, 2020; Mazero, 2019; Weissman, 2017). The latter relies on information quality, interdependence, commitment, trust, and shared vision (e.g. Attaran, 2020; PwC and Insurance Ireland Leaders, 2020;

	1	2	3	4	5	6	7	8
1 Alignment	0.90							
2 Asset investment	0.32	0.91						
3 Communication	0.69	0.35	0.90					
4 Cooperation	0.85	0.19	0.65	0.94				
5 Human-specific assets	0.70	0.35	0.80	0.66	0.93			
6 Information management	0.63	0.40	0.75	0.66	0.56	0.86		
7 Shared vision	0.57	0.30	0.75	0.61	0.56	0.65	0.88	
8 Top management support	0.64	0.54	0.79	0.65	0.77	0.71	0.75	0.90

**Table 2.**  
Correlations and the squared root of AVE (on diagonal)

**Source(s):** Table by authors

Dimensions	Items	Ireland	Portugal	Statistical differences
C	We meet frequently with our partners	3.23	3.48	-0.25 <sup>a</sup>
C	We have a formal and flexible communication system with our partners	3.45	3.33	0.12 <sup>a</sup>
C	We can discuss anything with our partners concerning our mutual benefit	3.68	3.52	0.15 <sup>a</sup>
C	We can always resolve conflicts through communication with our partners	3.78	2.90	0.87 <sup>a</sup>
IF	We have an advanced information-exchanging system with our partners	3.30	3.26	0.04 <sup>a</sup>
IF	We and our partners can exchange information easily and safely	3.35	3.57	-0.22 <sup>a</sup>
IF	We and our partners inform each other in advance of changing needs	3.45	3.29	0.16 <sup>a</sup>
IF	We and our partners are likely to share proprietary information with each other if it can help the other party	3.43	3.17	0.25 <sup>a</sup>
IF	We and our partners can keep the confidentiality of our mutual propriety information	3.65	3.71	-0.07 <sup>a</sup>
AG	We consider the agency agreement to be an important way to do business with our partners	3.63	4.00	-0.38 <sup>a</sup>
AG	We signed a detailed legal agency agreement with our partners	3.78	3.52	0.25 <sup>a</sup>
AG	We signed a relatively long-term agency agreement with our partners	3.61	3.00	0.61 <sup>a</sup>
AI	We have dedicated or reserved equipment to maintain the business relationship with our partners	3.56	3.75	-0.19 <sup>a</sup>
AI	We have purchased specialised equipment to maintain the business relationship with our partners	3.64	3.59	0.05 <sup>a</sup>
HSA	We and our partners' personnel regularly visit each other's facilities	3.33	3.26	0.06 <sup>a</sup>
HSA	We and our partners have built a cooperative team to maintain our relationship	3.64	3.76	-0.12 <sup>a</sup>
CO	We meet frequently with our partners	3.23	3.48	-0.25 <sup>a</sup>
CO	We cooperate with our partners with respect to product design	3.20	3.24	-0.04 <sup>a</sup>
CO	We cooperate with our partners with respect to process design	3.28	3.30	-0.03 <sup>a</sup>
CO	We cooperate with our partners with respect to quality management	3.38	3.29	0.09 <sup>a</sup>
AL	We cooperate with our partners with respect to forecasting and planning	3.24	3.17	0.06 <sup>a</sup>
AL	Our main partners are our strategically aligned partners	3.50	3.30	0.20 <sup>a</sup>
AL	We allocate profit evenly with our aligned partners	3.28	3.24	0.04 <sup>a</sup>
AL	We have exclusive strategic partnering alignment with our partners	3.33	3.04	0.28 <sup>a</sup>
TMS	Top management considers the relationship between us and our partners to be important	3.63	3.43	0.19 <sup>a</sup>
TMS	Top management supports our collaboration with the resources we need	3.53	3.24	0.29 <sup>a</sup>
TMS	Top management regards SCM as a high-priority item	3.53	3.39	0.13 <sup>a</sup>
COM	We and our partners always try to keep each other's promises	3.50	4.05	-0.55 <sup>a</sup>

**Table 3.**  
Descriptive results and  
statistical differences  
(continued)

Dimensions	Items	Ireland	Portugal	Statistical differences
COM	We have invested a lot of effort in the relationship with our partners	3.80	3.90	-0.10 <sup>a</sup>
COM	We and our partners have made sacrifices for each other in the past	3.60	3.55	0.06 <sup>a</sup>
COM	We and our partners are concerned about each other's welfare	3.63	3.89	-0.27 <sup>a</sup>
T	Our partners have been open and honest in dealing with us	3.58	3.55	0.03 <sup>a</sup>
T	We feel that we can trust our partners completely	3.43	3.45	-0.03 <sup>a</sup>
T	Our partners respect the confidentiality of the information they receive from us	3.75	3.80	-0.05 <sup>a</sup>
T	Our transactions with trading partners do not have to be closely supervised	3.70	3.45	0.25 <sup>a</sup>
SV	We and our partners share mutual understanding about our SCM goals	3.49	3.32	0.17 <sup>a</sup>
SV	We and our partners share mutual understanding about the importance of supply chain collaboration	3.64	3.40	0.24 <sup>a</sup>
SV	We and our partners share mutual understanding about our strategic goals	3.53	3.36	0.16 <sup>a</sup>

**Note(s):** <sup>a</sup>Mann-Whitney U test Point of Probability in all items below 0.01

**Source(s):** Table by authors

**Table 3.**

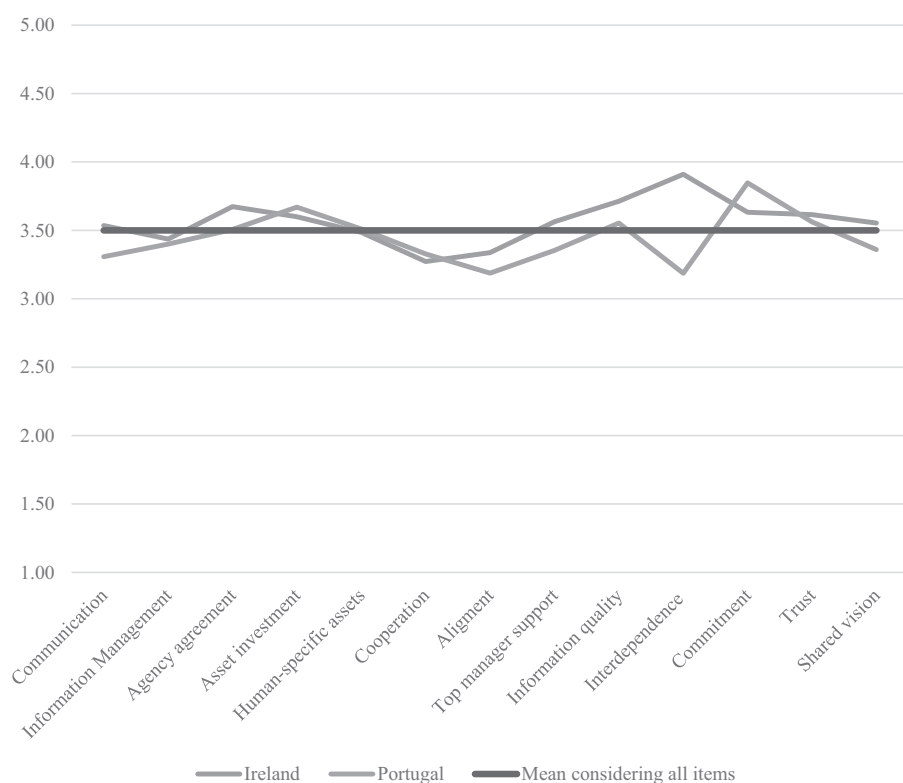
Nowicka, 2018; Hong *et al.*, 2014). These results are also in line with the findings obtained by Gupta and Gupta (2019), especially regarding the first category obtained by them ("operational decisions), which include workforce management, performance measurement, risk, and security.

The research suggests a scenario where, despite industry-specific nuances (idiosyncrasies), both countries exhibit well-developed distribution channels within their insurance supply chains. These channels have evolved over time, adapting to various regulatory and industrial changes. While statistical variations exist between the two nations, a positive overall assessment emerges from an analysis across all relevant dimensions.

All items present a positive assessment for both samples (Portuguese and Irish intermediaries), except for the item "we can always resolve conflicts through communication with our partners" (2.90 for Portuguese intermediaries), confirming the importance communication strategies in the insurance industry (in line with Alt *et al.*, 2021; Yu and Tseng, 2016). Authors would also like to highlight the item "we signed a relatively long-term agency agreement with our partners" since it presents a relatively low value (3.00 also for Portuguese intermediaries). Consequently, our results are in line with literature (e.g. Banker, 2021b; Attaran, 2020; Mazero, 2019; Weissman, 2017; Hong *et al.*, 2014).

Another item presenting differences is "it would be difficult to find a new partner if we lose this business" (2.43 for the Portuguese intermediaries). Additionally, this item shows the most significant difference in all the scale 4.35 (for the Irish intermediaries) versus 2.43. The results are also in line with the literature (e.g. Attaran, 2020; PwC and Insurance Ireland Leaders, 2020; Nowicka, 2018).

The authors contend this pioneering work in an essential part of financial services has further use in the technological advancement of insurance distribution and operations (in line with Alt *et al.*, 2021; Grewal *et al.*, 2021; Shankar *et al.*, 2021). Furthermore, the rise of FinTech and RegTech (Brophy, 2019) underscores the importance of SCM exploration in this sector.



Source(s): Figure by authors

Figure 1.  
Comparison results

Effective SCM practices are essential for successfully integrating both established supply chain technologies and disruptive innovations like blockchain-powered data exchange (Krafft *et al.*, 2020). This research paves the way for future studies examining how insurance intermediaries can leverage SCM to harness the full potential of technological advancements within the insurance industry.

### Implications

This research addresses two key gaps in the marketing literature concerning insurance supply chain management (SCM). Firstly, we examine the insurer-intermediary relationship from the intermediary perspective. Prior research has predominantly focused on the insurer's viewpoint, neglecting the intermediary's evaluation of this critical partnership. Secondly, we investigate potential regional variations in insurance SCM practices by comparing two EU countries, Portugal and Ireland. While existing studies acknowledge the importance of effective SCM, comparative analyses across regional contexts within the insurance sector are limited. By addressing these gaps, this study offers valuable insights into the dynamics of the insurance supply chain from the intermediary's viewpoint and explores potential regional variations within the EU.

*Theoretical implications*

This study contributes to SCM theory in several ways. First, it highlights the critical role of information and communication technology (ICT) in facilitating efficient distribution and retail management. Second, the findings reinforce the importance of fostering cooperation, alignment, and trust among supply chain partners. Effective collaboration strengthens upstream relationships and contributes to a more adaptable supply chain that can better respond to fluctuating demand.

Furthermore, the research underscores the need for cultural sensitivity within the insurance industry. Our results suggest that insurance companies should adapt their practices to consider the specific cultural contexts of each market they serve. This finding extends the Behavioural Theory of the Firm by demonstrating the influence of national culture on insurance supply chain management practices. In doing so, the study aligns with recent calls for a deeper understanding of cultural influences in business behaviour (Durach and Wiengarten, 2020; Gupta and Gupta, 2019; Goswami *et al.*, 2021).

*Managerial implications*

This study offers valuable insights for insurance industry management across several European countries. The findings highlight key differences in intermediary practices between Portugal and Ireland compared to countries with a prevalence of tied agents (e.g. France, Germany and Belgium). This distinction has significant ramifications for B2C insurance markets.

The research underscores the critical role of information and communication technology (ICT) in fostering efficient B2B relationships between insurers and intermediaries. This translates to improved responsiveness in B2C markets. Consequently, insurers and intermediaries should prioritize the development of synchronized ICT platforms. Standardized platforms will enhance downstream efficiency throughout the retail market and contribute to stronger cooperation and alignment between these key stakeholders.

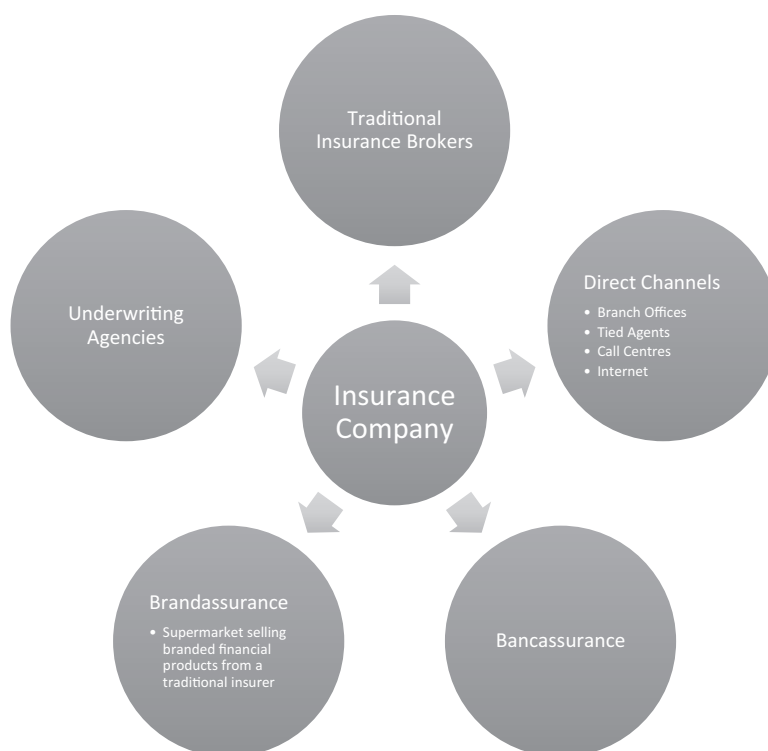
Given the importance of contracts within the insurance distribution system, further research is recommended to explore the inclusion of specific ICT-related protocols within contracts between insurers and intermediaries. This could help mitigate the potential bypassing of traditional intermediaries by B2C customers who utilize bancassurance or brand insurance options.

The study also suggests the importance of intermediaries embracing digital transformation efforts. Developing a strong website or call centre presence can enhance customer service and potentially counter the threat of customer disintermediation through bancassurance or brand insurance models (see Figure 2).

This study reveals interesting distinctions in how insurance intermediaries in Portugal and Ireland view Agency Agreements. Irish intermediaries tend to perceive them as more long-term and detailed documents, while Portuguese intermediaries see them as primarily functional. Building on this finding, the authors propose exploring incentive structures based on “gamification” principles within long-term contracts. Such an approach could potentially enhance the longevity and stability of B2C market relationships.

Both Portuguese and Irish intermediaries prioritize staff development, exceeding regulatory requirements in their respective countries. This aligns with Brophy’s (2014) observations regarding the Irish financial services industry’s shift towards enhanced staff training. The study also reveals that Irish insurers are more likely to invest in intermediaries through ICT infrastructure for product sales and continuous professional development programs.

The research underscores the importance of developing strong B2B relationships between insurers and intermediaries, particularly in the context of evolving consumer needs and



Source(s): Figure by authors

**Figure 2.**  
Distribution channels  
of insurers

market disruptions. The COVID-19 pandemic exemplifies the need for agility in adapting product offerings, particularly in non-life insurance sectors like health insurance. The study highlights the challenge faced by some B2B markets in efficiently adjusting supply to meet surging demand. Furthermore, the research points to the increasing frequency of pandemics and cyber threats, emphasizing the need for adaptable B2B distribution channels.

The findings suggest that Irish broker associations play a crucial role in facilitating access to top insurance industry management. The authors recommend that the Portuguese insurance industry consider replicating this approach to enhance communication and collaboration at the B2B level.

The study reveals a potential cultural influence on commitment levels between Portuguese and Irish intermediaries. Portuguese intermediaries appear to demonstrate stronger commitment to insurers through factors like keeping promises and investing in the relationship. The authors recommend formalizing these “informal promises” through long-term contractual provisions.

### Limitations and further research

While the sample size here is a clear limitation of this exploratory study, it is possible to observe some factors applicable, not allowing the application of other statistic methods/techniques. The number of intermediaries is in decline in Portugal and Ireland through many merger and acquisition activities. Processes related to SCM within the insurer and

intermediary relationship are very streamlined and generic, allowing for a small sample size to present a bigger picture. In future studies, it would be important to have a larger sample, including other European countries. Furthermore, the potential role of Artificial Intelligence (AI) solutions in mitigating risks within the insurance supply chain represents a promising avenue for future research. Investigating how AI can be leveraged to enhance efficiency, manage disruptions, and strengthen B2B relationships could yield valuable insights for the insurance industry.

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#### About the authors

Sérgio Dominique-Ferreira is an Adjunct Professor of Marketing at the Polytechnic Institute of Cavado and Ave, Portugal. He holds a PhD in Business and Management Studies (Marketing and Strategy). He has previously published articles in relevant journals, such as: Journal of Services Marketing, Journal of Retailing and Consumer Services, International Journal of Retail and Distribution Management, Journal of Hospitality Marketing and Management, European Journal of Management and Business Economics, Journal of Global Scholars of Marketing Science. He also won several awards in Conferences (best paper, best presentation), including invitations to serve as Keynote speaker at International Conferences. Sérgio Dominique-Ferreira is the corresponding author and can be contacted at: [sdominique@ipca.pt](mailto:sdominique@ipca.pt)

Richard Brophy is an experienced director of an insurance brokerage and academic, Richard Brophy has an academic interest in retailing financial services. Richard holds a Bachelor of Arts, Business degree from the University of Glamorgan, a Masters of Business Studies from Dublin City University, PhD in Financial Services from the University of South Wales and other professional qualifications in marketing, corporate governance, insurance and financial planning. He has previously published articles on rebranding and regulation in the insurance industry and won the Highly Commended Award from the Journal of Financial Regulation and Compliance.

Catherine Prentice is Full Professor of Marketing at the University of Southern Queensland, Australia, and the director of Asia Pacific Association for Gambling Studies. Prior to her academic career, Catherine had worked in various industries for over a decade as a business owner and as a senior corporate executive. She currently serves as Acting Director of Research, Associate Editor (AE) of Service Industries Journal, AE of Tourism Review and AE of Journal of Global Scholars of Marketing Science. And an editorial board member of Journal of Business Research, International Journal of Contemporary Hospitality Management, Journal of Hospitality and Marketing Management, Service Industries Journal, Journal of Global Scholars of Marketing Science, Tourism Review, Australasia Marketing Journal.

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# Cognitive social capital and new product performance: indirect effect of potential absorptive and innovation capacity: a tourism-based study

Patricia Pilar Zirena-Bejarano, Elbia Myreyle Chavez Zirena and  
Andrea Karina Caryt Malaga  
*Universidad Nacional de San Agustín de Arequipa, Arequipa, Perú*

## Abstract

**Purpose** – The purpose of this paper is to respond to the existing gap in the literature and analyze empirically the mediating role of potential absorptive capacity and innovation capacity in the relationship between socio-cognitive capital and new product performance in tourism businesses.

**Design/methodology/approach** – Partial least squares structural equation modeling (PLS-SEM) was applied to measure the effect of independent variables and mediators on the results of new products through information collected from 300 companies through a structured questionnaire applied to tourism companies.

**Findings** – Important findings are presented demonstrating the positive and significant influence of cognitive social capital on the results of new products; however, this is not enough, so the potential absorption capacity and the capacity for innovation play a very important role in improving the effect on the results of new products. The findings suggest that organizations should direct their culture and shared goals toward assimilation and knowledge and the development of innovation capabilities in order to obtain more successful new product results.

**Originality/value** – The study adds value to the study of social capital by analyzing social cognitive capital and its impact on new product performance. In contrast to previous studies, it suggests incorporating potential absorptive capacity and innovation capacity as mediating variables in a comprehensive model that illustrates the positive spillover effect, thereby enhancing the outcomes related to new product performance.

**Keywords** Social capital, Cognitive capital, Product performance, Innovation capacity, Absorptive capacity, Tourism, Mediation analysis

**Paper type** Research paper

## 1. Introduction

Tourism has become a globally important activity, and its growth in recent years has captured the attention of business investors. However, the aggressive competition faced by organizations suggests identifying the determinants of success, in this case, represented by the new product performance (NPP) (Najafi-Tavani *et al.*, 2023). Companies affected by the pandemic-induced crisis have been forced to design novel products expected to be successful



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(Jin *et al.*, 2019). On the other hand, there is evidence of high levels of failure when companies launch new products, as new products inherently carry uncertainty regarding their acceptance (Awwad and Akroush, 2016). Notably, there is a scarcity of studies analyzing the determinants of NPP, identifying a gap in the literature. This study aims to complement the understanding of the direct effect of cognitive social capital (CSC) on NPP and the mediating effect of potential absorptive capacity (PACAP) and innovative capacity (IC) on the relationship between CSC and NPP.

Given the complexity of the tourism sector, previous studies have recognized the importance of social capital as an explanatory factor in the development of new products (Chowdhury *et al.*, 2020; Wu *et al.*, 2018). Its relationships facilitate the transfer of information and knowledge necessary to create novel products, and within its dimensions, CSC will be analyzed because it allows the creation of an environment of trust and understanding conducive to streamlining the flow of information, avoiding misinterpretation of messages and ensuring that network actors have the same perception of the environment and share the same perspective on the execution of actions oriented towards the results expected by the network (Chowdhury *et al.*, 2020; García-Villaverde *et al.*, 2018a, b). Along these lines, the positive effect of social capital on IC has been demonstrated, although there is also evidence that an excess of cognitive proximity could limit access to new knowledge (Molina-Morales *et al.*, 2014; Pham *et al.*, 2022).

Due to the importance of having environmental information as an input to renew knowledge (Kim *et al.*, 2018), we consider it crucial to incorporate PACAP as a variable that enhances the relationship between CSC and NPP. Information becomes knowledge shared by the network of contacts driving NPP (Chowdhury *et al.*, 2020; Huang and Liu, 2019). Previous studies have evidenced the direct and positive effect of PACAP on NPP (Chen and Chang, 2019). Likewise, it has been analyzed as a mediating variable, showing that it drives the relationship between CSC and IC (Rodrigo-Alarcón *et al.*, 2014) and as a moderating variable between CSC and entrepreneurial orientation (Kousar *et al.*, 2019; Rodrigo-Alarcón *et al.*, 2020). Considering this, we infer that PACAP could improve the linkage between CSC and NPP.

The IC is also proposed as a determinant for achieving good NPP, representing the application of creativity embodied in new products (Lumpkin and Dess, 1996). Along these lines, companies meet the needs of their customers by improving the quality and characteristics of the products they offer and even improving their processes, seeking consumer satisfaction (Alexiev *et al.*, 2016). Innovativeness promotes the NPP placed in the market (Ding and Ding, 2022; Najafi-Tavani *et al.*, 2018; Sun and Lau, 2020; Zheir *et al.*, 2018). The present work seeks to address the gap in the literature regarding the determinants of NPP and the divergence of results from previous research, thus posing the following research questions:

*RQ1.* What is the effect of CSC on NPP?

*RQ2.* What is the mediating effect of PACAP on the relationship between CSC and NPP?

*RQ3.* What is the mediating effect of IC on the relationship between CSC and NPP?

Based on these questions, the research objectives have been formulated. The first objective analyzes the effect of CSC on NPP. The second objective examines the mediating effect of PACAP on the relationship between CSC and NPP. The third objective investigates the mediating effect of IC on the relationship between CSC and NPP. This research significantly contributes to the literature by enhancing the understanding of the effect of CSC as an antecedent of NPP as proposed by Chowdhury *et al.* (2020). The second contribution examines the indirect effects of PACAP and IC in a comprehensive model that has not been studied previously in the context of companies in the tourism sector in developing countries.

This is based on an empirical study conducted with 300 companies located in Arequipa-Peru, a city that is particularly interesting for empirical application due to the expected reactivation of the tourism sector. This anticipation is a result of the architectural wealth highlighted by UNESCO, in addition to its recent recognition as a creative city in culinary arts awarded in 2020. Among other attractions of interest for visitors.

## 2. Literature review

### 2.1 *New products performance*

In today's competitive landscape, companies must grasp the evolving needs and expectations of customers, necessitating a continuous renewal and introduction of new products to the market, even though success is not guaranteed. While there is existing research on NPP, studies have not reached consensus (Cendana, 2021; Ding and Ding, 2022). Following Walheiser *et al.* (2021), managers gauge success based on the commercial acceptance of new products, aligning with Mu *et al.* (2017), who advocate reaping benefits post the introduction of a new product or service in the market compared to competitors. The variable is identified with dimensions: financial result; market effects supporting product differentiation from competitors and the opportunity for the company to cater to a specific market segment of characteristics that differentiate the products from the competition; and finally, the opportunity offered (Wu *et al.*, 2010).

For this study, innovation, profitability and sales are proposed as indicators to measure NPP (Xie and Gao, 2018). Success is shown to hinge on a company's ability to innovate and create new products (Najafi-Tavani *et al.*, 2023; Xie *et al.*, 2021). Tseng *et al.* (2008) demonstrated that innovation influences the performance of the tourism and hospitality industry. In the same line, it is stated that the best way to face competition from other companies in the sector is by ensuring the development of new products and services (Xie *et al.*, 2021), achievable through innovation and absorptive capacities (Mlozi, 2018).

### 2.2 *Cognitive social capital*

The theory of social capital is examined for its ability to elucidate the connections formed at various organizational relationship levels (Pratono, 2018), defining it as the resources a company possesses, accessible through the existing networks within the organization (Nahapiet and Ghoshal, 1998). Additionally, the relationships formed among its actors represent a fundamental resource for a company's success (Suseno and Pinnington, 2018; Wu *et al.*, 2018). Social capital is a multidimensional concept that identifies the structural, relational and cognitive dimensions (Koka and Prescott, 2002). This study specifically focuses on CSC, which significantly impacts knowledge sharing (Kim and Shim, 2018; Molina-Morales *et al.*, 2014). It plays a pivotal role in interpreting shared goals and culture among network actors (García-Villaverde *et al.*, 2021; Rodrigo-Alarcón *et al.*, 2018), facilitating information transfer and guiding entrepreneurs to explore market opportunities with new products (Xu, 2016).

Research in the tourism sector suggests that the cognitive dimension influences business connections through shared culture and goals, fostering information and knowledge exchange within business networks (Birendra *et al.*, 2019). Additionally, such information flow promotes the creation of new knowledge to collaboratively develop innovation (Kim and Shim, 2018). Also, CSC was found to have a positive and significant effect on radical innovation (García-Villaverde *et al.*, 2021). Likewise, Ruiz-Ortega *et al.* (2021) revealed that cognitive proximity can facilitate tourism companies to take advantage of entrepreneurship opportunities. Although there is also research that showed that the advantage of strong

relationships that share values and culture can hinder access to new knowledge, losing innovation opportunities (Rodrigo-Alarcón *et al.*, 2018). Cognitive proximity can generate information and knowledge overload, blocking access to valuable external information and generating isolation and inertia (Machado *et al.*, 2017; Pham *et al.*, 2022). Based on these arguments, a hypothesis is put forward.

- H1. Cognitive social capital influences the new product performance in tourism companies.

### 2.3 Potential absorption capacity

Absorption capacity is recognized as the ability to identify new information, assimilate it and use it for commercial purposes (Cohen and Levinthal, 1990). Zahra and George (2002) propose the multidimensional concept identifying the potential and realized absorption as dimensions and as components of potential absorption, acquisition and assimilation and transformation and exploitation of realized absorption. In this paper we focus on the PACAP because it allows the development of competitive advantage through the permanent renewal of a stock of knowledge that is generated in the environment only to the extent that the members of the network demonstrate learning capacity (Fosfuri and Tribó, 2008). The members of the organization that have developed it are willing to acquire knowledge by interacting and sharing experiences with their peers (Crossan *et al.*, 1999). Assimilation concretizes the analysis, interpretation and understanding of new knowledge, which is incorporated into the company through socialization, also valuing previous knowledge (Mueller *et al.*, 2020).

The study of the PACAP is proposed because it is considered the main source of market information for the creation of novel and successful products. Flor *et al.* (2018). Posits that the process of acquisition and assimilation contributes to the development of novel products that are expected to be successful. It is confirmed that the PACAP is one of the important elements that influence the knowledge search of companies showing a curvilinear effect, which can generate advantages at a certain level and disadvantages at another level, for example, due to excessive costs and imbalance between cognitive distance and limited rationality (Kim *et al.*, 2018). Absorptive capacity has been studied, driving the relationship of social capital's cognitive dimension with innovation (Ortiz *et al.*, 2021; Rodrigo-Alarcón *et al.*, 2018). We propose the inclusion of PACAP and the following hypothesis.

- H2. The potential absorption capacity mediates the link between cognitive social capital and new product performance in tourism firms.

### 2.4 Innovation capacity

Innovation has become increasingly crucial for organizational performance, enabling firms to adapt to environmental changes (Novillo-Villegas *et al.*, 2022). It has been defined as the organizational capability to utilize resources to generate new ideas manifested in products, services and processes. Despite the attention innovation has garnered, there is no consensus on its determinants (Boukamel *et al.*, 2019). Romijn and Albaladejo (2002) suggest that a high level of innovative capacity drives the development and enhancement of current products and processes. Furthermore, firms harness their resources by transforming them into innovative products through innovativeness (Najafi-Tavani *et al.*, 2018). Previous studies have demonstrated that innovativeness is reflected in commercial strategies introducing new products to customers, promoting their acceptance and making them successful (Sun and Lau, 2020; Zirena-Bejarano *et al.*, 2023a, b).

Research conducted on IC has revealed that social capital positively influences innovation, which in turn impacts business performance positively (Hilmawati *et al.*, 2023;

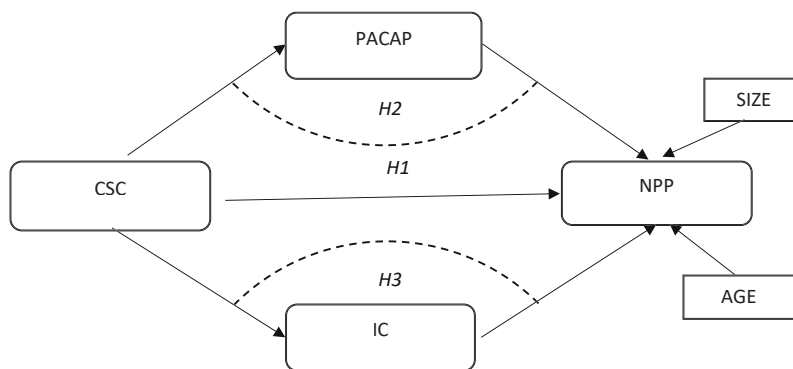
Zirena-Bejarano *et al.*, 2023a, b). Martín-de Castro *et al.* (2013) also revealed a positive moderating effect of innovation between human capital and innovative products, suggesting that firms with enhanced IC achieve superior results in their innovative products. Concerning the determinants of innovativeness, Eduardo *et al.* (2021) and Pham *et al.* (2022) propose and demonstrate that social capital positively affects the inclination for innovation, suggesting that better management of social capital will boost IC (García-Villaverde *et al.*, 2021). Social relations improve the competencies of firms, influencing their performance (Al-Shami *et al.*, 2021). On the other hand, it is suggested to examine the influence of IC on the NPP. Figure 1, shows the integral model. However, there is a reported lack of research in the tourism sector, opening the way to analyze this relationship in tourism firms in developing countries. We propose the following hypothesis.

*H3.* Innovation capacity mediates the link between cognitive social capital and new product performance in tourism firms.

### 3. Methods

#### 3.1 Research design

This research is a quantitative and causal study. It was developed to deepen the understanding of the variables CSC and NPP, including PACAP and IC as mediating variables, applying structural equations in a sample of 300 companies in the tourism sector.



**Note(s):**

Constructs studied

CSC: Cognitive social capital

NPP: New Product Performance

PACAP: Potential absorptive capacity

IC: Innovation capacity

Control Variables

Size: Determined by worker number

Age: Determined by the difference between current year and the company creation year

the dashed line represents the mediation relationship between CSC and NPP

**Source(s):** Authors' own elaboration

**Figure 1.**  
Theoretical model

### 3.2 Research instrument

The variables were measured through scales valid in the literature, which were adapted to the language and context of the study population. A seven-point Likert-type scale was used. Questions are shown in Appendix.

*NPP*: It was measured from three items: innovation, profitability and sales, which were adapted from Carbonell and Rodríguez-Escudero (2016) and Zhang *et al.* (2009). These items were taken considering that studies suggest that the NPP can be measured based on these indicators.

*CSC*: They are determined by the shared goals dimension and the scale proposed by Ye (2005), which has been applied and validated by other studies (Molina-Morales *et al.*, 2014), composed of six items.

*IC*: The capacity for innovation is defined as the ability to create new products from existing knowledge, motivated by the changes that occur in the market. As in the previous case, several scales were analyzed, selecting the one proposed by Kogut and Zander (1992); this scale was also adapted and validated by Akman and Yilmaz (2008).

*PACAP*: From the review of empirical works, the scale proposed by Flatten *et al.* (2011) was taken with seven elements.

*Control variables*: In the study, the age of the company has been taken as control variables, taking other studies that support the age could reflect experience (Lee, 2008), determined by the difference between the current year and the year of creation of the company's business. The other variable introduced in the study is company size, determined by the number of workers, indicating that companies with more than one worker have been considered.

### 3.3 Population and sample

The empirical research has been developed with information from businesses in the tourism sector of the Arequipa region, Perú, a country considered in development, contributing 3.66% to the gross domestic product (BADATUR, 2019). Receptive tourism in the region saw growth from 2.3 to 4.4 million tourists between 2010 and 2019, resulting in increased foreign exchange earnings, reaching 4,784 million dollars in 2019 (Banco Interamericano de Desarrollo, 2021). Along the same lines, Arequipa is the country's second-most important city, showing figures of growth in 2019 of 8.5% of visitors. However, the tourist potential of the region generates a favorable context for the application of the proposed model.

The research was conducted with data obtained from the Superintendencia de Administración Tributaria SUNAT under the guidelines established by the country's transparency law. The information was filtered considering only firms with more than one worker in force as of September 2021, achieving a total of 776 tourism firms as a population. Also, the questionnaire was built according to validated instruments previously published in scientific articles; these were adapted by language and context, initially a pilot of 30 questionnaires was applied and processed to have some previous results. The second step was to verify the relevance of the instrument; the third step was to start the field work with the application of the questionnaire, obtaining the 300 valid questionnaires with a response rate of 38.66% for a confidence level of 95% and  $p = q = 0.5$  with a sampling error of 4.43%.

### 3.4 Data analysis

The research was carried out through the application of a questionnaire sent to the manager of a tourism sector business via the internet, by telephone, and in some cases with a face-to-face visit. The form comprised 21 items: three items measured the NPP variable, six items for the CSC variable, five for IC and seven for PACAP without excluding any item. In addition, they were examined with PLS-SEM, a structural equation modeling technique based on variance (Henseler, 2018). SmartPLS 4.0.8.5 software was used because it seeks to

predict the dependent variable and allows us to observe different causal relationships and include mediators in the model (Sarstedt *et al.*, 2020). Subsequently, the measurement model was designed, evaluating the factor loads of the items; the reliability and validity of the indicators were evaluated, achieving values that allowed the evaluation of the structural model (Hair *et al.*, 2013). The bootstrapping technique was also applied to determine significance (Davison and Hinkley, 1997).

**4. Results**

*4.1 Descriptive results*

Table 1 shows the descriptive results of the research and control variables. The descriptive analysis was performed by calculating the mean, standard deviation and correlations. The results are shown in Table 1.

*4.2 Evaluation of the measurement model*

The indicators are analyzed as reflective because the items are considered a representative sample of the underlying construct and caused by it. Since they have the required reliability, some items could be omitted without changing the meaning of the construct, which could not be done in the case of indicators of a formative construct (Nunnally and Bernstein, 1994). The reliability and validity of the variables were evaluated with a systematic procedure that shows Cronbach’s alpha with values exceeding the threshold of 0.70, and then the composite reliability was analyzed, obtaining values also greater than 0.70 established as acceptable (Chin and Dibbern, 2010). The convergent validity presents values higher than 0.50, understanding that the proposed indicators substantially explain the measurement variable (Hair *et al.*, 2013). Also, the Fornell and Lacker criterion was used to determine the discriminant validity; the results are shown in italics, identified on the diagonal superior to the rest of the values of the spine to facilitate their interpretation. Likewise, the Heterotrait-Monotrait (HTMT) ratio is applied, with results greater than those that can be observed in the upper rows mentioned above, verifying that the proposed constructs have right discriminant validity (Henseler, 2018). See Table 2.

*4.2.1 Structural model evaluation.* Harman’s one-factor test is the technique that allows detecting common method bias through an exploratory or confirmatory factor analysis. It also suggests that including all items produces a factor of more than 50% of the variance, identifying the existence of common method bias (Fuller *et al.*, 2016). The result obtained from Harman’s test was 38.56%, a value that is below 50.00%, indicating that CMB is not present.

The present research proposes two models. The first model analyzes the direct effect between CSC and NPP, and the second model proposes the integration of PACAP and IC as mediating variables.

	Mean	SD	1	2	3	4	5	6
1. Age	11.730	12.586	1					
2. Size	5.590	6.088	0.222**	1				
3. CSC	4.838	1.143	0.070	0.036	1			
4 PACAP	5.031	0.864	0.069	0.131*	0.525**	1		
5. IC	5.322	1.013	0.101	0.104	0.465**	0.548**	1	
6. NPP	25.561	8.320	0.066	0.136*	0.394**	0.417**	0.385**	1

**Table 1.**  
Descriptive analysis and correlation of constructs

**Note(s):** \*\*The correlation is significant at the 0.01 level (bilateral). \*Correlation is significant at the 0.05 level (bilateral)

**Source(s):** Authors’ own elaboration

4.2.2 *Structural model 1: influence of CSC on NPP.* Table 3 shows the data from the evaluation of the direct relationships of the proposed model. At first, the analysis of the direct relationship between CSC and NPP is carried out, showing  $\beta = 0.420, p < 0.001$ , which shows a positive and significant effect of CSC on NPP, obtaining an  $R^2 = 0.176^{***}$ . These data allow us to accept hypothesis H1. The results are shown in Table 3.

4.2.3 *Structural model 2.* This model analyzes the strength and significance of the beta and  $R^2$  coefficients of the NPP variable. Hypothesis H2 posits that the strength of CSC and the NPP is mediated by PACAP. Hypothesis H3 suggests that the strength of CSC and NPP is mediated by IC. To test the mediation hypothesis, four conditions must be fulfilled (Baron and Kenny, 1986).

The first condition indicates that there must be a significant relationship between the independent variable CSC and the dependent variable NPP (Table 4); it shows a positive and significant effect with  $\beta = 0.420, p < 0.001$ . The second condition indicates that there must be a relationship between the independent variable CSC and the mediating variables PACAP and IC (Table 4). This condition is fulfilled, showing a positive and significant effect for PACAP  $\beta = 0.528, p < 0.001$ , and IC with  $\beta = 0.448, p < 0.001$ . The third condition indicates that there must be a relationship between the mediating variable and the dependent variable.

	Internal consistency		Convergent validity AVE	Discriminant validity: Fornell and Larcker and HTMT			
	Cronbach's alpha	Composite reliability		1	2	3	4
1. CSC	0.923	0.940	0.724	0.851	0.586	0.483	0.471
2. PACAP	0.855	0.891	0.541	0.528	0.735	0.621	0.526
3. IC	0.921	0.940	0.760	0.448	0.547	0.872	0.429
4. NPP	0.830	0.898	0.745	0.415	0.456	0.385	0.863

Source(s): Authors' own elaboration

**Table 2.**  
Analysis of reliability, convergent and discriminant validity of the constructs

Relationship	Direct effect	Standard deviation	T-statistics ( O/STDEV )	R <sup>2</sup>	Significance	Results
H1: CSC→NPP	0.420	0.044	9.432	0.176***	0.000***	Accepted

Note(s): \*\*\* ≤ 0.001

Source(s): Authors' own elaboration

**Table 3.**  
Analysis of the direct relationship model

Relations	Direct effects	95% confidence interval	R <sup>2</sup> adj	Significance (p < 0.05)
CSC → PACAP	0.528	0.454–0.605		0.000***
PACAP → NPP	0.264	0.131–0.393		0.000***
CSC → IC	0.448	0.363–0.529		0.000***
IC → NPP	0.149	0.033–0.263		0.000***
CSC → NPP	0.212	0.099–0.318	0.253	0.000***

Note(s): \*\*\*sig ≤ 0.001

Source(s): Authors' own elaboration

**Table 4.**  
Analysis of the relationship between variables

This condition is fulfilled since the results of the PACAP variables show a  $\beta = 0.264$ ,  $p < 0.001$ , and IC with a  $\beta = 0.149$ ,  $p < 0.001$ . The fourth condition indicates that when the independent, mediating and dependent variables are integrated into the same model, the effect of the independent variable on the dependent variable must be substantially reduced, as shown in Table 4. Hypothesis H1 establishes an initial effect of the CSC variable with NPP with  $\beta = 0.420$  (Table 3), and when the mediating variables PACAP and IC are incorporated, we have a  $\beta = 0.212$ , satisfying the fourth condition proposed by Baron and Kenny (1986). The mediating effect for H2 is 0.139\*\*\*,  $t$ -value 3.628,  $p < 0.001$  and for H3, it is 0.066\*\*,  $t$ -value 2.441,  $p < 0.015$ ; these results are shown in Table 5. In this way, H2 and H3 are accepted. According to the analysis procedure suggested by Zhao *et al.* (2010) and Nitzl *et al.* (2016), a complementary partial mediation is observed. This is evident as the effect of CSC on NPP does not completely vanish upon the introduction of the mediating variables PACAP and IC. This inclusion leads to a notable enhancement in the  $R^2$ , indicating a significant improvement in the model. Regarding the control variables, size and age, it can be observed that the size variable has a  $\beta = -0.015$  ns and age with  $\beta = 0.035$  ns, indicating that they do not contribute to the model. The results are shown in Tables 4 and 5.

4.3 Evaluation of predictive validity

To measure the predictive power of the model using the PLS predict technique,  $Q^2$  was evaluated, obtaining results greater than 0. Taking into account the symmetry of the prediction error distribution, RSME was used to evaluate the predictive power, resulting in indicators showing smaller prediction errors than LM, indicating a predictive power (Shmueli *et al.*, 2019). Table 6 and Figure 2 show the results obtained.

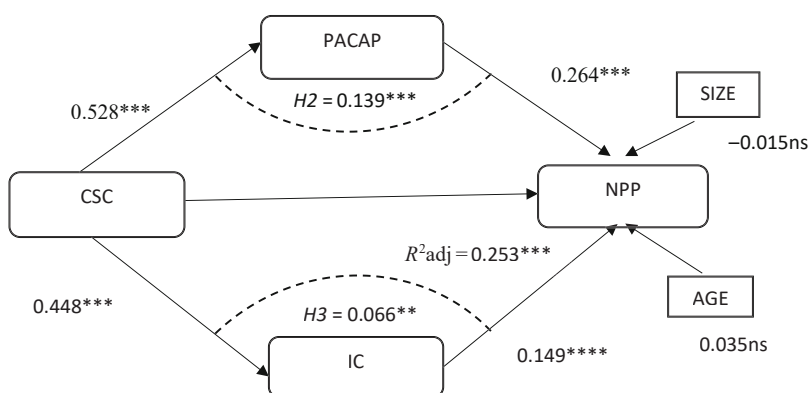
	Beta	Standard deviation	T-statistics ( O/STDEV)	Significance	Results
H2: CSC → PACAP → NPP	0.139	0.038	3.628	0.000***	Accepted
H3: CSC → IC → NPP	0.066	0.027	2.441	0.015**	Accepted

**Note(s):** \*\*sig ≤ 0.01; \*\*\*sig ≤ 0.001  
**Source(s):** Authors' own elaboration

**Table 5.**  
Mediation analysis

	Q <sup>2</sup> predict	PLS-SEM_RMSE	LM_RMSE	PLS-DEM-LM
Cabsor1	0.126	1.345	1.367	-0.022
Cabsor2	0.191	1.206	1.232	-0.026
Cabsor3	0.193	1.098	1.112	-0.014
Cabsor4	0.116	0.980	0.987	-0.007
Cabsor5	0.114	1.017	1.030	-0.013
Cabsor6	0.164	0.967	1.000	-0.033
Cabsor7	0.078	1.138	1.159	-0.021
CInno8	0.170	1.000	1.021	-0.021
CInno9	0.136	0.987	1.011	-0.024
CInno10	0.160	1.061	1.081	-0.020
CInno11	0.120	1.184	1.186	-0.002
CInno12	0.139	1.159	1.199	-0.040
Npp1	0.099	9.495	9.770	-0.275
Npp2	0.103	8.767	8.840	-0.073
Npp3	0.136	8.999	9.111	-0.112

**Table 6.**  
Results of prediction analysis



Source(s): Authors' own elaboration

Figure 2.  
Model results

## 5. Conclusions and implications

In the present research, the effect of CSC on NPP is studied. Although there is evidence of its association (Cendana, 2021; Zhou *et al.*, 2022), the results are not consistent, necessitating the analysis of other factors that improve the performance of new products. In line with these demands, the research results fill the existing gap, demonstrating that PACAP and IC have a positive and significant effect on the relationship between CSC and NPP in the context of the tourism sector in developing economies. It is essential for the company to have information about what is happening in the environment (Najafi-Tavani *et al.*, 2018; Wang and Steiner, 2020). Also, innovativeness plays an important role as a bridge for shared interests to materialize into NPP (Zheir *et al.*, 2018; Zirena-Bejarano *et al.*, 2023a, b). The findings indicate that the trust generated by the shared culture and shared goals leads to the detection and transfer of information that becomes viable in results through innovative products, confirming what was stated by Zhou *et al.* (2022) and El Manzani *et al.* (2019). The coincidence between the members of the organization ensures effective communication, facilitating the exchange of knowledge necessary to innovate products (Shang *et al.*, 2018). However, overconfidence produces isolation, a negative effect that generates blockage of external information, inertia or limitation to create new knowledge (García-Villaverde *et al.*, 2018b). Regarding the tourism sector, it is configured as a key factor in creating value by integrating tourism agents; interests are reconciled by sharing them in the network of contacts.

In accordance with the stated objectives, this article primarily focuses on the PACAP spillover effect generated between CSC and NPP, emphasizing the crucial role of knowledge acquisition in enhancing NPP in tourism companies. In that sense, the main contribution of this research lies in recognizing the significance of companies enriching themselves with new information and knowledge obtained from the environment regarding the evolving expectations of visitors. This information is leveraged by the organization, flowing seamlessly within the network facilitated by shared interests, values and company policies. Likewise, both CSC and PACAP establish an environment conducive to developing innovative products that meet expectations successfully (García-Villaverde *et al.*, 2018b). Second, the indirect effect of IC on the relationship between CSC and NPP is analyzed, revealing that IC is promoted through CSC. The collaborative atmosphere and shared objectives within the network, along with adherence to organizational norms, facilitate the development of IC and drive the creation of new products anticipated to be well received by tourists. Furthermore, upon separate analysis,

it is evident that PACAP has a more relevant mediating effect. This underscores a stronger effect on NPPs aligning with the findings proposed by Lyu *et al.* (2022) when there is a combination of CSC, PACAP and IC in an integral mediation model, and it is even observed that the interests shared by the members of the networks facilitate the flow of information and knowledge to achieve better NPP.

The theoretical contribution of this work is to confirm the hypothesis that CSC leads to NPP through PACAP and IC. The theoretical contribution links the social capital theory of Nahapiet and Goshal (1998), focusing on cognitive capital, with the theory of dynamic capabilities (Teece *et al.*, 1997), focusing on PACAP and IC, to understand the complexity of NPP (Griffin and Page, 1996) in an integral model that has not been studied so far. The variables have been analyzed in direct relationships in previous studies in the context of the tourism sector in developing countries. Therefore, it is considered a suitable environment for the application of the study due to the deep-rooted cultural identity of the members of organizations in this region. The results demonstrated the existence of a partial mediation that shows that acquisition, assimilation and CI are the intermediate links between CSC and the NPP. The shared interests of network actors leverage information, knowledge and skill to create innovative products and achieve better product performance.

In terms of practical contribution, company managers should encourage the members of the organizations to share values and culture without this meaning isolation from what is happening in the environment, as new information and knowledge are needed as an input for innovation to create products that meet the needs of tourists. First, it is proposed to create appropriate environments where network members interact and strengthen links based on common interests in order to develop channels for the transmission of information that will serve as input for the creation of innovative and successful products. Second, accelerate the process of acquisition and assimilation of knowledge through digital platforms, technological applications can offer endless opportunities to share information, to know the market demand and to offer tourism products and services (ticket sales, hotel reservations, restaurants, even a virtual tour based on immersive virtual reality). Third, foster the development of innovation capacity by organizing periodic meetings where network actors propose creative ideas to improve, transform or create new products that may be of interest to tourism visitors.

Although every possible precaution has been taken in the development of this study, there are certain limitations that should be mentioned. In the first place, it should be taken into account that this is cross-sectional research since the information was collected at a specific time and there is no longitudinal information to contrast the study hypotheses; it should also be mentioned that the information corresponds only to companies in the tourism sector in the Arequipa-Peru region, which could limit the generalization of the results. On the other hand, the probability of bias in the application of the scales and measurements used cannot be eliminated, and it should be clarified that scales validated in previous studies have been chosen. Finally, this article suggests some future lines of research, such as analyzing the effect of radical or incremental innovation on the performance of new products as well as analyzing the effect of market dynamism on the performance of new products, to identify which ones generate better results; it would also be important to delve into studies in other regions to compare and create a map of results.

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**Corresponding author**

Patricia Pilar Zirena-Bejarano can be contacted at: pzirena@unsa.edu.pe

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Importance of the number of product or service innovations, level of importance for your company	Satisfaction of the number of product or service innovations, level of importance for your company
Importance of the profitability of new products or services, level of importance for your company	Satisfaction of the profitability of the new products or services, level of importance for your company
Importance of sales of new products or services, level of importance for your company	Satisfaction of sales of new products or services, level of importance for your company

**Source(s):** Carbonell and Rodríguez-Escudero (2016), Zhang *et al.* (2009)

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**Table A1.**  
New product performance

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We share the same ambitions and visions as our contacts  
Our employees are motivated to seek common goals and missions with our contacts  
We share goals and objectives with our contacts  
We understand the strategies and needs of our contacts  
Our employees and those of our contacts have positive attitudes toward cooperation  
Our company and our contacts agree on how to carry out working relationships

**Source(s):** Ye (2005)

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**Table A2.**  
Cognitive social capital

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We seek relevant information about our sector on a daily basis  
Our managers motivate employees to use the sources of information in our sector  
Our managers expect employees to detect information outside our industry  
In our company, ideas and concepts are communicated between departments  
Our managers emphasize cross-departmental support to solve problems  
In our company there is a rapid flow of information, for example, if one department obtains important information, it immediately communicates it  
Our managers ask for regular interdepartmental meetings to exchange new developments, problems and achievements

**Source(s):** Flatten *et al.* (2011)

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**Table A3.**  
Potential absorption capacity

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We have a business culture that promotes innovation  
We are able to use knowledge from various sources to develop products/services  
We are able to quickly identify market changes and apply them to our own products, services and processes  
Our employees are able to contribute to activities such as product/service development, improvement of the innovation process and development of new ideas  
We are capable of evaluating new ideas coming from clients, suppliers, etc. in order to have them

**Source(s):** Kogut and Zander (1992)

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**Table A4.**  
Innovation capacity

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# The relevance of legal requirements in the going public process: the discretionary decision of adopting an audit committee

Leticia Castaño, José E. Farinós and Ana M. Ibañez  
*Department of Corporate Finance, Universitat de Valencia, Valencia, Spain*

## Abstract

**Purpose** – We study the role of having an audit committee (AC) as a signal of firm quality and as a monitoring device of the information quality contained in the listing prospectus.

**Design/methodology/approach** – Ordinary Least Squares regressions are used to examine the association between the presence of an audit committee and (1) the initial return (IR), and (2) the earnings forecast error in the listing prospectus in a sample of 55 Real Estate Investment Trusts that went public on the BME Growth market during 2013–2022. Heckman two-step estimation procedure to correct for endogeneity and bootstrap are used for robustness.

**Findings** – We show that IR and earnings forecasts are significantly affected by the presence of AC. The IR is higher and the earnings forecast included in the prospectus are of higher quality in firms with AC.

**Practical implications** – Our research provides (1) managers with new tools when deciding on their corporate governance structure in the listing process, (2) specific evidence for regulators on the role played by ACs in the process of going public, which may be useful in the context of the ongoing regulatory changes regarding admission processes in Europe, and (3) society with a sign that AC can enhance investor and public confidence in financial markets and foster a more stable and transparent investment environment.

**Originality/value** – The adoption of an AC is voluntary in this market, so this discretionary decision provides an exceptional opportunity to conduct such an analysis. Additionally, this issue has not been previously analysed in Europe.

**Keywords** Corporate governance, Audit committee, Going public, Initial return, Earnings forecast, Real estate

**Paper type** Research paper

## 1. Introduction

European companies are highly dependent on self-financing and bank financing. One of the alternatives to this dependence is the possibility of equity financing in the stock markets.

### JEL Classification — G12, G23, G34, M40

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Nevertheless, some of the main challenges that companies encounter in accessing capital markets are the regulatory requirements that hinder firms accessing the European stock markets and the initial and subsequent incorporation costs. These costs extend beyond mere financial considerations and encompass a range of other factors, including the need for enhanced transparency, governance, and increased management complexity. The European Union (EU), aware that firms require a favourable environment to be able to meet their financing needs through capital markets, is engaged in a debate on how to make these markets more accessible to companies without neglecting the necessary safeguards for investors (ESMA, 2024). Simplifying some of the incorporation requirements would reduce the costs that companies have to bear, providing them with incentives and making securities markets more attractive. Conversely, transparency and investor protection are essential for maintaining market security and confidence. From our point of view, the study of the process of requirement simplification is mandatory in order to evaluate its consequences on companies, investors and markets.

In this context, the aim of this research is to assess whether the constitution of an audit committee (AC), a rather costly requirement for companies, is beneficial for the incorporation of a company on the stock market by analysing the efficacy of having an AC as a signal of company quality and as a monitoring mechanism for the accuracy of information presented in the prospectus during the listing process. BME Growth for Real Estate Investment Trusts (REITs) is a good case study to evaluate this because the adoption of an AC is not mandatory, and this discretionary decision provides us with an exceptional opportunity to conduct such an analysis, which is not possible in most markets where this figure is mandatory [1].

The AC is a subcommittee of the board of directors that has the potential to play an important supervisory role, especially regarding the quality of information (financial and non-financial). Some of its primary responsibilities include overseeing the financial reporting process, ensuring the accuracy of financial statements, and compliance with laws and regulations, overseeing the external audit process, and monitoring the company's internal controls. The academic literature has devoted considerable attention to examining the role and effectiveness played by the AC covering areas such as intellectual capital efficiency (Waseem *et al.*, 2022), financial reporting reliability (Jaggi, 2023), long-term performance in equity markets (Kao *et al.*, 2024), earnings management (Zadeh *et al.*, 2023) and financial reporting quality (Dilshad *et al.*, 2023), as well as their impact on the initial public offerings (IPO) process. These last two issues are the focus of our research. Specifically, we study whether the presence of an AC has a significant effect on how investors perceive the quality of the firm that goes public in the BME Growth market for the admissions made on this market during the period from November 2013 to December 2022. Investigating the role of the AC in the going public process is crucial to understanding effectiveness in an environment where promoting transparency and protecting the interests of investors and other stakeholders is critical, while encouraging companies to go public by reducing their costs.

In the context of the current European debate referred above, this study aims to fill the gap in the literature on the effectiveness of the existence of an AC as a sign of the quality of the company and as a tool to control the quality of the information contained in the prospectus in a European market where its existence is not mandatory. To our knowledge, the effectiveness of the existence or not of an AC in the context of going public process had only been studied in Canada, US, Taiwan and Australia (Bédard *et al.*, 2008; Ettredge *et al.*, 2021; Kao and Chen, 2020; She, 2020; respectively). Moreover, our study provides new evidence since our results are different from those obtained so far in the aforementioned markets where either there is no relationship (Bédard *et al.*, 2008; Ettredge *et al.*, 2021; She, 2020) or the relationship between the existence of an AC and the initial return is negative (Kao and Chen, 2020).

The paper is organised as follows. Section 2 describes the audit committee and the characteristics of BME Growth. Sections 3 and 4 describe the theoretical framework and

literature review and hypotheses, respectively. The sample and the methodology used are described in section 5. The results obtained are shown in section 6. Section 7 concludes and Section 8 discuss implications and future research.

## 2. The audit committees and the characteristics of BME growth

Regarding the AC, during the 1970s a number of measures were implemented in the US to encourage listed companies to set up an AC. In Europe, however, large companies did not set up ACs until the 1990s, following the publication of different codes of good corporate governance. Over time, various institutional and professional organisations have advocated the creation of ACs, especially in listed companies. In Spain, the 1998 Olivencia Code proposed the voluntary creation of ACs for listed companies and identified as essential missions the review of the internal control system, the evaluation of the company's accounting verification system and the guarantee of the independence of the external auditor. The Olivencia Code had an enormous influence on the governance system of Spanish companies, since a significant number of large listed companies adopted the recommendation to create an AC. But it was with the Financial System Reform Law in 2002 that listed companies were obliged to establish an AC from 2003 onwards. However, this obligation applied to companies listed on an official secondary market (or regulated market) and, therefore, did not include companies incorporated in a Multilateral Trading Facility (MTF) such as BME Growth. It was with Law 22/2015 when a modification was included on this regard and catalogued the companies traded on BME Growth (then called *Mercado Alternativo Bursátil* -MAB- for growing companies) as companies of public interest having, therefore, the obligation to constitute an AC. However, Law 22/2015 left REITs traded on BME Growth out of this obligation. Therefore, the decision to have an AC is therefore at the REIT's discretion. That is why this is a good case of study on the effectiveness of the existence of an AC as a sign of the quality of the company and as an instrument for monitoring the quality of the information contained in the prospectus.

BME Growth has a flexible regulation in terms of admission, information and trading requirements, without foregoing an adequate level of transparency (Castaño *et al.*, 2023). One relevant feature is that all REITs have been incorporated by direct listing, that is, without an IPO. The initial admission price (reference price) is determined by the board of directors, considering an independent valuation, unless a private placement of shares occurs before listing for trading. In that case the reference price is derived from that placement.

## 3. Theoretical framework

The role and effectiveness of AC in the going public process have been analysed from a variety of angles, mostly including the information asymmetry, agency problem and signalling theory. It is worth noting that most of this literature refers to the quality of the AC rather than its presence, as its presence is mandatory.

The going public process is characterised by the existence of information asymmetry between firms and investors, as companies possess privileged insights into their future cash flows that prospective investors do not have. Thus, the greater the level of information asymmetry surrounding an IPO, the greater the underpricing, measured as the increase in the price of the shares at the initial time of listing (Ritter and Welch, 2002). Previous seminal studies show that these problems could be mitigated by transparent financial disclosure (Hughes, 1986). Since one of the main functions of an AC is to enhance the quality of financial information, by improving the quality of financial reports, an AC mitigates the information asymmetry between investors and issuers. Previous studies such as Bédard *et al.* (2008) and Venkataraman *et al.* (2008) find that an AC enhances the quality of financial reporting to mitigate information asymmetry, thereby improving IPO pricing efficiency.

Agency theory has also been related in the literature with the role and effectiveness of ACs in the going public process. This theoretical perspective posits the presence of agency issues between underwriters and issuers, resulting in underpricing as underwriters may deliberately undervalue IPOs to minimise their marketing efforts (see seminal work by Baron (1982)), consequently leading to an allocation of IPO shares that does not favour the issuers (Liu and Ritter, 2010). Given that the AC assumes the supervisory role of the board of directors concerning financial reporting, thereby enhancing the quality of financial disclosures, it potentially diminishes the bargaining power of underwriters. Consequently, the firm's performance could also be elucidated through the lens of agency theory (Kao and Chen, 2020). Previous seminal studies also show that these problems could be mitigated by transparent financial disclosure (Hughes, 1986), which minimises agency problems by reducing information asymmetry between management and shareholders. Additionally, this author also identifies management forecasts in a going public prospectus as a possible signal of the quality of the company. Karamanou and Vafeas (2005), in line with agency theory, find that corporate governance with an effective monitoring role increases the accuracy of management forecasts.

Finally, signalling theories state that the issuer or its managers attempt to communicate to investors the quality of their firm by choosing from a set of signals. These signals may include the proportion of shares held by shareholders with executive positions or sponsor (Saengchote and Charoenpanich, 2021), the reputation of the specialist agent (as investors may infer that an offering is of higher quality and/or less speculative if it is supported by a reputable agent (Paulus *et al.*, 2021)), the level of leverage (Brobert, 2016) or the board of directors structure (Filatotchev and Bishop, 2002), among others. The AC has the potential to play an important oversight role, especially with regard to the quality of information (financial and non-financial) communicated to the markets through the prospectus in the specific case of going public. Its creation and features can be used by existing shareholders as credible signals of the quality of their company and the quality of the information it provides. If the signal is effective, it would condition the price behaviour on the first day of trading, showing less underpricing. Furthermore, under the underlying hypothesis that the AC has a positive effect on the quality of financial information, as previous evidence shows (Bédard *et al.*, 2004; Klein, 2002), the AC provides a credible signal to build and maintain shareholders' confidence in the transparency and reliability of the financial information contained in the going public prospectus, thus validating the signalling theory.

#### 4. Literature review and hypotheses

Next, we have divided the literature review and hypotheses into the analysis of the effect of the AC on (1) the price behaviour of the first trading day and (2) the quality of the earnings forecasts disclosed in the listing prospectus for the first year after listing [2]. As we discuss below, these specific issues have not been previously analysed in Europe, thus our review refers to non-European markets. Instead, some research has been conducted in Europe on the relationship between various aspects of corporate governance and the issues analysed in this study (Saona *et al.*, 2020; Teti and Montefusco, 2022).

##### 4.1 Audit committee and the initial return when going public

Several studies have analysed the relationship between the AC and its characteristics and the initial return when going public.

Bédard *et al.* (2008) analyse a sample of 246 IPOs in the Canadian province of Quebec to determine if the establishment (voluntary in that market) and characteristics of the AC can be used as a signal by issuing companies to reduce the underpricing associated with IPOs. While

they do not find that the establishment of an AC at the time of the going public has a significant effect on underpricing, they do find that the level of IPO underpricing decreases significantly when its members are independent and have expertise in financial matters. Subsequently, Kao and Chen (2020) examine the effect of a pre-IPO AC on IPO pricing in 316 IPOs issued in Taiwan from 2007 to 2015. They find a significant negative relationship between the existence of an AC and the IPO underpricing and provide evidence on the presence of an AC to reduce agency problems between issuers and underwriters. She (2020), using a sample of 21 firms that made an IPO in Australian Securities Exchange (ASX) between 2008 and 2010, reported that the relationship between AC and the initial return is not statistically significant. In addition, Ettredge *et al.* (2021) demonstrate that the presence of an AC is not associated with the underpricing of IPOs with a newly established AC in a sample of 587 IPOs issued in the US during the period 2000–2010.

As pointed out before, this literature focus on IPOs, which involve soliciting new funds or investors to the market. Nonetheless, in our case of study, the fact that REITs go public through a direct listing, rather than by an IPO, changes the perspective from which to look at the market reaction on the first day of trading. It should be noted that in this market, the price taken as the initial admission price does not come from a book-building route, but rather it is determined by the REIT's board of directors based on the valuation of the company. In this sense, we associate the initial performance with higher market demand rather than higher underpricing. Thus, in a context where AC is voluntary, existing shareholders may utilise the presence of an AC as a mechanism in the company's quality signalling strategy (Castaño *et al.*, 2023). Because of the limited knowledge that investors have about companies that go public, they must place substantial reliance on the prospectus produced by the new issuer. The presence of an AC helps to ensure that the information communicated prior to the flotation is credible and that the company's management will continue to provide quality information even after the listing fostering the demand of shares on the first day of trading.

We, therefore, formulate the following hypothesis:

*H1.* The presence of an audit committee is positively associated with the initial return.

#### *4.2 Audit committee and earnings forecast error in the listing prospectus*

Previous evidence shows that ACs are positively associated with financial reporting quality (Bédard *et al.*, 2004; Klein, 2002). Although there is a relevant literature analysing how various variables influence the quality of management earnings forecasts included in the prospectus, the literature studying the effect of having (or not) an AC on the mentioned quality is scarce. Bédard *et al.* (2008) analyse the effect of having an AC on the quality of management earnings forecasts included in the prospectus for a sample of 246 IPOs in Quebec, where ACs are not mandatory and firms can voluntarily incorporate an earnings forecast in their prospectus. They do not find that the AC presence has an effect on management forecast precision.

Some authors examine the relationship between certain characteristics of the AC and the accuracy in earnings forecasting. Ahmad-Zaluki and Wan-Hussin (2010), in a sample of 235 IPOs in Malaysia that took place between 1999 and 2006, find that companies with a higher percentage of non-executive directors in the AC and a larger AC size exhibit greater accuracy in forecasts. Ben Ahmed *et al.* (2021) analyse the effect of the size of the AC on the accuracy of earnings forecasts in 33 companies that have gone public in Tunisia between 2011 and 2015. Their results reveal that firms with a suitably sized AC have a significant level of earnings forecast accuracy.

Finally, several studies analyse the relationship between the age and size of the issuer, the level of leverage, the size and independence of the board of directors, the quality of auditor, among others, and the earnings forecast error in the going public prospectus (Ammer and Ahmad-Zaluki, 2017; Bédard *et al.*, 2004; Chen *et al.*, 2020; Karim *et al.*, 2013; Mnif, 2010).

Following Bédard *et al.* (2008), we use the accuracy and bias of the earnings forecast for the first year after flotation included in the listing prospectus as a measure of the quality of the disclosed information. Given the role of the AC as a supervisor of the financial reporting preparation process, we expect that the presence of an AC in the REIT's governance structure will result in higher quality earnings forecast and, therefore, we hypothesise the following:

- H2.* The presence of an audit committee is associated with a lower error in the earnings forecast included in the prospectus.

## 5. Methodology

Our initial sample consists of all the REITs listed in BME Growth since the creation of the particular segment for REITs on 15 February 2013 until 31 December 2022. Over this period, there have been 100 admissions. For the initial return analysis, we have discarded those companies that have not traded on the first day or have only done so through block trading (bilateral trading), as the latter is not considered as an official closing price and, therefore, it is not representative of market behaviour (47 firms removed). Additionally, we have removed two companies from the sample because they are considered outliers with respect to the initial-day return (IR), as they could distort the results [3]. Thus, the final sample consists of 51 observations (listed companies). For the analysis of the earnings forecasts error, we have discarded those companies that have not included forecasts in their prospectus. As a result, the sample has been reduced to 55 observations (listed companies).

Data on market admissions, financial information and other information about the REITs were hand-collected from the Informational Document on Admission to the Market (IDAM), financial information and the relevant facts available on the BME Growth website. Specifically, to build the database, the IDAMs were read one by one, extracting from them all the data needed to calculate the variables defined in Table A1, except for one variable that refers to stock market data. Stock market data was obtained from the Bolsas y Mercados Españoles Group and from the Thomson Reuters Datastream database. To calculate the earnings forecast error, it was also necessary to review the first post-listing audited annual accounts of all the companies analysed, one by one.

Regarding the methodology for analysing the relationship between the AC and the initial return when going public, we have measured the initial return of REITs going public ( $IR_i$ ) by the return on the first trading day, obtained as the relative difference between the closing price of REIT  $i$  on the first day of trading ( $P_{ic}$ ) and the reference price ( $P_{ir}$ ) as shown in expression (1).

$$IR_i = (P_{ic} - P_{ir})/P_{ir} \quad (1)$$

To isolate the effect of the committee on IR, we control for other variables that previous literature has shown as related to the initial return of REITs when going public (Castaño *et al.*, 2023). We test the hypothesis with the cross-sectional regression model defined in expression (2). The control variables are shown in Table A1.

$$IR_i = \alpha + \gamma AUDITCOM_i + \sum_{j=1}^m \beta_j X_{ij} + \varepsilon_i, \quad (2)$$

where  $IR_i$  is the Initial-day Return of company  $i$  calculated from expression (1),  $AUDITCOM$  is a dummy variable that takes value 1 if REIT  $i$  has an audit committee prior to the listing and zero otherwise and  $X_{ij}$  are the control variables defined in Table A1. The natural logarithms of the variables  $SIZE$  ( $LNSIZE$ ),  $AGE$  ( $LNAGE$ ) and  $DEBT$  ( $LN(1+DEBT)$ ) have been used to minimise the influence of extreme values on expression (2) and expression (4) defined below.

Table 1 offers a summary statistics for the variables used in the IR sample, both for the full sample and by splitting the sample into the REITs that have an AC and those that have not.

We find a mean (median) IR of 1.58% (1%) for the full sample. Our results are in line with those obtained by Castaño *et al.* (2023) and within the wide range of IRs reported in previously REIT studies, as shown in the aforementioned study. When we split the sample by AC, we find that the average IR of the subsample with AC (2.49%) is higher than the sample without AC and we also see that REITs with AC are much larger and older than those without AC.

With regard to the methodology employed for the analysis of the relationship between the AC and the earnings forecast error in the listing prospectus, it is worth mentioning that the traditional measures used to assess the quality of financial reporting involve examining discretionary accrual levels in accounting statements and abnormal market returns linked to accounting information disclosures (Kao and Chen, 2020; Klein, 2002). Nevertheless, these measures are challenging to implement for companies with limited prior financial information and no history of share trading. Therefore, following Bédard *et al.* (2008), we calculate the earnings forecast error ( $EFE_i$ ) by comparing the expected earnings declared in the prospectus ( $FORECAST_i$ ) with its realisation contained in the first annual report after the listing ( $ACTUAL_i$ ), as in expression (3).

$$EFE_i = \left( \frac{FORECAST_i - ACTUAL_i}{|FORECAST_i|} \right) 100. \quad (3)$$

The signed earnings forecast error (EFE) in expression (3) measures *Bias*, while the absolute value of the EFE measures *Accuracy*. By examining the sign of the mean of earnings forecast bias (positive or negative), we can conclude whether the firm is optimistic or conservative (pessimistic) about its earnings forecast (i.e. whether the earnings are overestimated or underestimated).

Similarly, to test hypothesis H2 we analyse the relationship between earnings forecast error and the existence of an audit committee (AUDITCOM) through expression (4).

	Full sample					With AC			Without AC		
	N	Mean	Min	Median	Max	N	Mean	Median	N	Mean	Median
IR (%)	51	1.58	-4.34	1.00	7.69	8	2.49	1.71	43	1.41	1.00
Size (million €)	51	148.04	5.91	57.18	1,838.56	8	463.68	226.90	43	89.32	50.00
Age (years)	51	4.31	0.19	2.17	42.27	8	11.60	5.31	43	2.95	2.14
Auditor	51	0.586	0.05	0.63	1.00	8	0.49	0.55	43	0.60	0.63
Executives (%)	51	23.02	0.00	7.14	98.72	8	20.79	3.83	43	23.43	7.88
IGBMRET (%)	51	-1.96	-15.42	-0.26	5.98	8	-0.59	-0.56	43	-2.21	-0.26
DEBT (%)	51	31.27	0.00	33.93	79.14	8	32.24	35.23	43	31.09	33.93

Dummy variables	N	Num. Dummy 0	Num. Dummy 1
AUDITCOMIT	51	43	8
Property	51	38	13
Management	51	42	9
Reference price	41	16	25
PPP	51	30	21
Standard	51	9	42

**Table 1.** Summary statistics of the IR sample for the variables. Full sample and segmentation of the sample according to whether or not there was AC

**Note(s):** The variables are described in Table A1  
**Source(s):** Table by authors

$$ERROR_i = \alpha + \gamma AUDITCOM_i + \sum_{j=1}^m \beta_j X_{ij} + \varepsilon_i, \quad (4)$$

where  $ERROR_i$  stands for EFE and  $|EFE|$ . The control variables used are identical to those in expression (2), except for the IGBMRET and REFERENCE PRICE variables, as it was not appropriate to include it.

Regression models (2) and (4) have been estimated by cross-sectional Ordinary Least Squares (OLS), applying the methodology proposed by White to obtain a robust estimation of the parameters in the presence of heteroscedasticity. Additionally, we have used the bootstrap procedure (Fox, 2008) as we have a small sample size. For the same reason, we considered appropriate not to include more than 7 explanatory variables in the same model. To analyse the absence of multicollinearity among the regressors, we have used the Variance Inflation Factor (VIF). Finally, we check the possibility of endogeneity caused by selection bias through the two-step estimation procedure of Heckman (1979) [4].

Table 2 offers summary statistics for both the full sample and splitting it into the REITs that have an AC and those that have not. Examining the sign of the mean of the earnings forecast bias (EFE) for the full sample we can conclude that firms are optimistic about their future earnings in line with the findings of the main literature (Chen *et al.*, 2020). By splitting the sample, we observe that the same happens in the case of REITs without AC as the mean is positive. However, in the case of REITs with AC the opposite happens, as the negative sign of the mean indicates that the earnings forecast is pessimistic (or less optimistic) and future earnings are underestimated. Regarding the earnings forecast accuracy ( $|EFE|$ ), it is lower for the REITs that have an AC and, therefore, the quality of the forecasts is higher in these REITs.

## 6. Results

### 6.1 Audit committee and the initial return when going public

The results obtained for the seven regression models (see expression (2)) are shown in Table 3. We find that our variable of interest AUDITCOM is positive and statistically significant in all

	N	Mean	Full sample			N	With AC		Without AC		
			Min	Median	Max		Mean	Median	N	Mean	Median
EFE (bias) (%)	55	9.86	-54.58	0.00	34.04	3	-2.26	-0.45	52	10.56	0.00
$ EFE $ (accuracy) (%)	55	19.10	0.00	5.21	100.00	3	3.41	1.72	52	20.01	5.31
Size (million €)	55	59.53	7.04	28.80	329.43	3	147.07	152.69	52	54.48	28.09
Age (years)	55	2.90	0.19	1.91	31.49	3	1.63	2.08	52	2.97	1.91
Auditor	55	0.57	0.04	0.31	1.00	3	0.45	0.31	52	0.58	0.31
Executives (%)	55	25.82	0.00	8.53	93.4	3	4.80	7.14	52	27.04	10.05
DEBT (%)	55	29.09	0.00	18.97	134.26	3	15.46	12.08	52	29.87	20.38

Dummy variables	N	Num. Dummy 0	Num. Dummy 1
AUDITCOMIT	55	52	3
Property	55	43	12
Management	55	52	3
PPP	55	27	28
Standard	55	7	48

**Note(s):** The variables are described in Table A1

**Source(s):** Table by authors

**Table 2.** Summary statistics of the earnings forecast error sample for the variables. Full sample and segmentation of the sample according to whether or not there was a AC

	M1	M2	M3	M4	M5	M6	M7
Intercept	0.022	0.008	0.023	***0.030 <sup>b</sup>	*0.021 <sup>c</sup>	0.021	0.025
AUDITCOM	**0.025 <sup>b</sup>	*0.018 <sup>c</sup>	*0.025 <sup>c</sup>	**0.023 <sup>c</sup>	**0.021 <sup>c</sup>	*0.025 <sup>c</sup>	**0.023 <sup>c</sup>
LNSIZE	-0.005		-0.005	-0.003	-0.003	-0.005	-0.004
LNAGE				-0.070			
LNDEBT		*-0.034		-0.021	-0.022		-0.029
Auditor			-0.002				
Executives	** -0.001 <sup>b</sup>	* -0.002 <sup>c</sup>	* -0.001 <sup>c</sup>			** -0.001 <sup>c</sup>	** -0.001 <sup>b</sup>
IGBMRET				*0.112 <sup>c</sup>			
Property						0.001	
Management					-0.008		
Reference price	**0.011 <sup>b</sup>	*0.010 <sup>c</sup>	**0.011 <sup>c</sup>	**0.012 <sup>c</sup>	*0.011 <sup>b</sup>	**0.011 <sup>b</sup>	**0.012 <sup>b</sup>
PPP	**0.017 <sup>b</sup>	***0.020 <sup>a</sup>	**0.016 <sup>b</sup>	*0.013 <sup>c</sup>	**0.016 <sup>b</sup>	**0.016 <sup>b</sup>	***0.018 <sup>a</sup>
Standard	0.006	0.010	0.006			0.006	0.006
N <sup>(a)</sup>	41	41	41	41	41	41	41
Adjusted R <sup>2</sup>	0.202	0.214	0.178	0.222	0.153	0.178	0.231
F-test statistic	***5.20	**2.78	***4.83	**3.12	**3.07	***4.45	**4.16
VIF	[1.06-1.99]	[1.07-1.20]	[1.08-2.01]	[1.17-1.68]	[1.10-1.64]	[1.10-2.16]	[1.11-2.10]

**Note(s):** Multiple linear regression models estimated by cross-sectional OLS. Dependent variable is the initial-day return. Heteroscedasticity has been corrected using White's methodology

The variables are described in Table A1

VIF: Variance Inflation Factor. Maximum-minimum values are reported

\*\*\*, \*\*, \* significant at the 1%, 5 and 10% levels, respectively

<sup>a, b, c</sup> significant at the 1%, 5 and 10% levels, respectively, using the bootstrap methodology

<sup>(a)</sup> 10 observations have been lost out of the initial 51 since there are firms that do not perform an initial valuation of the company and therefore the REFERENCE PRICE variable has no value (see Section 2 for more information)

**Source(s):** Table by authors

**Table 3.**  
OLS regression models  
of AC and IR

the models. That is, the IR for those firms that have an AC is significantly higher than those that do not have one, accepting our first hypothesis H1. Thus, investors show more interest in and demand for the shares of companies with an AC, leading to an increase in the price on the first day of trading. These results suggest that companies with an AC provide greater guarantee and confidence in the financial information published, both in the issue prospectus and in the information to be published in the future. Our evidence is consistent with a context in which the going public takes place without an IPO and it is related with the signalling theory.

Our results are contrary to some studies, such as those by Bédard *et al.* (2008), Ettredge *et al.* (2021), and She (2020) who show that either there is no relationship between the existence of an AC and the initial return, or that the relationship between the two variables is negative, as in Kao and Chen (2020). It should be noted that in these studies the procedure of going public is an IPO and primarily rely on the theories of information asymmetry and agency theory.

Regarding the control variables, Table 3 shows that variables EXECUTIVES, PPP and REFERENCE PRICE have a significant relationship with the IR. These results are consistent with those of Castaño *et al.* (2023) and are explained by certain signalling theories related to capital structure, investor sentiment, and market peculiarities.

### 6.2 Audit committee and earnings forecast error in the listing prospectus

Table 4 presents the results on the relationship between our variable of interest (AUDITCOM) and the quality of managers' forecasts for the first post-listing annual earnings included in the prospectus (see expression (4)), so testing H2.

	M1		M2		M3		M4	
	Bias	Accuracy	Bias	Accuracy	Bias	Accuracy	Bias	Accuracy
Intercept	**52.20 <sup>a</sup>	***51.13 <sup>a</sup>	***46.99 <sup>a</sup>	***46.11 <sup>a</sup>	***53.67 <sup>b</sup>	***54.42 <sup>b</sup>	35.56	***51.39 <sup>b</sup>
AUDITCOM	***-25.92 <sup>a</sup>	***-26.74 <sup>b</sup>	** -28.26 <sup>a</sup>	* -26.69 <sup>b</sup>	* -18.13 <sup>c</sup>	* -20.45	** -22.59 <sup>b</sup>	** -21.60 <sup>b</sup>
LNSIZE	** -10.26 <sup>b</sup>	* -7.10 <sup>c</sup>	** -10.23 <sup>b</sup>	* -8.13 <sup>c</sup>	** -10.53 <sup>b</sup>	* -7.44	0.97	-2.15
LNAGE	** -52.43 <sup>b</sup>	***-53.82 <sup>b</sup>	** -51.65 <sup>b</sup>	***-51.16 <sup>b</sup>	** -53.45 <sup>b</sup>	***-55.50 <sup>a</sup>	** -50.22 <sup>b</sup>	** -51.53 <sup>b</sup>
LNDEBT	***-34.44 <sup>b</sup>	** -24.07 <sup>b</sup>	** -36.87 <sup>b</sup>	** -23.12 <sup>b</sup>	***-39.64 <sup>a</sup>	** -27.19 <sup>b</sup>	***-32.60 <sup>a</sup>	* -20.93 <sup>b</sup>
Auditor			-0.03	0.07				
Executives			20.38	17.77				
Property					* -25.65	* -23.46		
Management								
PPP	-5.61	-0.05						
Standard							35.56	0.44
<i>N</i>	55	55	55	55	55	55	55	55
Adjusted <i>R</i> <sup>2</sup>	0.188	0.149	0.236	0.169	0.209	0.189	0.128	0.120
<i>F</i> -test statistic	**2.44	**2.30	**2.53	*1.94	**2.52	*2.07	*2.10	*2.06
VIF	[1.02-1.28]	[1.02-1.28]	[1.02-1.28]	[1.02-1.28]	[1.04-1.23]	[1.04-1.23]	[1.09-1.21]	[1.09-1.21]

**Note(s):** Multiple linear regression models estimated by cross-sectional OLS. Dependent variable is the Earnings Forecast Error (ERROR). Bias regressions use the signed EFE as dependent variable. Accuracy regressions use the absolute value of EFE as dependent variable. Heteroscedasticity has been corrected using White's methodology. The variables are described in Table A1

VIF: Variance Inflation Factor. Maximum-minimum values are reported

\*\*\*, \*\*, \* significant at the 1%, 5 and 10% levels, respectively

<sup>a, b, c</sup> significant at the 1%, 5 and 10% levels, respectively, using the bootstrap methodology

**Source(s):** Table by authors

**Table 4.**  
OLS regression models  
of AC and earnings  
forecast error

Our results suggest that the presence of an AC has an effect on the quality of the earnings forecast in the first year after listing, as we find a significant negative sign for the variable AUDITCOM for all the models. This negative sign indicates that in REITs with an AC the earnings forecast error (Accuracy) is lower. In the case of the earnings forecast bias (Bias), it indicates that in REITs with an AC the earnings forecast is less optimistic. Therefore, our results support the second hypothesis (H2) and suggest that the quality signalled by the company through the establishment of the AC at the initial stage is subsequently ensured by the fulfilment of the forecasts. Our results differ from those by Bédard *et al.* (2008) as they suggest that the presence of an AC do not to have any effect on either earnings forecast accuracy or bias.

We find among the control variables that the level of leverage (LNDEBT) of the REITs influences the earnings forecast error. That is, companies with higher leverage will be subject to greater supervision and monitoring, which should result in more accurate forecasts and a lower forecast error as in Mnif (2010). By contrast, Ben Ahmed *et al.* (2021) and Karim *et al.* (2013) found that this variable was not significant.

On the other hand, we observe that the variable AUDITOR is negative and statistically significant in all the models. Thus, REITs with a more prestigious auditor have more conservative forecasts and are related to a higher accuracy of earnings forecasts. These results are in line with those obtained by Ahmad-Zaluki and Wan-Hussin (2010), Ammer and Ahmad-Zaluki (2017), Ben Ahmed *et al.* (2021), Chen *et al.* (2020) and Karim *et al.* (2013). However, they are contrary to the evidence provided by Bédard *et al.* (2008) and Mnif (2010), as they found that this variable is not significant.

As for the age of the issuing firm (LNAGE), the negative and statistically significant sign of the variable suggests that younger firms (with a short or non-prior operating history and probably more difficult to forecast their earnings) are related to a higher earnings forecast error as in Chen *et al.* (2020), but not consistent with the findings of Ahmad-Zaluki and Wan-Hussin (2010), Ammer and Ahmad-Zaluki (2017), Bédard *et al.* (2008), Ben Ahmed *et al.* (2021) and Mnif (2010), where this variable was not significant.

Regarding the MANAGEMENT variable, its sign shows that internal management is negatively related to earnings forecast error. This variable is significant at 10% and is not significant using the bootstrap methodology.

Finally, we do not find the variables SIZE and EXECUTIVES to have statistical significance.

## 7. Conclusions and discussion

This study analyses the effectiveness of the existence of an AC as a sign of the quality of the company in the going public process, which is currently the subject of intense debate at the EU regarding regulatory changes to simplify the admission process. We focus on the European market BME Growth because of the adoption of an AC is voluntary for these firms, a fact that provides a unique opportunity to analyse its effectiveness as it is a discretionary decision of the companies and not a legal requirement. Specifically, we analyse the REIT admissions on BME Growth during the period from November 2013 to December 2022.

Our results suggest that the discretionary decision of REITs to have an AC is not neutral in the direct listing process given that we find that (1) REITs with an AC have a higher initial return (suggesting a greater demand for shares), and that (2) earnings forecasts contained in their prospectuses for the first year after listing are of higher quality than in those cases where there is not an AC. Our findings suggest that the AC serves as a reliable signal of the company's quality and the information provided in the prospectus, which plays a fundamental role in establishing and upholding investors' trust in the reliability of these financial disclosures.

In a context in which the European Union is studying several measures aimed at promoting the use of stock exchanges as a source of financing for companies, including regulatory changes to relax the requirements demanded to companies for their incorporation on the stock exchanges, this study fills the gap in the literature on the role of ACs in the going public process in a European market where the existence of an AC is not mandatory by showing evidence of their important role in this process. To our knowledge, the impact of the existence or absence of an AC in the context of the going public process has only been studied in non-European countries. Our study provides new evidence with results that differs from that obtained in other markets in a field where the evidence is inconclusive.

### 8. Implications and future research

Our research has several implications. For practitioners, companies considering its listing on a stock market can use the findings of this study to make more informed decisions about their corporate governance structure. Knowing that an AC can improve the quality of information in their prospectuses and increase the IR on their shares, companies may choose to establish an AC despite the additional costs. They can also use this decision as part of their strategy to attract potential investors by highlighting their commitment with transparency and good governance. This issue is relevant in an increasingly competitive environment where financing is key for companies, and listing on the stock market is an option for companies to carry out their investments. Additionally, our research provides specific evidence for regulators on the role played by the companies' audit committee in the process of going public, an important feature in the current European Union debate on the benefits of encouraging companies to go public. Regulators should be aware, before making decisions on rules changes, that having an AC, for example, positively affects the quality of certain information in the going public prospectus. For researchers, it contributes to enriching the scarce literature on this topic, whose results are inconclusive, studying a European emerging market with specific rules for determining the initial price when going public and where neither new funds nor new investors are sought. Studies such as ours highlight the importance of market design (microstructure) in the functioning of markets. For society, the study demonstrates that the AC plays an important role in the going public process. The implementation of ACs can contribute to the stability and transparency of financial markets, which benefits the economy as a whole. A higher level of confidence in financial markets can attract more investments and investors, not only institutional but also retail, thereby fostering economic growth. Nevertheless, we are aware that our study is subject to the prevalent constraint observed in emerging markets, namely, the small size of the sample.

Future research would extend the study to the analysis of seasoned equity offerings (SEOs) once the quality of the companies has been discovered. Likewise, an analysis of how the decision of establish (or not) an AC affects the performance of BME Growth REITs over the long term would complete the information necessary to have a broader view of the role played by these committees.

### Notes

1. From the establishment of the market until October 2020 this market was called *Mercado Alternativo Bursátil* (MAB).
2. Additionally we have analysed whether the first annual report released by the REIT after listing has a greater effect on the prices of companies without an AC, assuming that the effect on prices will be driven by the earnings surprise. The results of our event study show that the stock market does not react to the earnings announcement, and there is no difference in behaviour between REITs with an AC and those without one. For the sake of brevity, results are not shown but they can be obtained from the authors on request.

3. Extreme values have been considered as being those that exceed three times the standard deviation of the  $IR_t$  mean.
4. The results are consistent with those obtained using OLS, not finding selection bias. For the sake of brevity, results are not shown but they are available from the authors upon request.

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Variable	Definition
AUDITCOM	Dummy variable that equals to one if the REIT has an AC prior to the listing and zero otherwise
Size	Market capitalisation on the listing day, in millions of euros
Age	Age of the issuing company from the constitution date to the listing day
Auditor	Ranking of the auditor based on the number of listings in which the agent has participated
Executives	Percentage of shares retained by shareholders in executive positions according to IDAM information
DEBT	Total debt to total assets ratio (both from the latest annual audited accounts or interim financial information subject to a limited review by its auditor, published in the IDAM)
IGBMRET	Buy-and-hold return of the Madrid Stock Exchange General Index (IGBM) computed 30 days prior to the listing
Property	Dummy variable equal to one if the property strategy followed by the REIT is diversified and zero if the property strategy followed is specialised
Management	Dummy variable equal to one if the management of the company is internal and zero if the management is external
Reference price	Dummy variable equal to one if the reference price determined by the board of directors of the REIT is equal to or less than the equilibrium price determined by the appraiser and zero otherwise
PPP	Dummy variable equal to one if the REIT has performed a private placement of shares (up to six months) before going public and zero otherwise
Standard	Dummy variable equal to one if the accounting standard used in the financial information is the national accounting standard and zero if it is the International Financial Reporting Standards

**Table A1.**  
Definition of  
variables<sup>(a)</sup>

**Note(s):** <sup>(a)</sup> For more details see Castaño *et al.* (2023)

**Source(s):** Table by authors

#### Corresponding author

Leticia Castaño can be contacted at: [leticia.castano@uv.es](mailto:leticia.castano@uv.es)

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# Exploring factors influencing smart tourism destination visiting behaviors in a historic country: a theory of e-consumption behavior

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Abdulla Al-Towfiq Hasan  
*Patuakhali Science and Technology University, Patuakhali, Bangladesh*  
Md. Masudur Rahman  
*University of Dhaka, Dhaka, Bangladesh, and*  
Mohammad Osman Gani  
*Bangladesh University of Professionals, Dhaka, Bangladesh*

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## Abstract

**Purpose** – This study aims to explore factors that influence tourists' visiting behaviors towards smart tourism destinations (STDs) by extending the theory of planned behavior.

**Design/methodology/approach** – Partial least squares structural equation modeling (PLS-SEM) technique is used to test the proposed hypotheses by analyzing 413 usable responses that are collected through personal interviews. Moreover, data are collected using structured interviews and analyzed by SmartPLS, 3.3.3.

**Findings** – This study results reveal that STD visit intentions significantly influence STD visiting behaviors among international and domestic tourists in Bangladesh. Moreover, the results show that e-attitude, resource efficiency norms and perceived environmental sustainability have significant impacts on STD visit intentions.

**Practical implications** – The study findings indicate that destinations' electronic flowcharts of places, usage of low impact and biodegradable materials and history and culture presented in the forms of games and stories increase travelers' motivation to visit STDs.

**Originality/value** – The study provides empirical evidence to support the importance of factors enhancing travelers' STD visiting behaviors by integrating e-attitude, resource efficiency norms, perceived environmental sustainability and STD visit intentions.

**Keywords** Tourist behavior, e-Consumption behavior, Resource efficiency, Environmental sustainability, Smart destinations, Visitor behavior

**Paper type** Research paper

## 1. Introduction

Since the world's tourists have been growing rapidly, promoting smart tourism destinations (STDs) has been inspired by changes in their behavioral patterns and extensive use of digital technologies since the last decade (Buckley *et al.*, 2015). With the incremental rapid growth of this sector, understanding tourists' choice behaviors (visiting behaviors) towards STDs has become crucial. However, the factors that may influence tourists' STD visiting behaviors are not well defined yet.

To address these undefined factors, a behavioral model may be developed to explore factors that necessarily affect tourists' visiting behaviors towards STDs because today's



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young generation (Generation-Z), the main customers of tourism industry, expects a recreational space that has integrated smart technologies in optimizing consumption and producing resources for benefiting both travelers and industry operators (Kumar and Dahiya, 2017). However, traditional tourism destinations have failed to meet the desire of the young generation. As a result, STDs have got an opportunity to be popular among tourists. STDs are innovative destinations that integrate smart technologies to optimize consumption and resource production for benefiting business, citizens and government (Mandić and Kennell, 2021). It focuses on unique geographical features of destinations that associate information technology for seamless access of customers' value-added services for responding to customers' needs before, during and after a trip (Tavitiyaman *et al.*, 2021). It is a logical evolutionary development of traditional tourism, which is built upon modern technology infrastructure, promoting sustainable and accessible development of tourist areas designed to improve visitors' experiences and enhance quality of life of residents. Due to the unique features, visitors' traveling rate towards STDs has grown exponentially across the world. However, research efforts for promoting STDs by exploring factors influencing tourists' STD visiting behaviors are scarce.

Besides, the term "smart tourism" has been quite fashionable due to the extensive growth of information and communication technology (ICT). This development of ICT has led to the birth of smart tourism, and thus, smart tourism has become the most critical factor in the tourism industry. The tourism industry has contributed approximately 5.81 trillion US\$ to the global economy in 2021, increasing by about one trillion US\$ from 2020 (Suyunovich and Jaxongirovna, 2023). Coupled with the global economic contribution, tourism industry has contributed approximately Bangladeshi Taka (BDT)809.6 billion (4.7% of the total gross domestic products (GDP)) to the national GDP of Bangladesh, and it is expected that this contribution will be increased by 6.40% per annum to BDT1596.0 billion (5% of total GDP) in 2026 (Hafsa, 2020). Besides, Bangladesh received 6.50 lakh (650 thousand) foreign visitors in 2023 compared to 1.35 lakh (135 thousand) visitors in 2021 (Siddiqui, 2023), greater than 292%. The number of domestic tourists has increased approximately to 2 crores (200 hundred thousand) in 2022 compared to 1 crore (100 hundred thousand) in 2021 (The Bangladesh Monitor, 2023). Thus, it is argued that careful design and development of tourism destinations can convert Bangladesh's natural resources into economic capital.

Given the significance of the tourism industry, promoting STDs has been crying need for enhancing both the tourism industry and economic growth of a historic country like Bangladesh. However, the previous empirical studies have mainly focused on environmental importance and destinations' attributes of STDs. As such, Cavalheiro *et al.* (2020) explain that STDs promote a country's environmental, socio-cultural, economic and political values; Dabeodoal *et al.* (2019) note that smart tourism has significant contributions to sustainable urban development; and Mandić and Garbin Praničević (2019) explain that public and private amenities, destinations' attractions, image and character and price attract travelers to visit STDs. Besides, tourists' attitude, subjective norms and perceived behavioral control have strong effects on STD revisit intentions (Torabi *et al.*, 2022); Chen and Hung (2016) explain that resource saving tendency impacts an individual's green product acceptance intentions; and Yoo *et al.* (2017) identify that utilitarian and hedonic motivations, perceived enjoyment and information quality are related to intentions towards gamified smart tourism applications. However, tourists' psychological factors (i.e. e-attitude, resource efficiency norms and perceived environmental sustainability) that may influence them to visit a historic country like Bangladesh remain unexplored. To the best of the authors' knowledge, scholars have not conducted research yet on understanding how e-attitude, resource efficiency norms, environmental sustainability perceptions and smart tourism visiting intentions influence tourists' smart tourism visiting behaviors.

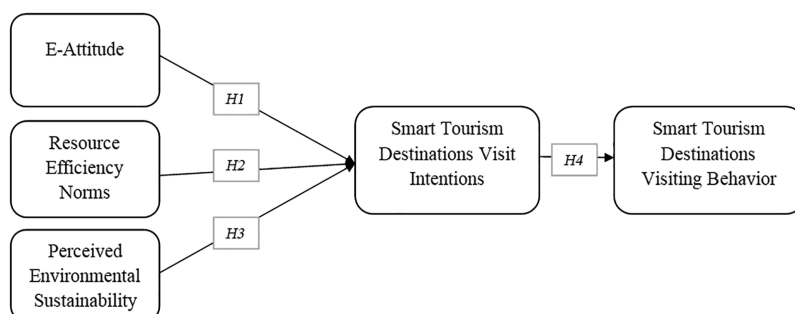
Therefore, this study has proposed the theory of electronic consumption behavior (TeCB), incorporating e-attitude, resource efficiency norms and perceived environmental

sustainability by extending theory of planned behavior (TPB) to predict tourists' STD visiting behaviors in Bangladesh. Specifically, this study attempts to (1) investigate the causal effects of e-attitude, resource efficiency norms and perceived environmental sustainability on STD visit intentions and (2) examine the causal effect of STD visit intentions on STD visiting behaviors (see Figure 1). The rest of this study is arranged as follows: review of literature is detailed in Section 2; Section 3 details methodology; results of this study are discussed in Section 4 and conclusions and implications of the study are discussed in Section 5.

## 2. Literature review

Research interest in smart tourism has been growing since the extensive growth of urban smart infrastructure and ICT development at the beginning of 21st century (Bastidas-Manzano *et al.*, 2021). The applications of smart technologies in integrating urban infrastructure, the development and use of mobile applications technologies, widespread use of social media and virtual reality and an increase in live videos have offered the opportunities for sharing tourists' experiences across the world. Thus, today's tourists can receive the pervasive tour information before, during and after a trip regarding a particular tourist destination, and technologically literate tourists are more likely to visit smart tourist destinations (Mandić and Garbin Praničević, 2019). Besides, people of today's world are accustomed to using smart technologies (i.e. smart phones) and social media (García-Haro *et al.*, 2024). Consequently, approximately 192.26 million people use mobile phones in Bangladesh in 2024 (Chowdhury *et al.*, 2022). Out of that amount, about 63.3% use smartphones in Bangladesh (Xpress, 2023, December 28).

Therefore, the smartphone users who visit tourist destinations prefer smart tourist destinations. As a result, Bangladesh has become one of the important tourist zones because it is a historic country with over 50 attractive tourist spots with both esthetic beauty and economic value (Hasan, 2023), and thus, approximately 650 thousand foreign visitors in 2023 and 20,000 thousand domestic visitors in 2022 travel to Bangladesh (Siddiqui, 2023; The Bangladesh Monitor, 2023). Furthermore, one-fourth (approximately 45.9 million) of the country's young population (e.g. age of 15–29 years) is more accustomed to using smart technologies (i.e. smartphone) than the other generations (Islam *et al.*, 2022) This young generation is called Generation-Z who are the main customers of the tourism industry in Bangladesh. Hence, the smart tourism has become pivotal for the growth of the tourism industry in Bangladesh, and thus, studies focused on exploring factors influencing STD visiting behaviors have gained priority among researchers.



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Figure 1.  
Proposed research  
framework

### *2.1 Difference between tourists and visitors*

Tourists and visitors are seemingly same; however, they are distinct from each other. According to the World Tourism Organization, tourists are people who travel to or stay outside their usual environment less than one consecutive year for leisure or other purposes (Camilleri, 2018), while visitors are people who visit a destination outside their usual environment for less than a year for any purpose such as holidays, recreation, education, business, etc. (McCreary *et al.*, 2024). Besides, tourists are a specific type of visitors who travel to a specific destination primarily for leisure, recreation and cultural experiences, while visitors refer to people who travel to a specific place for leisure, business or personal reasons (Camilleri, 2018). Furthermore, tourists are often engaged in activities such as sightseeing, local attractions explorations, etc., while visitors engage themselves in visiting friends and relatives, attending events or performing business activities in a particular location (McCreary *et al.*, 2024).

### *2.2 Theory of e-consumption behavior (TeCB)*

In social psychology, theory of reasoned action (TRA) and TPB are widely used for predicting human behaviors. TRA was developed by Ajzen and Fishbein (1975), which explains that individuals' intentions are described by their attitude and subjective norms. Later, Ajzen (1991) extended TRA by adding new predictive variable-perceived behavioral control, because human behavioral intentions are not only determined by their attitude and subjective norms but also by their capacity and resources, and thus, TPB was developed. TPB describes that human behaviors are explained by behavioral intention, which is influenced by individuals' attitude, subjective norms and perceived behavioral control (Ajzen, 1991). In the same fashion, this study extends TPB because tourists' e-consumption behavior (i.e. STD visiting behaviors) may not be explained solely by their attitude, subjective norms and perceived behavioral control. E-consumption behavior may be predicted by how individuals can react towards a particular product/service through the electronic means/media. Thus, this study extends TPB, incorporating e-attitude, resource efficiency norms and perceived environmental sustainability, and develops TeCB to measure STD visiting behaviors among domestic and international tourists in Bangladesh.

### *2.3 Smart tourism destination visiting behaviors*

Behavior refers to actions measured by commonly accepted standards (Godey *et al.*, 2016). Sun *et al.* (2020) and Hasan and Aziz (2024) demonstrate behavior as a function of intention determined by individuals' perceived behavioral control, subjective norms and attitudes. Ghosh and Mukherjee (2023) argue that tourists' behavior is the process or way in which they choose tourist destinations, travel there and evaluate about that destination. Furthermore, Torabi *et al.* (2022) contend that STD visiting behaviors are likely to be influenced by tourists' attitudes and subjective norms. Based on these discussions, it can be argued that STD visiting behavior could be the function of STD visit intentions, which may be determined by e-attitude, resource efficiency norms and perceived environmental sustainability.

### *2.4 e-Attitude and smart tourism destination visit intentions*

Empirical studies have established the relationship between e-attitude and intentions, where e-attitude is defined as an individual's psychological disposition of liking or disliking the use of ICT for storing, retrieving and transmitting information electronically in a digital form (Hasan, 2022b). Furthermore, Berhe *et al.* (2020) explain e-attitude as the degree to which an individual evaluates electronic means favorably or unfavorably. Conclusively, e-attitude

towards STDs can be described as the degree to which a tourist favorably or unfavorably evaluates particular STDs before performing a specific behavior.

In a previous study, the importance of attitude has been discussed in several contexts, where Novianti *et al.* (2022) explained that tourists' attitude plays a vital role in explaining their intentions towards STDs. Furthermore, Chung *et al.* (2018) demonstrated that attitude significantly influences tourists' behavioral intention towards heritage tourism in Korea. Therefore, it can be assumed that investigating the causal effect of e-attitude on behavioral intentions towards STDs is pertinent, and thus, the study proposes the following hypothesis.

*H1.* e-Attitude significantly influences STD visit intentions.

#### *2.5 Resource efficiency norms and smart tourism destinations visit intentions*

Earlier empirical studies have established a strong relationship between norms and intentions in different contexts, where a norm is defined as something which is expected or standard widely accepted in society (Farrow *et al.*, 2017). Basically, norms are two types: injunctive and descriptive (Linek and Ostermaier-Grabow, 2018). Descriptive norms involve individuals' perceptions that are typically expected or performed (Conner, 2020). Hence, resource efficiency norms are one kind of descriptive norms which can be typically expected to be performed by citizens in society.

In previous studies, a norm is explained as an important predictor of individual's behavioral intentions. As such, Novianti *et al.* (2022) explain that tourist beliefs and subjective norms are significantly related to traveling intentions towards STDs. García-Milon *et al.* (2020) mention that social influence (subjective norms) significantly affects tourists' STD visit intentions. Therefore, it is pertinent to examine the causal relationship between resource efficiency norms and STD visit intentions, and thus, the current study proposes the following hypothesis.

*H2.* Resource efficiency norms significantly influence STD visit intentions.

#### *2.6 Perceived environmental sustainability and smart tourism destinations visit intentions*

Although earlier studies have established a strong tie between perception and intentions, the relationship between perceived environmental sustainability and intentions is less studied. McNeely (2021) demonstrates environmental sustainability as the condition, where resources like wildlife, water and air are preserved for future generations. Besides, Baloch *et al.* (2023) explain environmental sustainability as an ecological condition, where natural biodiversity exists, reducing environmental pollution and carbon emissions and saving natural resources. Conclusively, perceived environmental sustainability can be explained as the degree to which an individual evaluates or treats environmental issues that help generate economic benefits and preserve natural resources. The concept of environmental sustainability consists of three dimensions, such as social, economic and environmental issues.

In the smart tourism context, economic and environmental issues are highlighted, and it is argued that if travelers are concerned about environmental issues, then they prefer some systems or mechanisms that maximize economic growth, preserving the natural environment (Wu and Madni, 2021). Thus, it can be assumed that examining the causal effect of perceived environmental sustainability on STD visit intentions is crucial. Thus, the study proposes the following hypothesis.

*H3.* Perceived environmental sustainability significantly influences STD visit intentions.

*2.7 Smart tourism destination visit intentions and smart tourism destination visiting behaviors*

Before defining STD visit intentions, behavioral intention is explained as individuals' tendency to perform specific future behaviors (Hasan, 2023a). Behavioral intentions refer to planning commitment that is predicted by pre-intention variables such as affective and conative aspects of smart tourism (Hasan, 2022a). Hasan and Rahman (2023) explain behavioral intentions as the likelihood of engaging in a particular behavior. Furthermore, Liu *et al.* (2020) argue that behavioral intention is formed by motivational components that are highly correlated with the behavior itself. In this regard, STD visit intentions can be described as the degree to which a tourist formulates a conscious plan to visit STDs or not in future. Thus, STD visit intentions may be the function of e-attitude, resource efficiency norms and perceived environmental sustainability.

In the early literature, Jeong and Shin (2020) explain that behavioral intention leads to the actual behavior towards STDs. Besides, Pai *et al.* (2020) mention that tourists' revisit intention is significantly related to tourists' happiness towards STDs. Based on these discussions, it can be inferred that STD visit intentions can significantly explain tourists' visiting behaviors towards STDs, and thus, the study proposes the following hypothesis.

*H4. STD visit intentions significantly influence STD visiting behaviors.*

### **3. Methodology**

Bangladesh is one of the most potential countries in the world for tourism industry and has many tourist attractions such as historical mosques, mountains, archaeological sites, longest natural beach, hill forests, picturesque landscape, etc. Bangladesh receives 650 thousand (6.50 lakh) foreign visitors in 2023, contributing 4.7% to the total national GDP (Siddiqui, 2023; Hafsa, 2020) and 2 crore domestic tourists in 2022 (The Bangladesh Monitor, 2023). Thus, the study considers both domestic and foreign tourists from different tourist destinations in Bangladesh.

#### *3.1 Measures*

Due to the scarcity of existing validated measurement items of resource efficiency norms and perceived environmental sustainability, the study attempts to develop necessary measurement items of each construct. Thus, a review of literature and focus group discussions (FGDs) have been administered step by step. First, construct domains and items are identified by a review of literature on smart tourism. Second, FGDs have been administered, which consist of 8 members, including industry operators, academicians and both domestic and foreign tourists. Social science researchers extensively use FGDs because of its insightful data and low cost (Woodyatt *et al.*, 2016). The members of FGDs are selected conveniently, and participants are provided the meeting time and date via a smartphone, using WhatsApp mobile applications. At the scheduled date and time, FGD sessions start and the floor is open for all the members to freely discuss the resource efficiency norms and perceived environmental sustainability.

Initially, 9 items of resource efficiency norms and 11 items of perceived environmental sustainability have been generated in a Likert-scale-type format. Third, in-depth interviews among 10 experts in the tourism industry and STDs were administered to verify the content validity of the developed measurement items. Fourth, a pre-test was conducted among the 40 tourists who have visited STDs in Bangladesh as well as the world to check the content conciseness and clarity. Fifth, reliability and validity of the newly developed measurement items are checked, and thus, the measurement items' reliability is checked by Cronbach's

alpha and composite reliability (CR) values; and the items' validity is checked by factor loadings and average variance extracted (AVE). Finally, 3 items of resource efficiency norms and 4 items of perceived environmental sustainability have been retained for the main survey to test the proposed hypotheses in the context of STD visiting behaviors in Bangladesh.

On the other hand, the measurement items of e-attitude, STD visit intentions and STD visit intentions are adopted and modified to fit into the research context. Three measurement items of e-attitude are adapted from Hasan (2022a, b). Three items suggested by Hasan (2023b, c) are used for measuring STD visit intentions. Furthermore, three items for measuring STD visiting behaviors are adopted from Hasan (2023a). Importantly, the respondents were asked to score all the items that are presented in a five-point scale, where "1" denotes strongly disagree and "5" denotes strongly agree.

### 3.2 Questionnaire design

The final survey questionnaires were first developed in English and translated into Bangla by proficient individuals and then again translated into English by other native language specialists to detect confusing words and remove them. After careful translations, the final questionnaires were prepared in a structured format with three sections. First, the concept and purposes of the study are briefly described. Second, the demographic variables such as gender, age, occupation and annual income are briefly illustrated. In the last section, the study constructs and all measurement items of each construct are presented in an assertive sentence format for quick and easy understanding.

### 3.3 Study population, sampling procedures and data collection

The population of this study is both domestic and foreign tourists who visit STDs in the world at least once in their life, currently living in Bangladesh, aged between 18 and 70 years. A convenience sampling technique was applied to collect data from both domestic and international tourists from different selected tourist destinations in Bangladesh. Purposively, Cox's Bazar Beach, Kuakata Beach, Sundarbans mangrove forest, Ratargul Swamp Forest and Bisnakandi were selected as study locations. Importantly, the study follows the same sampling techniques opted by Gani *et al.* (2023) and Poon and Tung (2024) in their studies.

To carry out this study, 5 well-trained enumerators were appointed and briefed about the concept and purpose of this study. In the subsequent efforts, the enumerators purposively invited 1,000 participants and asked to fill up the survey questionnaires. Importantly, the respondents were asked to participate in the study process voluntarily. A total of 452 (with a response rate of 45.20%) respondents agreed to take part in the study process and provided the requested information. After data screening and evaluations, 39 problematic data with extreme values and missing information were removed, and the subsequent 413 usable (with a valid response rate of 41.30%) responses were used for further analysis. It is important to note that among the 413 valid responses, 56 were collected from foreign tourists and the remaining 357 were collected from domestic tourists from July 2023 to September 2023. Proportionately, respondents as foreign tourists are far fewer than domestic tourists due to the difficulty of approaching them and communicating with them in Bangladesh.

### 3.4 Data analysis

Following Anderson and Gerbing's (1988) two-step approach, the study administers the research through partial least squares structural equation modeling (PLS-SEM), using SmartPLS 3.3.3. Since data are collected from specific categorical respondents and specific time periods, the question of common method bias (CMB) may arise. To solve this issue, the study employed several techniques. For instance, order bias is controlled by mixing up the

measurement items of all variables. Besides, participants were asked to complete extra questions unrelated to the study within the questionnaire to avoid response format bias. Furthermore, respondents are informed that there are no right and wrong answers to reduce method bias. Furthermore, variance inflation factors (VIFs) are obtained by a full collinearity test, and according to Table 3, the VIF values are less than 3.3, which indicates that the model is free from CMB (Kock, 2015).

Importantly, although covariance based structural equation modeling (CB-SEM) is widely used to test the existing theories in social psychological research, PLS-SEM is appropriate and required in the explanatory stage for building a theory (Usakli and Rasoolimanesh, 2023). Furthermore, PLS-SEM requires the least assumptions about properties of normal distribution of data, while CB-SEM requires multivariate normal data. In addition, PLS-SEM is used to explain the complex model, where all constructs are reflective in nature (Hair *et al.*, 2021). Importantly, the present study has developed a new theory, extending the TPB. Thus, due to the characteristics of PLS-SEM, this study has found PLS-SEM more appropriate than CB-SEM in the research context.

#### 4. Results

Using SPSS 25.0, respondents' descriptive statistics are prepared and presented in Table 1. The frequency analysis indicates that 60.77% ( $n = 251$ ) of participants are male and the rest 39.23% ( $n = 162$ ) are female. In the age group, 35.35% ( $n = 146$ ) of respondents belong to the 18–30 age group, 37.05% ( $n = 153$ ) of participants belong to the 31–45 age group and the rest 27.60% ( $n = 114$ ) belong to the 46–70 age group, with the mean age of 38.57 years. In case of occupation, 26.87% ( $n = 111$ ) of respondents are students, 45.28% ( $n = 187$ ) are office workers and the rest 27.85% ( $n = 115$ ) are involved in other professions. In the level of participants' annual income, income of 31.71% ( $n = 131$ ) of respondents is below US\$4000, that of 43.83% ( $n = 181$ ) of respondent ranges from US\$4000 to US\$10000, and that of the rest 24.46% ( $n = 101$ ) of respondents is above US\$10000.

##### 4.1 Evaluation of the measurement model

To evaluate the measurement model, PLS-SEM is used following the steps suggested by Hair *et al.* (2013). The study performs confirmatory factor analysis to identify that each item loads

Variables	<i>n</i>	Percentage (%)
Gender		
Male	251	60.77
Female	162	39.23
Age (years)		
18 to 30	146	35.35
31 to 45	153	37.05
46 to 70	114	27.60
Mean age is 38.57 years		
Occupation		
Students	111	26.87
Office workers	187	45.28
Others	115	27.85
Annual income (US\$)		
Below US\$4000	131	31.71
US\$4000–US\$10000	181	43.83
Above US\$10000	101	24.46

**Table 1.**  
Demographic profile of  
respondents ( $n = 413$ )

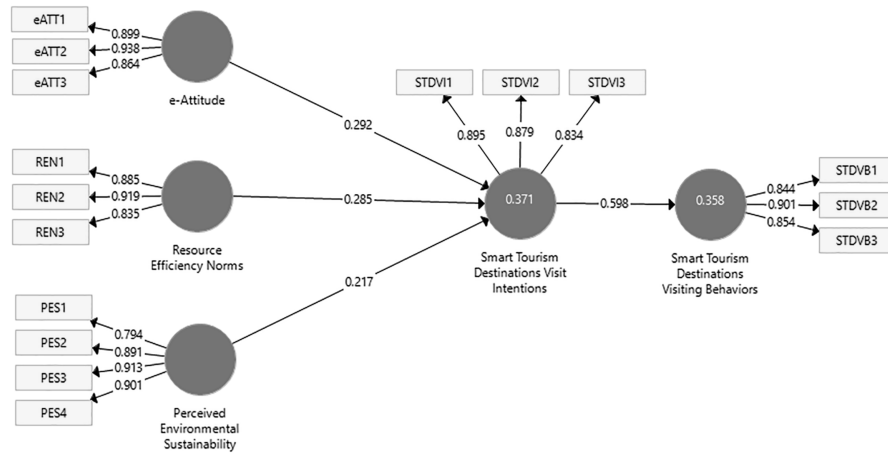
**Source(s):** Created by authors

to a specific construct and meets the criterion of all indicators' reliability. The reliability is measured by Cronbach's alpha and CR values. Table 2 and Figure 2 represent the  $\alpha$  values and CR values that are greater than the recommended threshold of 0.70 (Hair *et al.*, 2013).

Constructs/Items	Outer loadings	Cronbach's alpha ( $\alpha$ )	Composite reliability (CR)	Average variance extracted (AVE)
<i>e-Attitude</i>				
Information and communication technologies used in smart tourism destinations are a good idea	0.899	0.884	0.928	0.812
Information and communication technologies used in smart tourism destinations are a wise decision	0.938			
Information and communication technologies used in smart tourism destinations are beneficial	0.864			
<i>Resource Efficiency Norms</i>				
I think that smart tourism destinations install low-flow shower head	0.885	0.855	0.912	0.775
If light bulbs are needed, the smart tourism destinations install LED or CFL bulbs	0.919			
I think that smart tourism destinations use insulating in building to use less heating and cooling energy	0.835			
<i>Perceived Environmental Sustainability</i>				
I believe that smart tourism destinations conserve ecosystems using low-impact materials	0.794	0.898	0.929	0.768
I believe that smart tourism destinations implement green supply chain strategies	0.891			
I believe that smart tourism destinations recycle waste and recover energy	0.913			
I believe that smart tourism destinations use bio-degradable materials	0.901			
<i>Smart Tourism Destinations Visit Intentions</i>				
I will visit smart tourism destinations	0.895	0.839	0.903	0.757
I'm willing to visit smart tourism destinations	0.879			
I will make an effort to visit smart tourism destinations	0.834			
<i>Smart Tourism Destinations Visiting Behaviors</i>				
I frequently visit smart tourism destinations	0.844	0.834	0.901	0.751
When visiting tourism destinations, I often visit smart tourism destinations	0.901			
I frequently go for visiting tourism destinations that have the characteristics of smart tourism destinations	0.854			

Source(s): Created by authors

**Table 2.**  
Measurement model  
results



**Figure 2.**  
Measurement model

**Source(s):** Created by authors

Furthermore, the measurement model's adequacy is checked by convergent validity and discriminant validity, where convergent validity is checked based on three criteria. First, each item's factor loadings should be greater than 0.70; second,  $\alpha$  and CR for each construct must be greater than 0.70 and third, each constructs' AVE should exceed 0.50 (Ab Hamid *et al.*, 2017). Table 2 represents that the factor loadings range from 0.794 to 0.938,  $\alpha$  values are between 0.834 and 0.898, CR values range from 0.901 to 0.929 and AVE values range from 0.751 to 0.812, which have met the aforementioned criteria. Hence, the constructs' convergent validity has been confirmed.

Similarly, the measurement model's discriminant validity is measured by two criteria. First, item loadings on any other construct are smaller than the item loadings to construct correlations; and second, the square root of the AVE of each construct is larger than the AVE of each construct (Fornell and Larcker, 1981). Table 3 shows that all AVE values of each construct are smaller than the square root of the AVE of each construct. Thus, discriminant validity has been established.

#### 4.2 Evaluation of the structural model

**4.2.1 Evaluation of model fitness.** The fit of the research model is measured by calculating goodness-of-fit indices. Due to this fact, the current study analyzes cross-validated

	eATT	REN	PES	STDVI	STDVB
eATT	0.901				
REN	0.329	0.880			
PES	0.270	0.554	0.876		
STDVI	0.444	0.501	0.454	0.870	
STDVB	0.460	0.546	0.488	0.598	0.867
VIFs	1.136	1.519	1.462	1.000	1.253

**Table 3.**  
Results of discriminant validity and collinearity

**Note(s):** eATT = e-attitude; REN = resource efficiency norms; PES = perceived environmental sustainability; STDVI = smart tourism destination visit intentions; STDVB = smart tourism destination visiting behaviors; VIFs = variance inflation factors

**Source(s):** Created by authors

redundancy ( $Q^2$ ) and effect size ( $f^2$ ) for measuring the model's predictive relevance.  $Q^2$  is measured when the goodness-of-fit index is not appropriate for model validation because the characteristics of a valid model and invalid model seem to be similar (Henseler and Sarstedt, 2013). The  $Q^2$  values of STD visit intentions and STD visiting behaviors are presented in Table 4 as  $Q^2 = 0.275$  and  $Q^2 = 0.265$  that are greater than zero, respectively, indicating that the proposed research model is relevant for this study. Furthermore, effect size ( $f^2$ ) is calculated to quantify the effects of exogenous variables on endogenous variables compared with the changes in R-square.  $f^2$  is calculated by the following formula. Effect size  $f^2 = \frac{R^2_{Inclusive} - R^2_{Exclusive}}{1 - R^2_{Inclusive}}$

According to this study, Table 5 represents the effect size ( $f^2$ ) of e-Attitude, resource efficiency norms, perceived environmental sustainability and STD visit intentions, which are 0.119, 0.085, 0.051, and 0.558, respectively, reflecting small, small, small and large effect size since Cohen (1988) notes that  $f^2$  value of 0.02, 0.15 and 0.35 or above, respectively, represents small, medium and large effect size.

**4.2.2 Hypothesis testing.** The present study evaluates the SEM to calculate the effects of exogenous variables on endogenous variables in terms of path coefficients ( $\beta$ ),  $T$ -statistics and  $p$ -value. Table 6 and Figure 3 reveal that all hypothesized relationships of the proposed model are accepted, where H1 demonstrates that the strength of relationship between e-attitude and STD visit intentions is found to be positively significant ( $\beta = 0.292$ ,  $t = 5.712$ ,  $p = 0.000$ ), supporting H1, and thus, this result implies that tourists who are positive about the applications and usage of information technologies in tourist destinations and tourism services have strong positive intentions towards visiting smart tourist destinations. Consistent with the findings of this study, Hasan (2022a, b) explains that e-attitude significantly affects behavioral intentions among ridesharing customers in Bangladesh. However, Trivedi *et al.* (2018) note that attitude towards environment-friendly packaging is insignificantly related to consumers' green purchase intentions.

According to H2, resource efficiency norms are significantly related to STD visit intentions ( $\beta = 0.285$ ,  $t = 5.300$ ,  $p = 0.000$ ), supporting H2, and thus, the study findings

Total	SSO	SSE	$Q^2 (=1-SSE/SSO)$
STDVI	1,239	898.775	0.275
STDVB	1,239	910.793	0.265

**Note(s):** STDVI = smart tourism destination visit intentions; STDVB = smart tourism destination visiting behaviors; SSO = sum of squares of observations; SSE = sum of squares of prediction errors

**Source(s):** Created by authors

**Table 4.**  
Blindfolding results

Latent variables	$f^2$	Decision
eATT	0.119	Small
REN	0.085	Small
PES	0.051	Small
STDVI	0.558	Large

**Note(s):** eATT = e-attitude; REN = resource efficiency norms; PES = perceived environmental sustainability; STDVI = smart tourism destination visit intentions

**Source(s):** Created by authors

**Table 5.**  
Effect size of latent  
variables on  
behavioral intentions

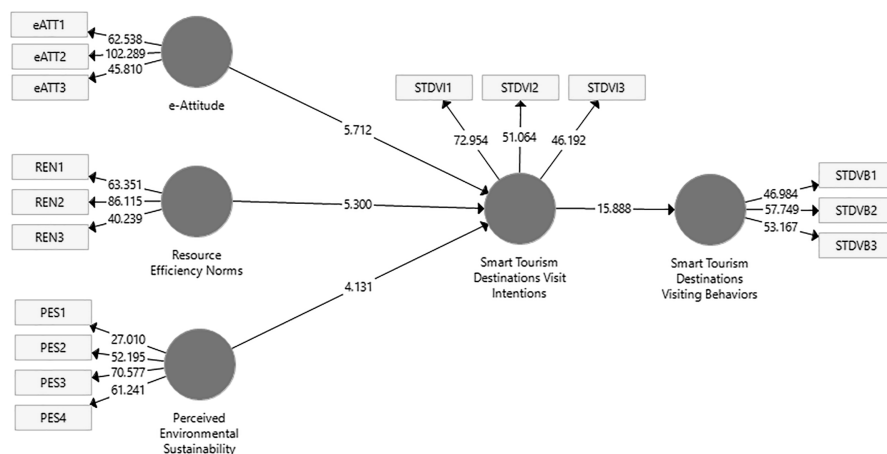
indicate that tourists who are involved in conserving natural resources show positive intentions towards smart tourist destinations. Consistently, Wang *et al.* (2018) mention that personal norms are significantly related to STD intentions. Furthermore, this study's result demonstrates that perceived environmental sustainability is significantly related to smart tourist destination visit intentions (H3;  $\beta = 0.217, t = 4.131, p = 0.000$ ), which supports H3, and thus, this result indicates that tourists who believe that STDs conserve natural ecosystems and use biodegradable and low-impact materials are likely to show positive intentions towards STDs. Aligned with this result, Pandža Bajs (2015) have found that tourists' perceived value has a significant influence on their behavioral intentions.

Furthermore, H4 states that STD visit intentions significantly influence STD visiting behavior ( $\beta = 0.598, t = 15.888, p = 0.000$ ), which supports H4, and thus, this result indicates that tourists having positive strong intentions are more likely to visit STDs. Aligned with this result, Hasan (2023a) has found that agro-tourist destination visit intention has a significant influence on agro-tourist destination visiting behaviors.

Hypothesis	Relationships	Beta	T-statistics	p-values	Decisions
H1	e-Attitude -> smart tourism destination visit intentions	0.292	5.712	0.000	Supported
H2	Resource efficiency norms -> smart tourism destination visit intentions	0.285	5.300	0.000	Supported
H3	Perceived environmental sustainability -> smart tourism destination visit intentions	0.217	4.131	0.000	Supported
H4	Smart tourism destination visit intentions -> smart tourism destination visiting behaviors	0.598	15.888	0.000	Supported

**Source(s):** Created by authors

**Table 6.**  
Path coefficients and hypothesis testing



**Figure 3.**  
Structural model

**Source(s):** Created by authors

## 5. Conclusion and implications

Destinations' facilities, landscapes, access to available information and infrastructure are considered to be the most critical factors that influence tourists' STD visiting behaviors (Tavitiyaman *et al.*, 2021). In the past studies, mainly tourists' experience, attitude, emotional attachment and tourists' prior knowledge are identified as key factors leading to STD visit intentions (Pai *et al.*, 2020). However, so far scholars have not paid adequate attention to exploring factors related to technology perception, resource conservation and environmental sustainability, which can motivate tourists' STD visiting behaviors in the era of smart technologies.

Thus, the current study uniquely develops TeCB to measure the impacts of e-attitude, resource efficiency norms and perceived environmental sustainability on STD visit intentions and the subsequent effect of intentions on smart tourist destination visiting behaviors among international and domestic tourists in Bangladesh. The study results indicate that all hypothesized relationships are accepted, which will uniquely contribute to tourism literature including natural, heritage and STDs in Bangladesh as well as the world.

### 5.1 Theoretical implications

The current study has left several unique theoretical implications for researchers and academicians because it has developed TeCB by extending TPB by incorporating e-attitude, resource efficiency norms and perceived environmental sustainability as predictive variables of intentions. Thus, the study has identified several unique factors that significantly influence tourists' visiting behaviors towards STDs. First, the findings reveal that STD visit intentions are significantly related to STD visiting behaviors, which is consistent with Hasan (2024) who explains that travelers' renewable energy consumption intention is significantly related to renewable energy consumption behavior among eco-tourists in Bangladesh. Thus, this study will uniquely contribute to tourism literature by explaining the significant impact of intentions on behaviors among both domestic and foreign travelers.

Second, Hasan (2022a, b) explains that e-attitude has a significant impact on behavioral intentions among ridesharing customers in Bangladesh, which is measured by three questions described by Hasan (2022a, b). Similarly, this study finding has revealed that e-attitude is significantly related to STD visit intentions, which will uniquely contribute to tourism literature. Third, most of the studies have demonstrated that norms such as subjective norms, personal norms and social norms significantly influence travelers' visit intentions (Park *et al.*, 2017). Consistently, the current study has uniquely identified that resource efficiency norms significantly affect STD visit intentions among domestic and foreign tourists in Bangladesh, which will uniquely contribute to tourism literature and smart tourism literature as well.

Fourth, existing studies have focused on perceived behavioral control that is significantly related to tourists' visit intentions (Verma and Chandra, 2018). Consistently, this study has revealed that perceived environmental sustainability is significantly related to tourists' smart tourist destination visit intentions, which will uniquely contribute to tourism literature. In this way, the current study expands tourists' behavioral studies by empirically testing the proposed model's hypotheses by collecting data from both domestic and international tourists, broadening the range of studies and generalizing study findings.

### 5.2 Practical implications

The study has offered several practical implications for STD marketers and policymakers. First, since tourists' visiting behaviors are impacted by their intentions, industry operators should add new technologies (e.g. mobile application-based room services, IT-enabled

situational information provider installation, etc.). Second, industry operators should develop such an environment that provides technology-enabled descriptions of tourist destinations' history, routes, weather and itineraries. Third, industry operators should develop electronic flowcharts of places which are visible and easy to find. Fourth, since today's tourists are positive towards saving resources (Wu *et al.*, 2017), industry operators should use products made of low-impact materials and low-energy-consuming machinery.

Fifth, most tourists have become concerned about environmental sustainability since the last 2 decades (Sharpley, 2020); thus, industry operators must adopt green technologies and use biodegradable materials in tourist destinations. Finally, destination marketers should display destinations' history and culture in the forms of games and stories, which will increase visitors' traveling interest.

### 5.3 Limitations and future research

Despite offering several useful findings regarding STD visiting behaviors, the study is still constrained by several limitations. First, the current study extends TPB and develops TeCB, while future studies may redesign the model again, including knowledge, experiences and motivation variables. Second, the study is conducted using a convenience sampling technique, which may generate bias, while future studies may use a simple random sampling technique to generalize the findings more accurately. Third, the study collects data simultaneously from both domestic and international tourists and analyzes the data as a single dataset.

However, further studies may collect data separately and classify them into two groups and compare them with each other. Finally, the study is conducted for a specific period, which may include attendant limitations of non-representativeness. However, future studies may collect data using a longitudinal study approach that is more comprehensive in nature and builds up more realizable and accurate key events in the study participants' lives (Hollstein, 2019) and can generalize the results to other STDs in other countries.

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**Corresponding author**

Abdulla Al-Towfiq Hasan can be contacted at: [towfiqhasan.du@gmail.com](mailto:towfiqhasan.du@gmail.com)

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# Identifying high-growth firms in five European countries: micro firms vs. larger firms

Paz Rico-Belda and Bernardí Cabrer-Borrás

*Department of Economic Analysis, Universitat de València, Valencia, Spain*

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## Abstract

**Purpose** – This study uses an extensive sample of firms from Germany, France, UK, Portugal and Spain with the aim of obtaining conclusive results on the determinants that drive a firm to be high-growth firm (HGF). This sample includes micro firms, which are not generally considered in the literature. There are several reasons to take them into account: not excluding an important part of the business fabric, the results can be extrapolated, the study can show if micro firms also present high growth and if there are differences in the factors that determine the probability of being an HGF between both segments of firms.

**Design/methodology/approach** – A multivariate dynamic model of binary choice is used to analyse the probability of a company being classified as high growth. Then, with the Blinder and Oaxaca decomposition, the differences in the probability of being an HGF between micro firms and non-micro firms are studied.

**Findings** – The results show that HGFs demonstrate persistence, and younger firms are more likely to be HGFs. Micro firms also register high growth, although they are less dynamic and show a negative differential with respect to larger firms as highlighted by the characteristic component.

**Originality/value** – In some countries, such as Spain and Portugal, micro firms predominate, and these tend to be less dynamic, so to identify how to improve business dynamics, the factors that limit the growth of this type of company must first be determined. In this paper, in line with Acs and Mueller (2008), we therefore include firms with less than ten employees so as not to exclude an important part of the business fabric and to ascertain whether this type of firm also shows high growth.

**Keywords** High-growth firms, Gazelles, Micro firms, Birch–Schreyer index, Dynamic binary choice models, Blinder–Oaxaca decomposition

**Paper type** Research paper

## 1. Introduction

It is a widely accepted fact in the economic literature that a small number of firms which show high growth are the ones that generate the greatest net employment in the economy (Birch and Medoff, 1994; Schreyer, 2000; Acs and Mueller, 2008). High-growth firms (HGFs) generate a higher employment rate than their competitors, and therefore, HGFs are crucial for boosting growth in economies (Acs and Mueller, 2008; Henrekson and Johansson, 2010; Jansen *et al.*, 2023). This fact explains the great interest shown in HGFs by both policymakers (European Commission, 2010) and researchers.

Birch (1979, 1981) showed that a small number of HGFs generated most of the net employment. Since this seminal work, many studies have focused on identifying the

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characteristics of HGFs and the factors that determine them. However, as Rocha and Ferreira (2021) indicate, despite the vast academic literature, no definitive conclusions have been reached because of the widely divergent criteria used to identify HGFs. As Cristofaro *et al.* (2024) highlight, identifying the factors contributing to the high growth of firms provides valuable insights for entrepreneurs, investors and policymakers, ultimately increasing the likelihood of firms' success. Moreover, the benefits of such identification extend to improved resource allocation, targeted investments and the development of supportive policies that collectively enhance the overall economic landscape.

Mason and Brown (2013) consider that, although public initiative tends to stimulate innovation and entrepreneurship, mainly related to technology, it does not always target those firms that may be more dynamic. According to these authors, "technology policy is not a substitute for high-growth firm policy". In the same vein, the results of Daunfeldt *et al.* (2016) for Swedish firms, during the period 1997–2008, "suggest that the relationship between R&D and high growth is, at best, highly complex but is most likely negative". To implement adequate policies, first the factors that determine the presence of HGFs need to be clearly identified. Similarly, as indicated by Marrocu *et al.* (2012), the location of a company is an important factor in its development, and it should be given more consideration, since the local endowment of capital, both human and intangible, generates and catalyses externalities, as evidenced by Rico and Cabrer-Borrás (2020a, b).

This study aims to analyse in depth the characteristics of HGFs to obtain conclusive results on the determinants that foster an HGF. In this paper, in line with Acs and Mueller (2008), we include firms with fewer than ten employees to avoid excluding an important part of the business fabric and to ascertain whether this type of firm also shows high growth. Moreover, HGFs are identified using the neutral index proposed by Birch–Schreyer (BS), which allows small firms to be considered without biasing the results towards them, as occurs with the Eurostat–Organisation for Economic Co-operation and Development (OECD) definition.

This paper addresses three research questions: What are the determinants that drive a firm to be HGF? Are there differences in the factors influencing the probability of being an HGF between micro firms and larger firms? Do external factors, related to the location of firms, influence the emergence of HGFs?

To accurately determine the factors of business growth, a dynamic multivariate binary choice model is used, which enables the identification of some of the explanatory factors of the probability of being an HGF. In addition, using the decomposition of Blinder (1973) and Oaxaca (1973), the differences in the probability of micro firms being HGFs are analysed.

This paper makes several contributions to the literature. First, it uses a broader definition of HGF by including micro firms. Second, it considers external factors as determinants of the probability of being an HGF. Finally, it applies a methodology that allows for an analysis of the differences in the probability of being an HGF between micro and non-micro firms.

## 2. Theoretical background

### 2.1 Definitions of high-growth firms

Various criteria have been proposed in the literature to classify a firm as HGF (Henrekson and Johansson, 2010). The criteria depend on the indicator used (turnover, employment, profit, etc.), the measure of growth (in absolute or relative terms) and the period considered. Mogos *et al.* (2021) state that the definition of an HGF is important, since "identification of HGFs and results vary significantly with the specific definition used, as well as with the

specific variable used to measure growth". Delmar *et al.* (2003) point out that firms classified as HGFs using one definition can cease to be so when using another.

Birch and Medoff (1994) stipulated that an HGF should have a minimum of 20% turnover growth each year over a five-year window, starting from a base-year revenue of at least \$100,000. According to Lopez-Garcia and Puente (2012), using turnover to calculate growth leads to comparison problems due to the lack of consensus on how to deflate this variable. For this reason, the growth indicator employment is recorded in the literature as being the more commonly used indicator.

As indicated by Coad *et al.* (2014) and Aldrich and Ruef (2018), no unanimous agreement exists in the literature on the concept of HGF, although the Eurostat-OECD (2007) indicator is often considered the standard definition for HGF (Grover *et al.*, 2019; Jansen *et al.*, 2023). The Eurostat-OECD definition considers firms with average annualised growth in employees greater than 20% per annum over a three-year period and with ten or more employees at the beginning of the observation period as HGFs. However, as pointed out by Daunfeldt *et al.* (2015), applying a size threshold of ten employees might exclude many small entrepreneurial firms that show high-growth rates. This creates a sample selection problem, which may lead to incorrect policy decisions since the spread of small HGFs differs across countries, regions and sectors. In our study, in line with Acs and Mueller (2008), firms with less than ten employees are considered; these are referred to as micro firms. Our objective is to compare the behaviour of micro firms with that of firms with more than ten employees and identify whether they present a different behaviour.

The use of relative change in employment as a growth measure is complicated, since this skews towards small firms. However, the absolute change in employment skews towards large firms. For this reason, Birch (1987) and Schreyer (2000) propose an index which combines absolute and relative growth, known in the literature as the BS index:

$$BS = (E_{i,t} - E_{i,t-3}) \left( \frac{E_{i,t}}{E_{i,t-3}} \right) \quad (1)$$

where  $E_{i,t}$  and  $E_{i,t-3}$  correspond to employment at the end and beginning of the period, respectively.

HGFs are firms that rank in the top 10% percentile of the BS index. It can be demonstrated that this measure, while still dependent on firm size, always gives rise to a smaller bias towards any size class than either the relative or the absolute measure of growth (Schreyer, 2000). However, Hölzl (2014) considers that BS index gives more attention to absolute job creation and therefore does not provide a definitive solution for measuring growth. In samples containing many firms with less than ten employees, as is the case of Spain and Portugal, the definition using BS index would be the most appropriate.

Birch (1987) used the term gazelle to describe small firms that grow very quickly, as opposed to what he called mice firms, those that are small and with low growth and elephant firms, which are very large but with low growth. The OECD (Ahmad, 2006) proposed using the term gazelle to describe young firms, less than five years old, with an average annualised growth of employees greater than 20% per year over a period of three years and with ten or more employees at the beginning of the observation period.

After presenting the different definitions, this paper considers the following types of firms. (1) HGFs that are in the 10% percentile with the highest value of the BS index [1], and within these, we distinguish between those that have more than ten employees and those that have fewer than ten employees (micro firms); (2) mice firms, those with less than twenty employees (but more than ten employees) and that do not present high growth (Acs and Mueller, 2008); (3) elephant firms, those with more than five hundred employees and not

presenting high growth (Acs and Mueller, 2008), and (4) those firms that do not fall within the previous classifications.

### 2.2 Literature review

Birch (1979, 1981) pointed out that a small number of fast-growing firms were responsible for most of the economy's job creation. Several empirical studies have corroborated this finding. In addition, many studies have shown that, although HGFs can be of any size, it is young and small firms which predominate. However, Brown *et al.* (2017) consider that there are many myths around what is an HGF and attempt to break down the information in terms of to what degree young, small and high-technology firms predominate.

Although Gibrat's law [2] assumes that the growth rate of a firm is independent of its size, this law is inconsistent with the empirical evidence since Sutton (1997) reveals a negative correlation of growth with firm size. Caves (1998) concludes that business growth is independent of size above a certain threshold, while for small businesses the growth rate decreases with size. Likewise, most studies agree that smaller firms tend to grow faster than larger ones (Birch, 1981; Acs and Mueller, 2008; Lotti *et al.*, 2003). However, Acs and Mueller (2008) show that HGFs are present in all sizes.

There is no conclusive evidence in the literature regarding the influence of age. For example, Birch (1981) considers HGFs to be very young firms, and various research studies (Yasuda, 2005; Lopez-Garcia and Puente, 2012; Daunfeldt *et al.*, 2014) show a negative relationship between growth and age. Coad and Karlsson (2022) evidence that the majority of HGFs are small and young. However, Acs *et al.* (2011) show that HGFs are relatively old, since the average age of these firms was 25 years (Grazzi and Moschella, 2017). As indicated by Delmar *et al.* (2003) and Mogos *et al.* (2021), firm age rather than size is often considered a determinant of rapid growth. In this vein, Haltiwanger *et al.* (2013) show that when controlling for age, the effect of size disappears.

According to Giner *et al.* (2016), the sector to which a firm belongs has an ambiguous effect on the growth process. However, Henreksson and Johansson (2010) and Satterthwaite and Hamilton (2017) conclude that HGFs have a greater presence in the services sector. Along the same lines, Daunfeldt *et al.* (2016) find that HGFs are over-represented in knowledge-intensive service industries, although other studies reveal that HGFs tend to be present in all sectors, not necessarily dominating in highly technological sectors (Acs and Mueller, 2008; Henreksson and Johansson, 2010; Lopez-Garcia and Puente, 2012). In fact, with regard to innovation and technology, Kang *et al.* (2018) show that research and development drive business growth. Likewise, Segarra and Teruel (2014) show that investment in R&D positively affects the probability of being an HGF. However, Daunfeldt *et al.* (2016) show, in Sweden, that the industries with high research and development (R&D) intensity have a lower share of HGFs than those with a lower R&D intensity.

Benesová *et al.* (2018) argue that the creativity of human resources and their performance influence the rapid growth of firms. Likewise, Daunfeldt *et al.* (2015) and Lopez-Garcia and Puente (2012) support the idea that human capital is a fundamental factor in HGFs. The quality of human capital can be measured through labour productivity. However, Moschella *et al.* (2019) indicate that the results regarding productivity are mixed. Bianchini *et al.* (2017), Du and Temouri (2015) and Levratto *et al.* (2010) observe that the higher the productivity, the higher the growth. However, Daunfeldt *et al.* (2014) find no association between productivity and high growth.

Levratto *et al.* (2010) and Lopez-Garcia and Puente (2012) find no relation between a firm's financial situation and high growth. More specifically, Coad *et al.* (2011) and Bianchini *et al.* (2017) consider the role of profits, a lesser-researched characteristic, as a determinant of

HGFs. They show that HGFs are more profitable than other firms, although, as has been observed, very few studies focus on this variable.

The quality of the business ecosystem and public policies to encourage entrepreneurship are also determining factors in the presence of HGFs. Morris *et al.* (2015) and Benesová *et al.* (2018) argue that rapid growth derives from public encouragement of innovation and the creativity of human resources. Likewise, location is a determining factor in the proliferation of HGFs (Bravo-Biosca *et al.*, 2013; Li *et al.*, 2016), since, as indicated by Giner *et al.* (2016), the main urban and technological spaces are significantly linked to the existence of HGFs. However, for Littunen and Tohmo (2003), the firm's location is not a determining factor.

Coad *et al.* (2014) indicate that most of the research on HGFs is static. This has implications for economic policy, which needs assurances that growth at  $t$  will remain at  $t+1$ ; if this cannot be sustained over time, policies that stimulate growth are irrelevant (Daunfeldt and Halvarsson, 2015). However, the empirical evidence in this regard is not conclusive. Hölzl (2014), Mogos *et al.* (2021) and Erhardt (2021) find that the persistence of high growth depends on the choice of its definition.

Following this review of the literature, we conclude that there are no irrefutable results on the factors that determine a firm to be HGF.

### 3. Methodology and data

#### 3.1 Methodology

In order to determine the factors that characterise a firm as HGF, a dynamic multivariate binary choice model is proposed, where the probability of being an HGF is a function of the individual characteristics of the firms and the environment in which they operate.

From the utility theory approach, an economic agent, with a rational behaviour, would choose between two exclusive alternatives, maximising the expected utility. The  $i$ th agent would choose option 1 if his utility,  $U_i^1$ , is greater than the utility given by option 0,  $U_i^0$ . This comparison, from the mathematical point of view, can be expressed through the following probabilistic inequality,  $Prob(U_i^1 > U_i^0)$ .

The way to quantify utility is by assigning a probability to each of the rational decisions using the following equation:

$$P_i = Prob(Y_i = 1) = Prob(U_i^1 > U_i^0) = F(X_{ij}\beta) \quad (2)$$

where  $F(X_{ij}\beta)$  is the distribution function evaluated for the  $j$  characteristics associated with firm  $i$ . The vector of the characteristics [3] is denoted by  $(X_{ij})$ , while  $(\beta)$  is the vector of coefficients. Thus, the modelling of the choice of firms can be done through the following behaviour equation or binary choice model:

$$Y_i = F(X_{ij}\beta) + \varepsilon_i \quad (3)$$

where  $Y_i$  is a dichotomous variable that takes the value of 1 if firm  $i$  is an HGF and 0 if it is not.

After estimating the discrete choice model, the non-linear decomposition proposed by Yun (2004) is applied to examine the difference in the probability of being an HGF between micro and non-micro firms. The original approach of the method of decomposition, proposed by Blinder (1973) and Oaxaca (1973), makes it possible to determine what part of the difference in probability corresponds to each one of the two components considered by these authors. The first component collects the difference in the explanatory variables observed between the two groups, and the second component collects the difference in the unobservable characteristics, quantified by the discrepancy in the response to the

explanatory variables of both groups. The Blinder–Oaxaca method was intended for linear models but was later generalised for non-linear models (Yun, 2004).

If, as indicated, the probability of being an HGF for a firm  $i$ ,  $P_i$ , is given by:

$$P_i = F(X_{ij}\beta) \quad (4)$$

the breakdown of the difference in the probability of being an HGF between non-micro firms (L) and micro firms (S) can be obtained by:

$$\overline{P}_L - \overline{P}_S = \left( \overline{F(X_L\hat{\beta}_S)} - \overline{F(X_S\hat{\beta}_S)} \right) + \left( \overline{F(X_L\hat{\beta}_L)} - \overline{F(X_L\hat{\beta}_S)} \right) \quad (5)$$

The first addend includes the difference explained by the different characteristics of each group, given the same coefficients. The second addend indicates the unexplained difference, i.e. for the same characteristics, the part corresponding to the different responses of the two groups.

### 3.2 Database and variables

This paper uses a sample of firms from five European countries: Germany, France, the United Kingdom, Portugal and Spain. From the Orbis database, information on active firms from these five European countries is selected for the three-year window from 2016 to 2019 [4]. There is a sample of 602,604 firms, classified in the following sectors: industry, energy, construction, commerce, transport, hospitality, communications, business services, education, health and other services.

In the literature, HGFs are considered to initially have at least ten employees. In Spain and Portugal, where the size of the firms is small, the selection of the sample can have significant consequences, whereby a particular sector with smaller firms, such as services, is underrepresented. For this reason, this study also considers firms with fewer than ten employees. The restriction imposed by the definition of HGF may lead to sample bias towards medium- and large-sized firms, and the results could not then be extrapolated to the business population. However, to obtain the sample, firms were required to provide information on the number of employees for the years considered, which implies that the firms in the sample are survivors, excluding those less than 4 years old. It should be noted that around 50% of firms disappear within their first 3–4 years (Coad, 2018). Our imposition, together with the inclusion criteria and data verification by Orbis (Moody's, 2024), mean that young firms are underrepresented in the sample. Despite this, if the criterion of considering only firms with more than 10 employees at the beginning of the sample were established, as required by the OECD-Eurostat definition of HGF, young and small firms would be even further underrepresented.

The dependent variable is a binary variable that takes value 1 if the firm has fast growth and 0 otherwise. The HGFs are those that are in the 10% percentile of the highest value of the BS index. The size of the firm, as an explanatory variable, is quantified by the logarithm of the number of employees, in line with that proposed by Giner *et al.* (2016) and Moschella *et al.* (2019). To check whether micro firms have a differential effect on the probability of being an HGF, a dummy variable is generated, which takes the value of 1 if it has less than ten employees and 0 otherwise.

Human capital is measured through a *proxy* variable such as worker productivity, which is calculated as the ratio between operating income and the number of employees. For the financial conditions of the firms, in this study, the debt ratio is considered, which is the quotient between the total debt and own resources. For Lopez-Garcia and Puente (2012), a high debt ratio could be considered an indicator of fewer financial restrictions. However,

excessive debt could pose a risk of presenting solvency and financing problems in the future, which is why Lopez-Garcia and Puente (2012) also include the quadratic term of this variable among the explanatory variables.

The age of the company is quantified by the years that have elapsed since registration of the firm until the end of the sample period. As the literature also suggests, age squared is included as an explanatory variable to test whether age has a non-linear influence on the probability of being an HGF.

In line with the classification made by the National Institute of Statistics (INE) [5] of the sectors according to their technological level, four dummy variables are generated: non-technological, medium-high technology, high technology and cutting-edge technology.

Business profitability is also included as an explanatory factor, which is defined as the quotient between ordinary results before taxes and total assets (ROE). Location is accounted for using country dummies, with a dummy variable being generated for each of the five countries. Location is also considered to be included through the Human Capital Index (HCI) and the Global Competitiveness Index (GCI), published by the World Economic Forum (WEF). The HCI assesses the level of education, skills and employment of the population of each country (WEF, 2016). Likewise, the GCI is an indicator of the quality of public institutions (Schwab, 2016). Finally, as control variables, 11 sectoral dummies are included.

Table 1 shows the distribution of the firms in the sample according to their growth, as well as the descriptive statistics of their characteristics. Figure 1 shows the distribution of firms by country and according to the activity sector to which they belong.

From Table 1 [6], it can be deduced that HGFs are those with the highest profitability. The percentage of HGFs in the micro firm segment is lower than in firms with more than ten employees. Therefore, micro firms appear to be less likely to be HGFs than larger firms. Figure 1 shows that the sectors of business services, manufacturing and commerce predominate in the sample.

#### 4. Results

In the binary choice model, the lagged endogenous variable is included as an explanatory variable, with the aim of checking whether there is persistence in episodes of high growth, the proposed model being a dynamic model. All explanatory variables used in the model are collected at the beginning of the considered period. In this way, the factors can be considered *ex ante*, avoiding possible sources of endogeneity (Giner *et al.*, 2016; Rodrigues *et al.*, 2021).

The results of the different estimated models are presented in Table 2. All the models are estimated in a manner consistent with the existence of heteroskedasticity in the sample. We consider both the logistic and normal distribution functions, and the results show that the most appropriate specification is that of the Probit model, which is shown in Table 2.

First, it should be noted that the country dummy variables, which collect the location of the firms, and the GCI and HCI variables are highly correlated, so they cannot be included together. For this reason, Model 1 is estimated, including the dummy variables of the countries. Focusing on Model 1, in Table 3, the results indicate a positive and high persistence in the probability that a firm experiences high growth, as evidenced by Lopez-Garcia and Puente (2012), Hölzl (2014) and El-Dardiry and Vogt (2023). Erhardt (2021) also shows persistence in high growth among surviving firms, but when both surviving and exiting firms are considered, high growth does not persist.

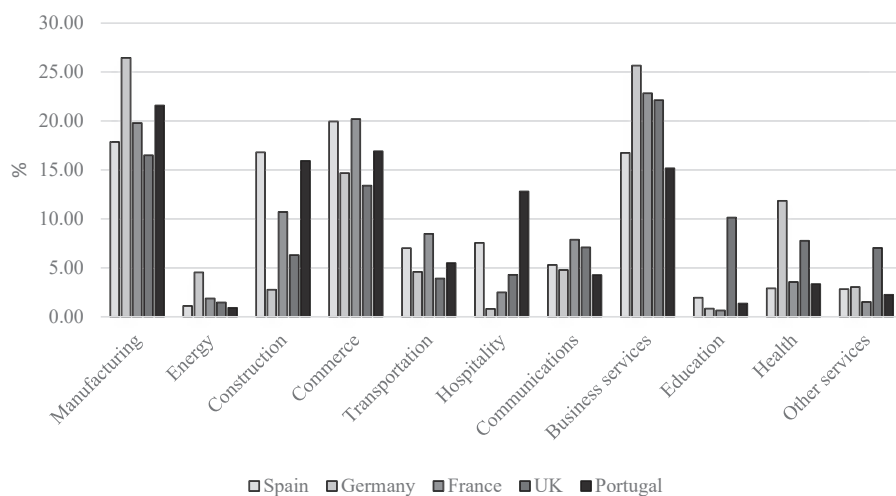
In the sample, 65.41% of the firms that present high growth in 2019 also show high growth in 2018. By segment, 74.20% of the firms with more than ten employees had high growth in 2018 and 2019, compared to 43.04% of the micro firms. The coefficient of the micro

**Table 1.**  
Average values and  
distribution of firms  
according to their  
growth

	Firms		Age		Employees		Productivity		Debt		ROE (%)					
	Number	%	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.				
<i>1. HGFs</i>																
Fewer than 10 employees	18,068	3.00	11	8	4	3	761.80	106.72	32,626.24	6.13	2.00	29.63	27.64	22.94	83.14	
Over 10 employees	46,045	7.64	26	21	673	91	325.98	142.94	2,252.55	4.48	1.47	41.96	20.81	15.74	69.86	
<i>2. Mice</i>																
Fewer than 10 employees	53,238	8.83	22	21	14	14	262.09	88.59	6,365.36	3.44	1.06	25.05	13.43	9.96	61.94	
Over 10 employees	3,814	0.63	40	29	33	3,847	998	150.90	2,120.07	6.19	1.57	82.46	9.75	8.78	84.46	
<i>3. Elephant</i>																
Fewer than 10 employees	402,893	66.86	17	16	4	3	243.02	77.88	3,882.13	4.23	0.98	38.08	13.18	9.06	73.81	
Over 10 employees	78,546	13.03	29	25	19	75	43	299.10	1,431.61	4.39	1.12	67.13	13.30	10.11	69.33	
<i>Total of firms</i>	602,604	100.00	20	18	15	89	5	274.53	88.24	6,803.83	4.27	1.08	42.62	14.22	10.05	72.41

**Note(s):** Corresponds to data for the year 2016. Turnover in thousands of euros

**Source(s):** Compiled by the authors from Orbis



Source(s): Compiled by the authors from Orbis

**Figure 1.**  
Distribution of HGFs  
by country and  
productive sector

firm variable indicates that there is a negative differential in the probability of a micro firm becoming HGF compared to larger firms. Likewise, the probability of becoming HGF is determined by the following characteristics of firms: age, profits, productivity, business size and technological level.

The age of the company has a non-linear U-shaped effect, so that the youngest and oldest firms are the ones with the highest probability of being an HGF. The parameter of the age variable is statistically significant, and its negative sign indicates that as age increases, the probability of becoming HGF decreases. Thus, it becomes clear that younger firms are more likely to be HGFs. Likewise, the positive sign of the squared age coefficient indicates that the probability of being an HGF decreases with age but at an ever-smaller rate. Both the size of the firm and the productivity of the employees positively affect the probability of being an HGF. Debt is not statistically significant. Regarding profits, the results indicate that the more profitable the firms are, from an economic point of view, the greater the probability of being an HGF.

The estimated parameters of the variables that reflect the technological level of the firms lead us to conclude that the probability of being an HGF increases with technological level. With the reference category being that of sectors with cutting-edge technology, the non-technological and medium technological sectors show negative differential effects in comparison, while the sectors with high technology do not present differences in the probability of being an HGF in firms with the latest technology. Finally, in relation to the productive sector, all sectors, without exception, present a positive differential effect with respect to the reference category, which is the commerce sector. This result indicates that firms in the commerce sector have a lower probability of being an HGF than any other firm belonging to other sectors. Firms with the greatest differential effect are those in the construction sector.

With Model 1, and for the mean values of the variables, both for micro firms and non-micro firms, a difference in probability of 0.22 points is obtained, which means that micro firms present a lower probability of being an HGF by 22% points than large firms.

Table 2.  
Probit model  
estimation

Variable	Total sample		Fewer than 10 employees Model 3		Over 10 employees Model 4	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Constant	-2.263	0.000	-1.721	0.000	-2.682	0.000
Persistence (Y in t-1)	1.596	0.000	1.707	0.000	1.531	0.000
<i>Firms' characteristics</i>						
Micro firms (1)	-0.100	0.000	-	-	-	-
Age	-0.020	0.000	-0.044	0.000	-0.010	0.000
Age squared	1.15E-04	0.000	3.62E-04	0.000	4.90E-05	0.000
Size	0.201	0.000	0.007	0.268	0.265	0.000
Productivity	0.127	0.000	0.130	0.000	0.114	0.000
Debt	0.004	0.475	0.161	0.398	-0.021	0.026
Debt squared	-2.43E-05	0.598	-0.011	0.536	1.54E-04	0.010
ROE	0.069	0.000	0.060	0.000	0.058	0.000
<i>Technology (2)</i>						
Non-technological	-0.247	0.000	-0.398	0.000	-0.163	0.000
Medium-high	-0.210	0.000	-0.443	0.000	-0.109	0.003
High	-0.053	0.227	-0.250	0.258	0.028	0.582
<i>Productive sector (3)</i>						
Manufacturing	0.177	0.000	0.296	0.000	0.085	0.000
Energy	0.109	0.000	0.212	0.000	0.042	0.169
Construction	0.358	0.000	0.438	0.000	0.258	0.000
Transportation	0.288	0.000	0.336	0.000	0.218	0.000
Hospitality	0.272	0.000	0.458	0.000	0.088	0.000
Communications	0.162	0.000	0.060	0.000	0.172	0.000
Business services	0.207	0.000	0.142	0.000	0.252	0.000
Education	0.185	0.000	0.385	0.000	0.112	0.000
Health	0.203	0.000	0.103	0.000	0.229	0.000
Other services	0.234	0.000	0.226	0.000	0.228	0.000

(continued)

Variable	Model 1		Total sample		Model 2		Fewer than 10 employees Model 3		Over 10 employees Model 4	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
<i>Localisation</i>										
GCI	-	-	0.049	0.075	-	-	-	-	-	-
HCI	-	-	0.011	0.006	-	-	-	-	-	-
<i>Control variable</i>										
Country dummies	Yes		No		Yes		Yes		Yes	
Number of observations	602,604		602,604		420,961		420,961		181,643	
Log likelihood	-1,26,066.20		-1,26,100.80		-55,568.78		-55,568.78		-68,095.20	
McFadden R-squared	0.38		0.38		0.25		0.25		0.34	
Prediction R-squared	92.13		92.15		95.70		95.70		84.00	
<b>Note(s):</b> The endogenous variable is a dichotomous variable that takes the value of 1 if it is a high-growth firm and 0 otherwise										
Reference categories: (1) Firms with over ten employees, (2) High technology and (3) Commerce										
The productivity variable is logarithmic										
<b>Source(s):</b> Compiled by the authors										

Table 2.

Variable	Total sample	Fewer than 10 Employees	Over 10 Employees
Persistence (Y in $t-1$ )	44.07	44.18	48.56
<i>Firms' characteristics</i>			
Micro firms	3.97	–	–
Age	–0.78	–1.74	–0.39
Age squared	0.00	0.01	0.00
Size	8.03	0.27	10.36
Productivity	5.07	5.20	4.45
Debt	0.17	6.42	–0.83
Debt squared	0.00	–0.45	0.01
ROE	2.74	2.40	2.26
<i>Technology</i>			
Non-technological	–7.31	–15.32	–6.40
Medium-high	–6.30	–16.91	–4.29
High	–1.69	–9.81	1.09
<i>Productive sector</i>			
Manufacturing	7.05	11.69	3.34
Energy	4.33	8.42	1.63
Construction	14.08	17.08	10.10
Transportation	11.41	13.22	8.52
Hospitality	10.76	17.80	3.44
Communications	6.44	2.40	6.74
Business services	8.22	5.65	9.89
Education	7.37	15.11	4.38
Health	8.05	4.12	8.98
Other services	9.30	8.97	8.91

**Table 3.**  
Marginal and  
differential effects in  
percentage points

**Source(s):** Compiled by the authors from models of Table 2

In Model 2, the dummy country variables have been replaced by the GCI and HCI variables. As can be seen, the goodness of fit is the same as in Model 1. This model leads us to conclude that external factors, related to the location of the firms, have a positive impact on the probability that the firms are high-growth, corroborating the results obtained in the empirical literature (Acs and Mueller, 2008; Bravo-Biosca *et al.*, 2013; Li *et al.*, 2016).

The Probit model is also estimated for each of the considered firm segments (Table 2, Models 3 and 4) in order to compare their results. From the results obtained, some significant differences are observed in the coefficients of the factors in the two groups of firms. To compare the results, the marginal and differential effects of the factors on the average firm of each of the two segments are calculated. The results are shown in Table 3, and from these, it can be concluded, firstly, that inertia is much greater in large firms than in small ones. Secondly, although age continues to have a non-linear U-shaped effect in both segments, the effect is greater in micro firms, although it decreases at a higher rate than in larger firms. The size variable is not significant in small firms, while in larger ones it positively affects the probability of being an HGF. The marginal effects of both productivity and profitability are quite similar between the two groups of firms. Debt in micro firms has an inverted U-shaped effect. However, in larger firms it has a U-shaped effect, and according to Lopez-García and Puente (2012), “this effect is possibly due to credit not being the main source of external finance of HGFs, but risk capital or, as has been found elsewhere, internal finance from the group to which the high-growth firm belongs”. This difference in the effect is the cause of the debt variable not being significant for the total sample. Regarding the technological level, in

both cases, the probability of being an HGF increases with technological level, but in micro firms the differential effect of non-technological ones, with respect to the reference category, is greater than in larger firms.

Finally, regarding sectors, among micro firms, hospitality and construction are the sectors with the highest probability of being an HGF. In firms with more than ten employees, the differential effects with respect to the reference category are smaller and the sectors with the highest probability are construction and business services.

In conclusion, it should be noted that HGFs have high persistence and younger firms are more likely to be HGFs. Likewise, company size, labour productivity, profitability and technological level positively affect the probability of being an HGF. Debt has a positive influence on micro firms, while it is a factor that reduces the probability of larger firms being an HGF. Micro firms show a lower probability of presenting high growth than larger firms. Finally, the retail sector has the least probability of being an HGF, while firms in the construction sector show the highest probability.

To identify the factors that explain the difference in the probability of being an HGF between the two groups of firms, the Blinder–Oaxaca decomposition is applied. The results obtained are shown in Table 4. The difference in the probability of being an HGF between the two segments is 21.0% points, in favour of firms with more than ten employees, a similar figure to that calculated with Model 1. The explained component indicates that if micro firms had the characteristics of larger firms, the probability of being an HGF would increase by 21.5% points. The unexplained component is not statistically significant at 5% significance and, therefore, is null. Thus, the difference in the probability of being an HGF, between the two segments of firms, is explained solely by the characteristic component. When analysing the contribution of quantitative factors to the gap in probability between the two segments of firms, size is seen to be the factor that mainly increases the probability of being an HGF in micro firms. Size is followed by persistence, while the remaining variables either decrease it, such as age, or have no effect at all. Consequently, firm size emerges as the key variable explaining the difference in the probability of being an HGF between the two segments of firms.

## 5. Conclusions

This study uses an extensive sample of firms from five European countries with the aim of obtaining conclusive results on the determinants that drive a firm to be HGF. Likewise, this

	Coefficient	<i>p-value</i>
Over 10 employees	0.253	0.000
Fewer than 10 employees	0.043	0.000
Difference	0.210	0.000
Explained component	0.215	0.000
Unexplained component	−0.005	0.053
Persistence (Y in $t-1$ )	0.074	0.000
<i>Firms' characteristics</i>		
Age	−0.018	0.000
Age squared	0.006	0.000
Size	0.145	0.000
Productivity	0.009	0.000
Debt	0.000	0.299
Debt squared	0.000	0.302
ROE	0.000	0.000

Source(s): Compiled by the authors

**Table 4.**  
Blinder–Oaxaca  
decomposition by  
company size

sample includes the segment of firms with fewer than ten employees, a category not normally considered in the literature. Exclusion of this segment of firms would mean, with our sample, focusing only on 30% of the data and neglecting the remaining 70%. There are several reasons for using this expanded sample: by not excluding an important part of the business fabric, the results can be extrapolated to the business population; the study can show if micro firms also present high growth and if there are differences in the factors that determine the probability of being an HGF between both segments of firms.

The results lead us to conclude that economic and business policies aimed at fostering HGFs are likely to be sustained over time, given the evident high inertia in the probability of maintaining high growth. Younger firms are more likely to be HGFs; therefore, measures that promote entrepreneurship are essential. Likewise, the size of the firm, labour productivity, profitability and technological level have a positive influence on the probability of being an HGF. Therefore, the appropriate strategies to promote the existence of HGFs are those aimed at improving the productivity of employees, increasing the technological level of firms and fostering growth in business size.

As has been verified, micro firms have a lower probability of being an HGF than larger firms, and the fundamental factor that explains this difference is size. Therefore, policies aimed at increasing the size of a firm would improve the percentage of HGFs in the economy. In general terms, the factors that determine the probability of being an HGF are the same in micro firms as in larger firms, although there are some differences in their effects. For example, inertia is higher in larger firms than in micro firms. Age has a non-linear U-shaped effect in both segments, but the effect is greater and decreases at a faster rate in micro firms than in large firms. Debt in micro firms has an inverted U-shaped effect, while it has a U-shaped effect on large firms. Finally, the probability of being an HGF increases with the level of technology, but its effect is greater in micro firms.

The empirical results show that external factors, related to the location of firms, also determine the existence of HGFs. Therefore, the authorities should also promote the development of capital, both tangible and intangible, in areas where firms are located, as well as guarantee macroeconomic stability and the proper functioning and development of labour and financial markets.

Firms have various business policies that can foster growth. Based on the results, notable strategies include boosting labour productivity through training and incentive schemes, investing in digitalisation and technology, diversifying products or services and implementing marketing campaigns to attract new customers and expand market share. As a future line of research, we envisage breaking down the determinants of HGFs by sector in order to identify effective sectoral strategies.

#### Notes

1. Within these, the gazelles would be the companies characterised as being less than five years old.
2. Gibrat (1931).
3. In this paper, a dynamic model is proposed, which means the agent's decision at  $t-1$  is included within the characteristics vector, i.e. the variable  $Y_i$  at  $t-1$ . For simplicity, the time subscript has not been included in the model.
4. For business growth to be calculated over a three-year window, data must be collected for four years. In this case, information is collected on the number of employees in each firm for the years 2016, 2017, 2018 and 2019.
5. See <https://www.ine.es/daco/daco43/notaiat.pdf>
6. The high dispersion of some variables, such as productivity, makes the median a better measure of position than the mean.

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**Corresponding author**

Paz Rico-Belda can be contacted at: [paz.rico@uv.es](mailto:paz.rico@uv.es)

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# Mapping the research landscape: exploring the relationship between corporate entrepreneurship and the circular economy

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Eloísa Díaz-Garrido, Isabel Soriano-Pinar and Sara Bermejo-Olivas  
*Department of Business Economy, Rey Juan Carlos University – Madrid Campus,  
Madrid, Spain*

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## Abstract

**Purpose** – The analysis of current research trends in a specific research topic provides a starting point for future research. As a means to represent the conceptual structure of this field of study, this paper aims to analyse how the relationship between the research topics of corporate entrepreneurship and the circular economy has been studied in the literature.

**Design/methodology/approach** – The methodology employed herein is the bibliometric technique of co-words. Specifically, 138 documents were analysed, obtained from the Web of Science (WOS) database and published between 2003 and 2022.

**Findings** – Through co-word analysis, this study maps the most relevant themes in the research between corporate entrepreneurship and the circular economy. The strategy map reveals diverse thematic approaches, including organisational learning and the role of managers.

**Originality/value** – This study combines corporate entrepreneurship and the circular economy and provides new insights through bibliometric co-word analysis. By connecting these two topics, it assists researchers, practitioners and policymakers in advancing knowledge and practice in the related literature.

**Keywords** Corporate entrepreneurship, Circular economy, Bibliometric analysis, Co-word analysis

**Paper type** Research paper

## Introduction

The circular economy has become one of the main pillars of policies in developed countries, which strive to develop policies, measures, and objectives towards the implementation of a circular system (European Commission, 2017; Murray *et al.*, 2017). Along these lines, the Spanish Government has developed a Spanish Circular Economy Strategy, known as the Spain Circular 2030 (Government of Spain, 2020), in line with the principles of the European Green Pact (2019), which lays the foundations for the promotion of a new production and consumption model in which the value of products, materials, and resources is retained in the economy for as long as possible.

The transition into a circular economy is challenging due to the economic investment required and the production system complexity (Veleva and Bodkin, 2018), which requires companies to rethink product and process design (European Commission, 2015). This transition entails a resource revolution involving disruptive change, entrepreneurial spirit, and radical socio-economic changes. Massive innovation and mental shifts are required in

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order to address this transition, which grant tremendous entrepreneurial opportunities (Veleva and Bodkin, 2018). Corporate entrepreneurship refers to a phenomenon that encompasses the creation of new businesses, entry into new markets, and the development of new products by established firms to promote and sustain corporate competitiveness through improving the firm's position, transforming the organisation, markets, and industries, exploiting value-creating opportunities, and achieving superior results (Antonicic and Hisrich, 2004; Guth and Ginsberg, 1990; Zahra, 1991, 1993). Circular entrepreneurship initiatives address sustainability by enabling the introduction of short-term responsiveness and autonomous radical change in entrepreneurial firms (Zucchella and Urban, 2019). The circular economy demands innovation at all levels in order to achieve economic and social benefits (Veleva and Bodkin, 2018). Corporate entrepreneurship offers value to companies by identifying new opportunities, fostering innovation development, the emergence of new businesses, and renewal (Zahra, 2007), and by providing a creative approach to addressing circularity objectives.

The academic debate on the circular economy is relatively new and remains insufficient. Research on the topic has been conducted at macro, meso, and micro levels, as it is estimated that implementation requires change at each level. At the macro level, this involves adjusting the industry and structure of the economy (Kirchherr *et al.*, 2017), and promoting circularity in cities, provinces, regions, or countries through environmental policies and institutional actions (Du *et al.*, 2009; Van Buren *et al.*, 2016; Schneider *et al.*, 2017; Merli *et al.*, 2018; Prieto-Sandoval *et al.*, 2018; Ormazábal *et al.*, 2016). At the meso level, companies' relationships at the territorial level promote eco-parks and industrial symbiosis through eco-industrial networks (Murray *et al.*, 2017; Neves *et al.*, 2020). At the micro level, studies aim to identify ways to increase circularity through process improvement or innovations that improve consumption and production methods (Kirchherr *et al.*, 2017; Merli *et al.*, 2018). Overall, the implementation of the circular economy requires change at each level to promote a recycling-oriented and environmentally concerned society.

Studies into entrepreneurship in a circular economy focus on individual enterprises, but relatively few studies explore the transition to a circular economy in established companies (Cullen and De Angelis, 2021; Veleva and Bodkin, 2018). At the individual level, entrepreneurship translates circular opportunities into circular economy practices with the creation of start-ups that reduce negative impacts on the environment and society, while corporate entrepreneurship is recognised as comparable to individual entrepreneurship from a business perspective (Elert and Stenkula, 2022). While existing research has highlighted the potential of corporate entrepreneurship to foster innovation, resource efficiency and sustainable practices, it has done so primarily through the business benefits it offers and its impact on firm performance. There is therefore a need for empirical research that directly links corporate entrepreneurship activities to the successful adoption and implementation of circular economy principles within organisational settings (Lupoae *et al.*, 2023). A comprehensive analysis is therefore needed to explore their interconnectedness and conceptual structure.

In order to fill this research gap, this paper attempts to identify the most relevant issues and research trends concerning the topics of corporate entrepreneurship and circular economy to represent the conceptual structure of this field of study. To this end, bibliometric techniques based on co-word analysis are employed to answer the following research questions:

- RQ1. What are the characteristics of the research that analyses the relationship between corporate entrepreneurship and the circular economy?
- RQ2. What is the conceptual structure and what trends can be identified?

This study examines 138 articles from the Web of Science database to explore and demonstrate the connection between corporate entrepreneurship and the circular economy (Lee, 2008; Leydesdorff and Welbers, 2011). It elucidates the relationship between these subjects through co-word analysis and proposes ways to commence research on policies related to corporate entrepreneurship.

This paper outlines a research agenda for future studies in corporate entrepreneurship and the circular economy. It includes bibliometric analysis, results, conclusions, and suggestions for future research, thereby facilitating further exploration and advancement in this area.

### Theoretical foundations of the bibliometric study

A bibliometric co-word analysis was utilised to examine research on corporate entrepreneurship and the circular economy. This method offers several advantages over Systematic Literature Reviews, including those of broad publication coverage, trend analysis, and valuable insights for future research directions. The combination of the two methods can provide a comprehensive understanding of a research field, and offers a well-rounded perspective for researchers (Zupic and Čater, 2015).

Co-word analysis is a quantitative method that quantifies and synthesises bibliographic data from articles to identify patterns of knowledge across the scientific literature (Theeraworawit *et al.*, 2022) based on the concept of co-occurrence, that is, the simultaneous occurrence of words in the same document (Callon *et al.*, 1983). The content of the literature enables the creation of a network of knowledge entities through networks of co-words (Wang *et al.*, 2015) that make it possible to show the evolution of the field (Pinillos *et al.*, 2022; Xu *et al.*, 2018).

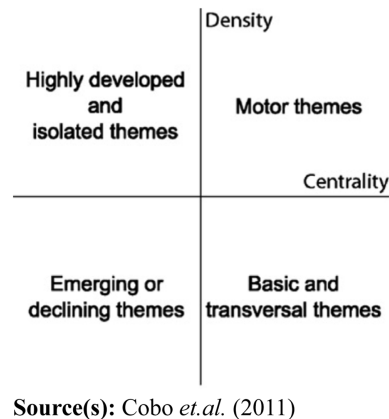
Co-word analysis clusters words from articles, by identifying strong links within semantic groups. It quantifies the intensity of relationships between clusters to identify significant clusters (Cobo *et al.*, 2011).

The strategic map is a tool employed to analyse research topics through the determination of their density and centrality. Density measures the strength of relationships between words, while centrality measures the intensity of these relationships, and indicates their significance in the field (Callon *et al.*, 1991; Cobo *et al.*, 2011). The greater the centrality, the greater the significance of the research topic in gathering essential research for the development of the research field (Ribeiro *et al.*, 2022).

Considering these factors, the themes can be categorised into a two-dimensional space based on the quadrant in which they appear (Cobo *et al.*, 2011), as can be observed in Figure 1:

- (1) *Motor themes*: These are collected in the upper right-hand quadrant and refer to themes that are well-developed and significant in the structuring of a research field. The papers collected in this quadrant have strong centrality and high density. The placement of themes in this quadrant implies that the themes are related to concepts applicable to other themes with which they have a conceptual relationship.
- (2) *Niche themes*: In the upper left-hand quadrant, there are themes that have well-developed internal links but unimportant external links. They represent topics of marginal importance to the field as they are highly specialised and peripheral in nature.
- (3) *Emerging or declining themes*: The lower left-hand quadrant represents those themes that are weakly developed and marginal. They are characterised by low density and centrality and are therefore considered to be emerging or declining.

Figure 1.  
Strategic diagram



- (4) *Basic themes*: represented in the lower right-hand quadrant are those themes that are important for a research field but have not yet been developed.

### Methodology

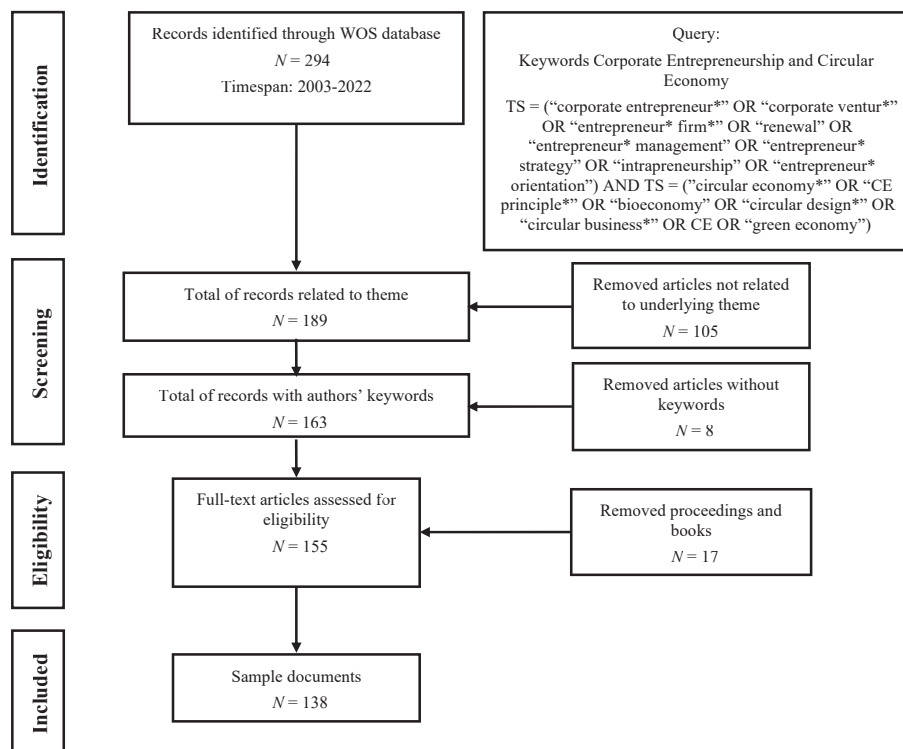
For the selection of the articles to be analysed, the Web of Science was employed as a certified database and the PRISMA methodology (Moher *et al.*, 2009) was followed. Specifically, the selection process is carried out in four stages (identification, selection, eligibility, and inclusion), as shown in Figure 2.

The study analysed 294 articles published between 2003 and 2022, including search terms in their titles, keywords, and abstracts. Based on the work of Urbano *et al.* (2022) the final sampling of articles was carried out using keywords, Boolean operators, and advanced search options to find the topics of study (see query in Figure 2). The final sample consisted of 138 documents, excluding 130 that failed to meet the inclusion criteria. The selection phase established inclusion and exclusion criteria, while the eligibility phase determined the number of articles included. Given the small number of papers that addressed both constructs simultaneously, papers were included that addressed one or more dimensions of corporate entrepreneurship (innovation, venturing, or renewal) with one or more dimensions of the circular economy policies, thereby excluding all papers that addressed only one of the constructs, and also included papers on the circular economy that considered the individual level of analysis.

The author's keywords have been revised to avoid confusion with the CE acronym, and has replaced the expressions *corporate entrepreneurship* and *circular economy* with *entrepreneurship* and *circular economics*. A bibliometric study using the Bibliometrix package obtained 495 keywords, 74 synonyms, and eliminated meaningless words and those with an incomplete meaning.

### Descriptive analysis

A descriptive analysis of the final database is first provided, as shown in Table 1. The 138 articles of the sample were written by 369 different authors, with an average of 2.8 authors per article. Approximately 31.16% of these authors collaborated internationally. The total number of references used was 8,263 and the total number of author's keywords used was 495.



Source(s): Authors' own

Figure 2.  
PRISMA methodology  
workflow

Description	Results
<i>Main information about the data</i>	
Timespan	2003:2022
Sources	92
Documents	138
Annual growth rate	18.94%
Document average age	5.41
Average citations per doc	21.96
References	8,263
Author's keywords	495
Authors	369
Single-authored docs	19
Co-authors per doc	2.8
International co-authorships %	31.16
<b>Source(s):</b> Authors' own	

Table 1.  
Sample characteristics

The evolution of the literature from 2003 to 2022 shows an irregular distribution. The first paper considered appeared in 2003, and there was continuous growth since 2018, as shown in Table 2. The number of published articles reached 63, contributing 45.65% of the total, and resulting in an annual growth rate of 18.94%.

Concerning the journals that have published such articles and their impact, a total of 92 journals have been used. The top 10 journals have published 45 papers out of the total (32.61%) and have received a total of 1,472 citations (48.56%), while 60% of the remaining sources (55 journals) have only published one article each. These journals include “Small Business Economics” (8), “Entrepreneurship Research Journal” (6), “Journal of Cleaner Production” (6), “International Entrepreneurship and Management Journal” (5), and “Journal of Entrepreneurship in Emerging Economies” (5), and these 30 articles have received a total of 940 citations. The results are shown in Table 3.

The contribution of the authors and their impact is reflected in the number of papers published and citations received both locally and globally. Most of the authors have written a single paper on these topics, and only the top 15 have contributed two or three papers. Table 4

Year	No articles	TC	Mean TC per article	Mean TC per year
2003	1	24	24	1.14
2007	2	151	75.5	4.44
2008	1	9	9	0.56
2009	4	216	54	3.6
2010	6	291	48.5	3.46
2011	4	282	70.5	5.42
2012	3	69	23	1.92
2013	5	207	41.4	3.76
2015	12	733	61.08	6.79
2016	6	57	9.5	1.19
2017	15	287	19.13	2.73
2018	7	267	38.14	6.36
2019	9	64	7.11	1.42
2020	17	231	13.59	3.4
2021	19	113	5.95	1.98
2022	27	30	1.11	0.56
<i>Total</i>	<i>138</i>	<i>3,031</i>		

**Source(s):** Authors' own

**Table 2.**  
Annual publication  
and citation

Source	Articles	% total	TC	PY_start
Small Business Economics	8	5.80%	434	2015
Entrepreneurship Research Journal	6	4.35%	31	2016
Journal of Cleaner Production	6	4.35%	314	2011
International Entrepreneurship and Management Journal	5	3.62%	152	2013
Journal of Entrepreneurship in Emerging Economies	5	3.62%	9	2021
Journal of Organizational Change Management	4	2.90%	180	2007
Journal of Business Research	3	2.17%	192	2012
Resources Conservation and Recycling	3	2.17%	130	2020
Management Decision	3	2.17%	7	2020
European Journal of Innovation Management	2	1.45%	23	2017
<i>Total</i>	<i>45</i>	<i>32.61%</i>	<i>1,472</i>	

**Source(s):** Authors' own

**Table 3.**  
Most relevant sources  
from corporate  
entrepreneurship and  
circular economy

Most productive authors (by no articles)			Author's impact (by citations)		
Author's name	Articles	Local TC	Author's name	Articles	TC
Zahra, S.A.	3	18	Zahra, S.A.	3	272
Urbano, D.	3	12	Kuratko, D.F.	2	230
Kuratko, D.F.	2	31	Filatotchev, I.	1	212
Mustafa, M.	2	3	Wright, M.	1	212
Urban, B.	2	1	Deng, W.J.	1	159
Kim, D.	2	1	Hu, J.	1	159
Ziyae, B.	2	0	Ma, S.S.	1	159
Sáez-Martínez, F.J.	2	0	Wang, M.X.	1	159
D'amato, D.	2	0	Xiao, Z.B.	1	159
Ferreira, J.J.	2	0	Zhou, R.J.	1	159
<i>Total</i>	<i>22</i>	<i>66</i>	<i>Total</i>	<i>13</i>	<i>1,880</i>

Source(s): Authors' own

**Table 4.**  
Top 10 most  
productive authors and  
most cited

shows the most relevant authors in terms of scientific output and research impact. The top 10 contributing authors have published 22 papers (approximately 16% of the sample), while only the top 6 have been cited at least 66 times. Zahra, SA. and Urbano, D. published three articles with 18 and 12 citations, respectively. In terms of impact, the 10 most relevant authors obtained a total of 1,880 citations (62% of the total citations received by the sample), where Zahra, SA., Kuratko, DF., Filatotchev, I., and Wright, M. with only 7 articles between them, received a total of 926 citations, while Deng, WJ., Hu, J., and Ma, SS. jointly published a single article that received 159 citations. These results show the predominance of interest in corporate entrepreneurship over that of the circular economy, which can be due to the newness of this line of research, which prevents the most recent papers from being cited in the sample.

The results show the impact of the articles through the total number of citations and are shown in Table 5, which highlights the papers that relate to the circular economy and to corporate entrepreneurship. The papers by Kuratko and Audretsch (2013), Kuratko *et al.* (2015), Bierwerth *et al.* (2015), and Zahra *et al.* (2009) received 17, 14, 11, and 9 citations,

Document	Year	Local citations	Global citations	Normalized total citations
Kuratko, D.F., 2013, Int. Entrep. Manag. J.	2013	17	120	2.90
Kuratko, D.F., 2015, Small Bus. Econ.	2015	14	110	1.80
Bierwerth, M., 2015, Small Bus. Econ.	2015	11	93	1.52
Zahra, S.A., 2009, J. Bus. Venturing	2009	9	212	3.93
Zahra, S.A., 2015, Small Bus. Econ.	2015	9	53	0.87
Turner, T., 2015, Small Bus. Econ.	2015	8	72	1.18
Castrogiovanni, G.J., 2011, Int. J. Manpower	2011	8	53	0.75
Sebora, T.C., 2010, J. Organ. Change Manag.	2010	7	24	0.49
Rutherford, M. W., 2007, J. Organ. Change Manag.	2007	6	87	1.15
Nason, R.S., 2015, Small Bus. Econ.	2015	6	39	0.64
<i>Total</i>		<i>95</i>	<i>863</i>	

Source(s): Authors' own

**Table 5.**  
Most relevant  
documents of  
corporate  
entrepreneurship and  
circular economy

respectively, in the database. These articles examine corporate entrepreneurship as a way to revitalise businesses and they address the new challenges of a highly uncertain environment by improving business performance. The theoretical foundations provided by these articles also show their relevance at a global level within the field of entrepreneurship, with citations received from outside our field of study. The importance of these articles may be due to the need to favour certain internal characteristics of the company that facilitate the identification of the opportunities offered by the circular economy to companies to develop innovation, renewal, and the creation of new companies.

The articles analysed used a total of 455 keywords, which were used 579 times. The top 15 keywords were used 105 times (18.13%) and are shown in Table 6. “Innovation” (16), “entrepreneurship” (12), “corporate venturing” (7), “strategic entrepreneurship” (9), and “strategic renewal” (4) are related to the fields of study of the individual entrepreneur and corporate entrepreneurial behaviour, with a frequency of use of 48 (8.29%). “Sustainability” (10) and “bio-economy” (3) reflect relevant aspects of the circular economy with a frequency of 13, representing 2.25% of the total number of keywords used. Sustainability focuses its analysis on the incorporation of the three principles of sustainability (environmental, economic, and social) from a broader perspective than does the circular economy, while the bio-economy is associated with the idea of replacing fossil resources with bio-based resources through the development of knowledge and innovation.

The remaining keywords (among the top 20 most cited) represent the lines of research on both the circular economy and corporate entrepreneurship related to the characteristics of the company that favour the development of both policies within organisations. “Firm performance” is in second place with a total of 15 uses, which reflects the importance of corporate entrepreneurship or the circular economy in business results.

### Results and discussion

In response to the initial question, analysing the authors’ keywords helps us to pinpoint the main thematic areas of interest in the field of study. Figure 3 depicts the co-word network, which can be utilised to identify and interpret the research themes. The co-word network graph displays the co-occurrences of words, with nodes representing words, and lines

Words	Occurrences	% occurrences
Innovation	16	2.76%
Firm performance	15	2.59%
Entrepreneurship	12	2.07%
Sustainability	10	1.73%
Strategic entrepreneurship	9	1.55%
Corporate venturing	7	1.21%
Human resource management	6	1.04%
Corporate strategy	4	0.69%
Dynamic capability	4	0.69%
Middle managers	4	0.69%
SMEs	4	0.69%
Strategic renewal	4	0.69%
Training	4	0.69%
Bio-economy	3	0.52%
Capability	3	0.52%
<i>Total</i>	<i>105</i>	<i>18.13%</i>

**Table 6.**  
Most frequent author’s  
keywords

**Source(s):** Authors’ own

reflecting their relationship. Corporate entrepreneurship and the circular economy were excluded from this graph due to their distortion of the representativeness of the search.

Three clusters of words can be distinguished, representing the different research themes. The largest cluster is shown in red and is called “innovation” as it is the most representative node. The most closely related keywords are “innovation,” “entrepreneurship,” “family business,” “corporate strategy”, and “human resource management”. It highlights the importance of innovation and entrepreneurship in the corporate strategy, which facilitates the integration of circular economy principles through the exploration and exploitation of new opportunities offered by the circular economy. These results are in line with previous studies, such as those carried out by Sehnem *et al.* (2022), which show that innovation can support the implementation of the circular economy and the circularity of resources. The remaining keywords reflect the need to adapt policies on human resources to facilitate the development of entrepreneurial initiatives and to stimulate entrepreneurial behaviour in firms, as shown in previous studies (Castrogiovanni *et al.*, 2011).

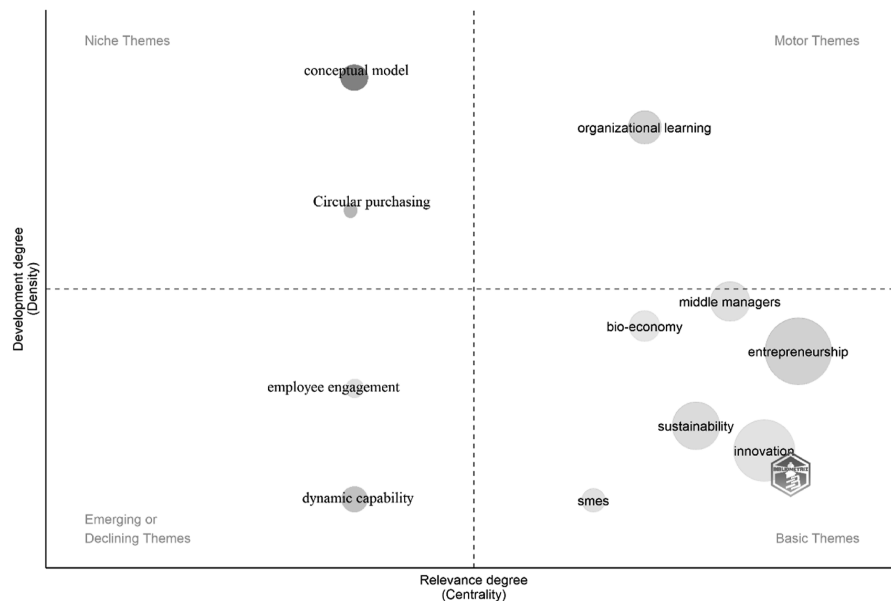
The second group, represented in green, includes research on the circular economy and sustainability, where the keywords are “sustainability”, “firm performance”, and “urban planning”, which indicate not only the need to incorporate sustainability principles to improve firm performance, but also the importance of studying the interaction between entrepreneurship and sustainability in the context of cities (Foster, 2020). These findings are in line with Lichtenthaler (2021), who shows that companies can achieve and maintain a competitive advantage in a circular economy that is increasingly dominated by sustainability. In the third cluster, in blue, the main relationships lie between “corporate venturing”, “strategic entrepreneurship”, and “family business”, and represent research that studies the creation of new ventures by established firms as a means of implementing strategic entrepreneurship, as well as studying their impact on family firms, since corporate venturing activities are particularly relevant to this type of firm (Minola *et al.*, 2021). The analysis of the research themes was completed with a strategic diagram that shows the importance of the themes according to their density and centrality, and places them in different quadrants. As shown in Figure 4, eleven research themes were identified, with four marginal themes located in the left-hand quadrant of the figure and a further seven in the right-hand quadrant, representing topics of interest or potential for research.

The lower left-hand quadrant contains themes that have a weak internal structure and remain underdeveloped. The themes “employee engagement” (13) and “dynamic capability” (12) represent topics with low centrality and density, which implies that they are emerging or declining topics with little research relevance. Of particular note are the papers by Dai and Liu (2015) and Ahmed *et al.* (2020), which analyse the role of employees and dynamic capabilities in the development of corporate entrepreneurship activities and reinforce the idea that active employee engagement and organisational adaptability are key factors in achieving the transition to business models of a more circular and sustainable nature.



Source(s): Biblioshiny’s output

Figure 3.  
Co-occurrence network



**Figure 4.** Strategy diagram in the study of corporate entrepreneurship and circular economy

**Source(s):** Biblioshiny's output

In the lower right-hand quadrant are the core or cross-cutting themes with high centrality and low density, which reflects the fact that these are underdeveloped themes, but with high relevance and with the potential to become driving themes for research. This quadrant hosts the highest number of keywords and, in line with the results shown in the co-word network, its most relevant themes are “entrepreneurship”, “innovation”, and “sustainability”, although it does include less important themes, such as “middle managers”, “bio-economy”, and “SMEs”.

The “entrepreneurship” research theme includes the most words, such as “entrepreneurship” (12), “strategic entrepreneurship” (8), “corporate venturing” (7), and “human resource management” (6), among others. The most relevant work is provided by Kuratko and Audretsch (2013), Kuratko *et al.* (2015), and Rutherford and Holt (2007). This line of research focuses on entrepreneurship, both at the individual and firm levels, as a way to improve the circularity of firms. On the one hand, at the individual level, employees play a major role in identifying entrepreneurial opportunities (Rutherford and Holt, 2007; Vargas-Halabí *et al.*, 2017), while from a corporate perspective, firm transformation should be directed not only towards the creation of new businesses (Kuratko *et al.*, 2015), but also towards the search for new opportunities that can change industry norms in terms of product offerings, markets, and internal processes (Kuratko and Audretsch, 2013), and can lead to the transformation of the firm. In this context, the firm needs to embrace circularity to gain a competitive advantage through corporate entrepreneurship activities.

Closely related to this “entrepreneurship” group, is the research topic named “innovation”, which groups four keywords, among which “innovation” (16) and “firm performance” (15) stand out, with the works of Yunis *et al.* (2018) and González-Moreno and Sáez-Martínez (2009). These studies highlight the importance of innovation in achieving sustainable development of corporate entrepreneurship activities and in

improving business performance. The use of information technology (Yunis *et al.*, 2018) and the technological intensity of the environment (González-Moreno and Sáez-Martínez, 2009) play a key role in the success of corporate entrepreneurship and the exploitation of new opportunities, which makes them conducive to the implementation of circular strategies based on the application of Industry 4.0 advanced technologies (Khan *et al.*, 2021; Jabbour *et al.*, 2019).

The third group of words “sustainability” (10), “sustainability performance” (3), and “urban planning” (3) constitute the “sustainability” research theme. This topic focuses on the need for agreements between institutions so that the circular economy focuses on more than just waste management, recycling, and material efficiency. The relationship between entrepreneurs and companies enables the use of technological advances through strategic partnerships to implement innovative strategies (Veleva and Bodkin, 2018), and leads to business models that require systemic change (Anttonen *et al.*, 2018).

The remaining themes in this quadrant, “middle managers”, “bioeconomy”, and “SMEs”, focus on the role of managers and employees in implementing entrepreneurial activities (Bierwerth *et al.*, 2015; Laasonen, 2023; Limroscharoen *et al.*, 2017) and in achieving higher levels of circularity through their business models by exploring outcomes in small and medium-sized enterprises (Alcalde-Calonge *et al.*, 2022).

In the upper right-hand quadrant, there is the driving theme “organisational learning” which groups the words “organisational learning” (3), “knowledge transformation” (2), and “knowledge creation” (2). It is characterised by high centrality and density and therefore drives the research area as it is well-established and has strong implications for the other research themes. Organisational learning refers to the need to develop the knowledge to explore and exploit the circular opportunities that arise in the environment. Corporate entrepreneurship is a source of new knowledge (Zahra, 2015) that can be harnessed from digital platforms (Arfi and Hikkerova, 2021) to create new capabilities to address the technological, social, and demographic changes that arise as a result of applying circular principles.

The upper left-hand quadrant contains specialised research topics such as “circular purchasing” and “conceptual model”, with high density but low centrality. This indicates their marginal importance in corporate entrepreneurship and circular economy research.

These results show that the research relating to both topics is characterised by being in a phase of expansion and development, where innovation and the identification of circular opportunities are considered relevant when developing new strategies aimed at sustainability. The importance of organisational learning and its relationship with the creation and exploitation of knowledge is shown to constitute the basis upon which companies must develop corporate entrepreneurship to exploit the circular opportunities that appear in the environment. Similarly, innovation and venturing are identified as the main entrepreneurial activities that facilitate the incorporation of circular principles, such as the reuse and recycling of materials, eco-design, and the improvement of the environmental effects of economic activity, where strategic renewal is linked to the decisions of management.

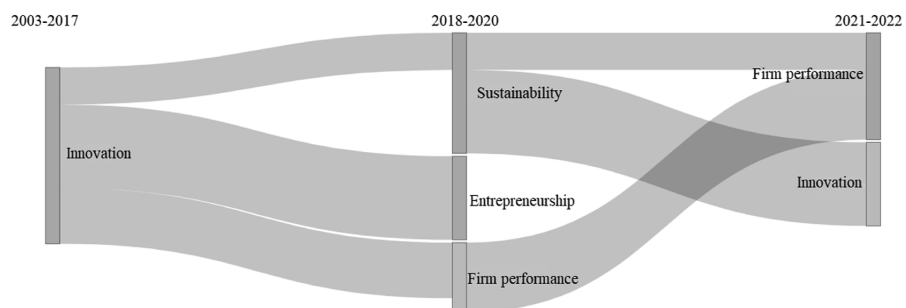
To identify the trends that answer the second question, we have analysed the evolution of the research themes over time using the Sankey diagram. Figure 5 shows the evolution over the three study periods. As can be observed, “innovation” is the central theme until 2017, which can be explained by the fact that there is very little scientific production on the circular economy and that it is one of the most relevant dimensions of corporate entrepreneurship. Between 2018 and 2020, innovation shifted towards three areas of interest: “sustainability”, “entrepreneurship”, and “business performance”. In the period 2021–2022, “firm performance” is maintained, and “innovation” reappears.

These findings show that, in the first period, innovation can facilitate the implementation of circular principles through innovation in production processes, improvements in the supply chain, the development of reverse logistics to reduce the consumption of materials and energy, the reuse of waste or recycling (Fernando *et al.*, 2023), and through innovation in circular products from design to recovery (García-Muñia *et al.*, 2019). In the second period, the emergence of the themes of sustainability, entrepreneurship, and business performance is justified by the growth of research on the circular economy and the adoption of sustainable development principles by businesses. Eco-innovation, eco-design, and advanced technologies applied to circular practices exert a positive impact on the innovation of business models, new materials, and products and services of a more sustainable nature (Alcalde-Calonge *et al.*, 2022; Jabbour *et al.*, 2019). The current business environment requires employees to be innovative and to bring new ideas in terms of products, services, and processes (Bičo and Knezović, 2023). This transition requires the exploration and exploitation of new opportunities in the environment through entrepreneurship and the search for actions to maintain and even improve business performance.

In the most recent period, “business performance” and “innovation” have emerged as current research trends, both of which incorporate the theme of “sustainability”. The importance of linking corporate entrepreneurship and the circular economy to achieve economic value creation is highlighted. In this respect, the literature recognises that it only makes sense to implement corporate entrepreneurship and the circular economy if there are business opportunities that lead to improved value creation, business performance, and competitive advantage. In particular, innovation appears to be the key dimension of corporate entrepreneurship, which enables the exploitation of circular opportunities that are commercially viable.

### Conclusions

The transition to a circular economy from a business perspective remains challenging in its entirety due to the economic investment required and the complexity of the current production system (Veleva and Bodkin, 2018), since it requires companies to totally rethink the design of products and processes (European Commission, 2015). Since corporate entrepreneurship is viewed as a strategic tool that facilitates the identification and exploitation of opportunities, the challenge is to exploit these opportunities in a circular manner (Veleva and Bodkin, 2018). Therefore, through bibliometric techniques based on co-word analysis using Biblioshiny software, the following questions have been answered:



**Figure 5.**  
Thematic evolution in  
corporate  
entrepreneurship and  
circular economy

Source(s): Biblioshiny’s output

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*What are the characteristics of the research that analyses the relationship between corporate entrepreneurship and the circular economy? and What is the conceptual structure and what trends can be identified?*

To answer the first question, an analysis of indicators of research activity was carried out. The results highlight the interest and growth experienced since 2018, with increasing publications. This justification may be due to the interest shown by European institutions, which promote the implementation of circular principles by offering companies new business opportunities, thereby challenging the traditional linear production model and promoting approaches of a more sustainable nature. By implementing circular economy practices, companies can optimise resource use, reduce waste, improve efficiency, and create products and services that are more sustainable. These changes in business models require an entrepreneurial approach, which implies the ability to identify opportunities, innovate, and adapt to the changing environment. The themes that have attracted the most interest in the papers analysed focus on the analysis of two of the main dimensions of corporate entrepreneurship, such as “innovation” and “corporate venturing”, together with themes more related to the circular economy, such as “sustainability”, and generic themes such as “firm performance”. This shows that through innovation or the creation of start-ups, companies can develop products, services and processes that are aligned with circular principles, for example, designing products that are easily repairable, modular, or use recyclable materials. These innovative initiatives not only contribute to environmental sustainability but can also create competitive advantages and improve business performance. Furthermore, the creation of start-ups or entrepreneurial projects within organisations can be an effective way to promote the circular economy. Internal start-ups can act as autonomous units dedicated to exploring and experimenting with new ideas related to circularity. These start-ups can have more flexibility and agility to test innovative solutions and to promote disruptive change within the organisation. Other themes that characterise research between corporate entrepreneurship and the circular economy focus on the role of factors internal to the company in the development of entrepreneurial activities with a high degree of circularity, be it the learning capacity, the development of innovative skills, or the ability to discover opportunities (Turner and Pennington, 2015), in which the managerial role plays a predominant role (Sebora *et al.*, 2010).

A thematic evolution analysis was conducted to answer the second question. The results of this analysis will define a future research agenda in this field. The study aims to explore the impact of firm performance and innovation on circular economy policies, delve into the concept of organisational learning, and examine the importance of strategic renewal in corporate entrepreneurship and the circular economy. The focus will be on how companies align their strategies with circular principles and leverage competitive advantages from their circular practices. Moreover, the study will investigate the relationships between various dimensions of corporate entrepreneurship and companies adopting circular strategies using approaches of mixed methods. It will also analyse the influence of managers on entrepreneurial behaviour for circular transformation, and identify management strategies and practices that promote the integration of circular principles and facilitate innovative solutions for sustainability. Furthermore, performance metrics for circular economy initiatives will be assessed to develop and evaluate appropriate measures to gauge their potential effectiveness within organisations. This will help align these initiatives with overall business performance and contribute towards long-term sustainability goals.

In Table 7, these ideas are summarised by identifying future research questions about the themes identified in the analysis that form an important research agenda:

The research presents important theoretical and practical contributions. From a theoretical point of view, the paper contributes to the literature in two ways. The

Theme	Research gap-research question
Innovation, circular economy, firm performance	Which corporate entrepreneurship activities improve firm performance when circular strategies are considered? What is the impact of circular policies on business performance, sustainability, and the achievement of competitive advantages?
Corporate entrepreneurship, organisational learning, circular economy	How do organisational learning strategies foster environmental awareness, resource efficiency and collaboration in the corporate value chain? What kind of organisational learning strategies are most likely to develop organisational knowledge that enables the implementation of circular principles?
Circular business models	What kind of corporate entrepreneurship activities facilitate the development of new circular business models? How does innovation in business models favour the creation of new, more sustainable value propositions?
Middle managers, circular economy, and corporate entrepreneurship	What is the role of managers in encouraging entrepreneurial behaviour for a circular transformation in the firm? What management practices favour the development of corporate circular entrepreneurship?
Metrics and indicators	What would the indicators of circularity be that allow the success of circular corporate entrepreneurship to be assessed? What indicators can be employed to assess the social and environmental impact of circular corporate entrepreneurship?
<b>Source(s):</b> Authors' own	

**Table 7.**  
Research agenda

bibliometric study has provided valuable information on the existing literature on corporate entrepreneurship and the circular economy, by shedding light on current trends, key research areas, and potential knowledge gaps. By analysing publication patterns, thematic connections, and emerging themes within the field, the study has contributed to mapping the research landscape. Furthermore, bibliometric analysis has identified key links between corporate entrepreneurship and circular economy concepts such as innovation, sustainability, resource efficiency, and business models. By uncovering these connections, the study has laid the groundwork for future research efforts aimed at exploring the mechanisms through which corporate entrepreneurship can drive the adoption of circular economy practices within organisations.

The methodological contribution demonstrates the effectiveness of bibliometric techniques in identifying research topics related to corporate entrepreneurship and the circular economy, and provides valuable insights for researchers, practitioners, and policymakers.

This study offers practical advice for the development of sustainable, innovative, and competitive business models. Corporate entrepreneurship enables companies to take advantage of the circular economy for competitive benefits. Key internal factors, such as organisational learning, the development of entrepreneurial skills, and policies on human resources, all promote entrepreneurship. Furthermore, innovations in new products, services, and processes can enhance circularity rates.

Inter-institutional agreements are essential for transitioning to a circular economy since they promote entrepreneurship and sustainability through knowledge exchange and strategic partnerships between companies.

### Limitations

However, this work is not without its limitations. On the one hand, the papers were retrieved from only the WOS database and therefore not all the relevant papers available on other databases have been captured. Furthermore, the search yielded a high number of papers unrelated to the specific topic at hand, and future research could be more comprehensive. The sample selection period ran until 31st December 2022, and hence it may exclude certain emerging and relevant lines of research that have been published since then. And lastly, this study is not free from subjectivity in the grouping of keywords, which could have biased the results obtained.

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**Corresponding author**

Eloísa Díaz-Garrido can be contacted at: [eloisa.diaz@urjc.es](mailto:eloisa.diaz@urjc.es)

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# Influence of HRM practices on innovation in software engineering: the mediating role of developer experience

Youngkeun Choi

*Sangmyung University, Seoul, South Korea*

## Abstract

**Purpose** – This study examines the influence of developer experience between human resource management (HRM) practices and innovation in software (S/W) engineering. This study uses motivation theory and investigates how HRM practices influence the innovative behaviors of S/W developers by using a mediator of affective developer experience.

**Design/methodology/approach** – For this, this study used a survey of S/W developers working in Korea. Out of 431 responses collected from 35 companies, 352 responses from 34 companies were usable for analysis and takes structural equation modeling.

**Findings** – The results show that developmental appraisal, externally or internally equitable reward and comprehensive training increase their affective developer experience affecting innovative behaviors positively in turn. However, selective staffing has no effect.

**Originality/value** – The results show that S/W developers pursue individual growth rather than success in their organizations. The findings show the context of S/W engineering in Korea and provide universalistic perspective when top managers motivate their S/W engineers by HRM system.

**Keywords** Human resource management practices, Developmental appraisal, Externally or internally equitable reward, Comprehensive training, Selective staffing, Developer experience, Innovative behaviors, Software engineering

**Paper type** Research paper

## 1. Introduction

Software engineering (SE) is a professional human activity that demands numerous skills and qualities from developers. While the attributes of developers and development tasks have been extensively studied, there has been limited investigation into developers as users of development tools. As users of integrated development environments (IDEs), developers should be considered in the context of user experience (UX) definitions, applicable to all users (Nylund, 2020; Hassenzahl and Tractinsky, 2006). However, the dual role of developers as both system users and system creators sets them apart uniquely. To address the specificity

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of SE, the concept of Developer Experience (DX) has been proposed (Fagerholm and Münch, 2012; Henriques *et al.*, 2018; AlOmar *et al.*, 2021; Anders, 2020; Powell and Bodur, 2019; Morales *et al.*, 2019). DX encompasses cognitive, emotional, and intentional aspects, understanding which can help practitioners enhance development environments concerning developers' needs, perceptions, and feelings (Fagerholm and Münch, 2012).

The research gap identified in this study is the limited investigation into developers as users of development tools within the field of Software Engineering (SE). Developers have a dual role as both users and creators of systems, which makes it challenging to evaluate them solely based on User Experience (UX). To address this uniqueness, the concept of Developer Experience (DX) has been proposed, but research on the impact of DX from the perspective of Human Resource Management (HRM) on software developers' innovative behaviors is still scarce. Therefore, this study aims to explore the relationship between HRM practices and the innovative behaviors of software developers through the lens of DX, providing new insights and practical contributions to HRM in the Korean software engineering field.

The structure of this paper is as follows: Chapter 2 describes the theoretical framework and presents the research model, including motivation theories and the theoretical background for how HRM practices influence software developers' behaviors using DX as a mediator. Chapter 3 details the research methodology. Chapter 4 reports the analysis results of the hypotheses. Chapter 5 discusses the key findings, presents several limitations of the study, and offers suggestions for future research.

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## 2. Theoretical framework and research model

DX is a concept that has emerged from the notion of user experience, but it differs from user experience in that it considers developers instead of users (Nylund, 2020). However, developers can be seen as users of software development tools. DX refers to the experience involving the interaction between development tools and developers in the software development process (AlOmar *et al.*, 2024; Fontão *et al.*, 2015; Henriques *et al.*, 2018; Alomar *et al.*, 2021; Anders, 2020; Powell and Bodur, 2019; Morales *et al.*, 2019). A complete understanding of DX can facilitate an understanding of the expectations, perceptions, and feelings of developers who participate in development tools. Furthermore, DX has a dualistic nature to UX-based DX, in which the developer is both a system tool user and a system producer who predicts the UX (Kuusinen, 2015). Understanding the relationship between the developer and the platform that a developer uses is essential because we can thereby predict whether the platform can satisfy developers and ensure usability and functionality (Fontão *et al.*, 2015; Parviainen *et al.*, 2015).

Individual innovation has been operationalized in various ways. For example, the construct has been thought of as a personality characteristic (Lua *et al.*, 2024; Hurt *et al.*, 1977). Others have taken a behavioral perspective (Schnellenbach, 2024; Janssen, 2000). According to Midgley and Dowling (1978), individual innovativeness refers to the individual's openness to new ideas and decision-making to adopt an innovation, free from the influence of the experiences of other employees. This definition is referred to throughout this study because it intuitively gives a more accurate interpretation of innovativeness, which is well supported in the literature, both directly and indirectly. Individually, innovation begins with the activity with employees who come up with novel ideas, and the

ideas often result from solving incongruities and discontinuities encountered at work (Kanter, 1968; Scott and Bruce, 1994; Kleysen and Street, 2001; Sirega *et al.*, 2019).

Surprisingly, although software engineering requires a lot of innovation, few studies investigate the relationship between DX and the innovative behaviors of software engineers. Fagerholm and Münch (2013) describe developer experience as a concept that captures how developers think and feel about their activities within their working environments, assuming that an improvement of the developer experience positively impacts software development project outcomes. They assume that several factors influence DX, which affects the outcomes of software development projects. The word “developer” refers here to anyone engaged in the activity of developing software, and “experience” refers here to involvement, not to being experienced, although the two are interlinked. The theoretical framework by Fagerholm (2015) is a presentation of the activities of developers in an individual and social environment, and how the experiences arise. The framework includes aspects such as experience objects, formations, influencers, content, progression, behavior outcome, and object outcome. These different aspects can be used to study DX from a wide variety of different viewpoints. Fagerholm and Münch (2013) takes an approach from psychology, and divide DX into three different sub-areas or categories – cognitive (How developers perceive the development infrastructure), affective (How developers feel about their work), and conative (How developers see the value of their contribution). Among them, affective DX consists of factors that influence how developers feel about their work. Respect and belonging are social factors that work to create a feeling of security. Attachment to persons, teams, or even work habits also belongs to this dimension. Positive feelings in general can be an important factor in good DX. Therefore, affective DX has been most strongly linked to positive work-related behaviors like innovative behavior. Organizations interested in increasing affective DX, seen as the one of most desirable forms of DX, might consider it seriously now simply because it can significantly influence software developers’ innovative behaviors, which is one of the positive work-related behaviors their organizations desire. Therefore, in a software engineering context, affective DX to their organization is likely to play a role in their innovative behaviors. Thus, this study makes the following hypothesis.

*H1.* The affective developer experience of software developers is positively associated with their innovative behavior.

Existing studies argue that the human capital characteristics of the target should be strategically considered in HRM. Snell and Dean (1992) examined the relationship between integrated manufacturing, defined as the use of advanced manufacturing technology (AMT), just-in-time inventory control (JIT), total quality management (TQ), and human resource management from a human capital perspective. AMT was positively related to selective staffing, comprehensive training, developmental appraisal, and externally equitable rewards for operations employees and to selective staffing for quality employees. TQ was positively related to these same human resource practices in quality and was also related to the comprehensiveness of training for operations employees. JIT was negatively related to selective staffing in operations and to performance appraisal in quality and positively related to staffing in quality. The two- and three-way interactions had negative effects.

Recognizing that not all employees possess knowledge and skills that are of equal strategic importance, Lepak and Snell (1999) draw on the resource-based view of the firm (Wernerfelt, 1984). Human capital theory (Stobe, 1990), and transaction cost economics (Williamson, 1989) to develop a human resource architecture of four different employment modes: internal development, acquisition, contracting, and alliance. They use this architecture to derive research questions for studying the relationships among employment modes, employment relationships. Human resource configurations, and criteria for competitive advantage.

Lopez-Cabrales *et al.* (2009) tested how human resources management (HRM) practices and employees' knowledge influence the development of innovative capabilities and, by extension, a firm's performance. The results of their study confirm that HRM practices are not directly associated with innovation unless they take into account employees' knowledge.

Developer motivation is another important factor in SE. Most studies on motivation in SE report that developers are distinct from other occupational groups concerning motivation (Beecham *et al.*, 2008). "The work itself" is the most commonly cited motivator. Still, there is a lack of detail regarding what aspects of the work are motivating, how motivational processes occur, and the outcomes of motivating developers (Beecham *et al.*, 2008). Investigations also show the importance of considering the affective aspects of SE. Over time, the presence and variation of developers' emotions have been documented (Shaw, 2008). Programming is influenced by mood (Khan, 2011), and happiness has been found to have productivity benefits (Graziotin *et al.*, 2014). This underlines the importance of considering affective aspects both for well-being and outcomes.

What are the prominent HRM practices in the software industry? That is the key question in this process. There have been some attempts to identify the salient practices in software companies. The Software Engineering Institute (SEI) at Carnegie-Mellon University made a detailed study of HRM practices in the software industry and designed a quality certification program known as the People Capability Maturity Model (P-CMM) (Curtis *et al.*, 1995). However, it isn't easy to generalize HRM practices, for organizational behavior can vary greatly from one industry to another. And relevant researches also show no consistent results (Agarwal and Ferratt, 1999). The diversity of results in the various studies invites researchers to probe for and identify the key HRM practices in the software industry to find the key practices for enhancing affective DX.

Therefore, to probe for the key HRM practice in the software engineering context, this study identifies the characteristics of software developers. The characteristics cited most often in the relevant studies are growth-oriented (Boehm, 1981; Chelsom *et al.*, 2005; Couger and Zawacki, 1978, 1980; Couger, 1992; Couger and Adelsberger, 1988; Couger and Ishikawa, 1995; Couger and McIntyre, 1987). They depict that growth-oriented software developers are challenged, learning new skills, etc. The need for growth may be due to the engineer's internal makeup, and they need to be marketable and keep up with the fast-changing technology. Software engineering requires a new software development methodology. To motivate software developers to learn and use this new methodology, HRM practices should focus on their growth-oriented characteristics. This study presents the following HRM practices to motivate software developers into DX for the characteristics of software developers.

Developmental appraisal systems can contribute to the DX of software. When the appraisal system is focused on employee development, it nurtures a sense of attachment and belonging. The appraisal system that incorporates an informal approach and a genuine interest in the development of the employee would give the employee a chance to grow and might prompt them to contribute more to the company's goals. Therefore, developmental appraisal will be positively associated with affective DX.

Reward systems include rewards and incentives such as scope for increased pay and benefits linked to performance, which are motivators in the software development context (Chelsom *et al.*, 2005). Previous research studies found a significant relationship between compensation and employees' attitudes (Angle and Perry, 1983; Mottaz, 1988; Jaiswal, 1982; Mobley, 1982). Mottaz (1988) found compensation and rewards to be the main factor in employees' attitudes. Salary might be a major criterion in organization choice, but once they are members of an organization, software developers look for vertical and horizontal growth. It has also been observed that there has not been a significant difference in salaries across companies. And profit sharing leads to better cooperation, better communication, and better participation (Weitzman and Kruse, 1990). Profit-sharing and stock ownership encourage team members to

identify with the organization and work hard on its behalf (Pfeffer, 1998). Therefore, equitable rewards such as salary and promotional opportunities can positively influence affective DX.

Selecting a staffing process means recognition for a high quality, good job done based on objective criteria which can motivate software developers. Wimalasiri (1995) found some connection between selection and employees' attitudes. Paré *et al.* (2001) found that HRM practices such as recognition, empowerment, and competence development had a significant positive effect on IT professionals' attitudes. For most IT professionals, a significant part of their motivation comes from their affection for managers for doing an outstanding job. Therefore, selective staffing will be associated with affective DX positively.

Comprehensive training includes all training opportunities to widen skills and specialization, which are key motivators for software developers (Couger and Zawacki, 1980). Many previous studies found a significant impact on comprehensive training (Kalleberg and Moody, 1994). Those working in software development need continuous learning because of the rapid changes in technology. A comprehensive and customized training program gives a sense of confidence to the developers to venture into new projects and prove their mettle. Therefore, when learning opportunities are available, it creates a sense of attachment to the company and enhances affective DX. Thus, this study makes the following hypothesis.

*H2.* Human resource management practices are significantly associated with affective developer experience.

*H2-1.* Developmental appraisal is positively associated with affective developer experience.

*H2-2.* Equitable reward is positively associated with affective developer experience.

*H2-3.* Selective staffing is positively associated with affective developer experience.

*H2-4.* Comprehensive training is positively associated with affective developer experience.

To our knowledge, the mediating role of affective DX in the relationship between HRM and innovative behavior has not been tested. However, several lines of reasoning point towards this pattern of relationship. First, consistent with the social exchange theory, when employees perceive a contract breach, emotional attachment to the organization and employee performance are severely affected. Second, previous empirical research has demonstrated the role of affective commitment as a mediating variable between other antecedent variables and employee performance (Conway and Briner, 2002; Cropanzano *et al.*, 2003). Affective commitment has been found to mediate the relationship between psychological ownership and OCBs (Vandewalle *et al.*, 1995), between perceived organizational support and OCBs (Bishop *et al.*, 2000), between emotional exhaustion and indicators of performance (i.e. OCBs and job performance, Cropanzano *et al.*, 2003), between leadership behavior and job performance (Yousef, 2000), and between work status and OCBs (Conway and Briner, 2002). Third, the mediating role of affective commitment can be explained by Fishbein and Ajzen's (1975) attitude-behavior theory which proposes that work attitudes originate from individuals' beliefs about the various aspects of the environment. These attitudes, in turn, form the basis of intentions and behaviors. In the context of this study, affective DX can be considered an attitudinal response that results from employment experiences and beliefs about the work environment (Rousseau, 1995). A belief that the psychological contract has been kept should positively affect the attitude of developers. Elevated affective DX should then translate into behavior that inhibits employees' contributions to their organization. A high level of affective DX may keep employees from displaying civic virtue behaviors or performing their work responsibilities innovatively. Based on these empirical and theoretical considerations, this study proposes that HRM could

increase affective DX. This, in turn, will result in more willingness on the part of the employees to engage in innovative behaviors. Hence, this study proposes that affective DX should fully mediate the association between HRM practices and their innovative behaviors.

*H3.* Affective developer experience mediates the relationship between human resource management practices and innovative behaviors.

*H3-1.* Affective developer experience mediates the relationship between developmental appraisal and innovative behaviors.

*H3-2.* Affective developer experience mediates the relationship between equitable reward and innovative behaviors.

*H3-3.* Affective developer experience mediates the relationship between selective staffing and innovative behaviors.

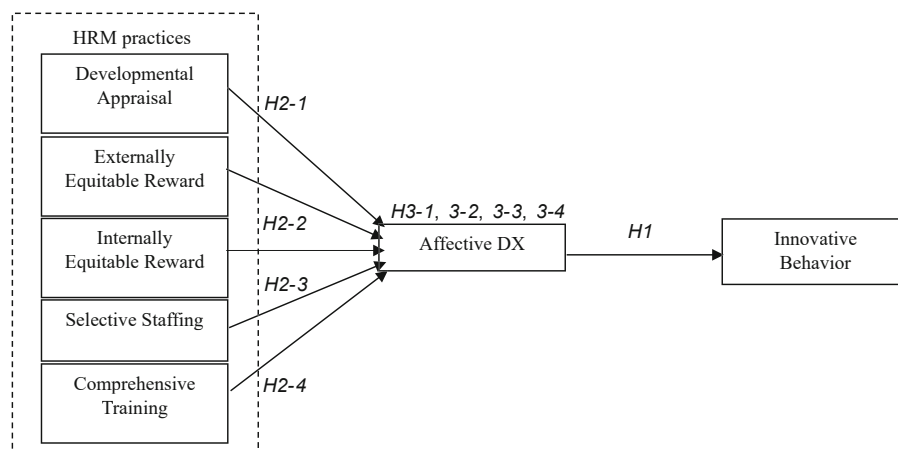
*H3-4.* Affective developer experience mediates the relationship between comprehensive training and innovative behaviors.

Figure 1 shows the research model.

### 3. Methodology

#### 3.1 Sample

The study's objective was to identify the types of HRM practices in software companies through empirical analysis. To achieve this, the perceptions of organization members regarding HRM practices were measured. A questionnaire survey was chosen for its efficiency in collecting data from a large number of individuals quickly and cost-effectively. The survey targeted software developers working in Korea, as they are directly involved in the software development process and can provide relevant insights into HRM practices. The reason this study surveyed in Korea is because Korea is one of the countries with developed IT, and as a result, many software developers work there and are required to take innovative actions. Out of 431 responses from 35 companies, 352 responses from 34 companies were useable for analysis. The sample included a diverse group of developers from various company sizes and demographics, ensuring a comprehensive understanding of HRM practices in the software industry.



Source(s): Figure by author

Figure 1.  
Research model

In Table 1, among the participants, 264 (75.0%) were men and 88 (25.0%) women. Regarding age, 101 people (28.7%) were in their 20s, 95 people (26.9%) were in their 30s, 87 people (24.7%) were in their 40s, and 69 people (19.6%) were in their 50s. Regarding work experience, 105 people (29.8%) had less than 5 years, 91 people (25.8%) had less than 10 years, 77 people (21.8%) had less than 15 years, and 79 people (22.4%) had more than 15 years. Regarding the level of education, 285 people (80.9%) graduated from college, and 67 people (19.1%) graduated from college. All companies where respondents work are located in Seoul, Korea. The percentages of software professionals responding broke down as follows: from the large-scale group, 156 (44.3%), from the small and medium-size enterprises, 91 (25.8%), and multinational companies, 105 (29.8%).

Before measuring validation and model testing, the responses were analyzed to identify the response set (Rennie, 1982). A response set is the tendency among subjects to respond to questions in a particular way independently of the content of the items (Kerlinger, 1973). No cases of response set were detected. Additionally, two tests of common methods variance were employed. First, Harman's one-factor test of common methods was conducted with satisfactory results. An additional test of partial correlation was also conducted (Podsakoff and Organ, 1986). This procedure stipulates that the first factor from the principal components analysis should be introduced into the partial least squares (PLS) model as a control variable (Dijkstra, 1983). This is based on the assumption that the first factor is the most likely to approximate common method variance (if any bias exists). If the factor produces changes in variance, it is assumed that common method variance is present (Podsakoff *et al.*, 2003). As anticipated, there were no significant changes in explained variance. Thus, it appears that common methods bias is not problematic.

### 3.2 Measurement

To select model criteria, this study extracted variables based on core theories through literature research and built a model. During this process, I listened to the opinions of software developers to hear opinions from the field. The present study involves the measurement of seven latent constructs, including developmental appraisal, externally equitable reward systems, internally equitable reward systems, selective staffing, comprehensive training, affective DX, and innovative behavior. These constructs were measured through scales borrowed from literature as follows. Appendix presents the survey questions for each variable.

*HRM practices:* Its survey contained scales developed by Snell and Dean (1992) to measure high commitment human resource practices: developmental appraisal measures whether performance appraisal is used for developing employees; externally equitable reward systems measure the extent to which the organization's pay levels were competitive

Category	Characteristics
Gender	Men: 264 (75.0%), Women: 88 (25.0%)
Age	20s:101(28.7%), 30s: 95(26.9%), 40s: 87(24.7%), 50s: 69(19.6%)
Work experience	0~5 years: 105 (29.8%), 5~10 years: 91(25.8%), 10~15 years: 77(21.8%), more than 15 years: 79 (22.4%)
Educational level	College: 285 (80.9%), Graduate school: 67 (19.1%)
Firm	Large-scale group: 156 (44.3%), Small and medium-size enterprises: 91 (25.8%), multinational companies: 105 (29.8%)

**Source(s):** Table by author

**Table 1.**  
The characteristics of the statistical population

with similar organizations; and internally equitable reward systems measured the extent to which the organization's pay structure was equitably construed: selective staffing measures the extensiveness of the firm's selection process; comprehensive training measures the extensiveness of the firm's training and development process;

*Affective DX:* Lee and Pan (2021) measured cognitive, emotional, and behavioral factors for the measurement of DX. In particular, affective DX includes the developer's feelings or emotions, such as positive emotion or pleasure.

*Innovative behavior:* Individual innovation has been operationalized in various ways. For example, the construct has been thought of in terms of a personality characteristic (Hurt *et al.*, 1977). Others have taken a behavioral perspective (Janssen, 2000). According to Midgley and Dowling (1978), individual innovativeness refers to the individual's openness to new ideas and decision-making to adopt an innovation, free from the influence of the experiences of other employees. This definition is referred to throughout this study because it intuitively gives a more accurate interpretation of innovativeness, which is well supported in the literature, both directly and indirectly. This study used a modified version of Scott and Bruce's (1994) measure of innovative behavior to examine the innovativeness of nursing employees. More specifically, the questions (items) were rephrased to provide a better fit for examining nursing employees. Scales ranged from 1 to 5 but the anchors varied depending on the question. An additional eight questions were included for collecting demographic information such as gender, age, tenure, and job title.

#### 4. Results

Gefen *et al.* (2000) suggested that the validity and reliability of the measures were assessed before hypothesis testing. Because the model included formative constructs, a component-based approach to structural equation modeling was taken; the calculations were performed using the Smart PLS 3.0 software package.

##### 4.1 Analysis of reflective measures

Tests were conducted to evaluate the convergent and discriminant validity and the reliability of reflective measures. To begin, factor loadings were used to establish convergent validity. Loadings over 0.70 on their respective factors are interpreted to indicate convergent validity (Straub *et al.*, 2004). A second indicator of convergence was also employed. Here, a value above 0.50 for the average variance extracted (AVE) for each construct is assumed to indicate sufficient convergence. Test results indicate that both of these conditions have been met.

Discriminant validity is demonstrated when the square root of the AVE is greater than the correlations between constructs (Bollen, 1986). The square-rooted AVEs for affective DX and innovative behavior are 0.7521 and 0.7412 respectively. Their inter-construct correlation is 0.2123. For a second test of discriminant validity, individual items may be assumed to possess sufficient discriminant validity if they load higher on their respective construct than on any other latent variable (Gefen *et al.*, 2000; Straub *et al.*, 2004). This was true for all items. Based on both tests, the measures possess sufficient discriminant validity. Reliability is established by examining the internal consistency measure for each construct. Constructs that exceed the 0.70 level are judged to possess sufficient reliability (Fornell *et al.*, 1982).

##### 4.2 Analysis of formative measures

The tests of validity and reliability were conducted on the formative constructs: developmental appraisal, externally equitable reward systems, internally equitable reward systems, selective staffing, and comprehensive training. To assess convergent and

discriminant validity, patterns of correlation between items and latent variables are depicted in a modified multi-trait, multi-method (MTMM) matrix.

Convergent validity is assessed via examination of item construct correlations (Chin, 1995). If items load significantly on their corresponding constructs, convergent validity is demonstrated. The results indicate that item weights are significant at a 0.05 level of significance, except for five indicators. The five non-significant items were further analyzed according to prescriptions for interpreting formatively measured construct results (Cenfetelli and Bassellier, 2009).

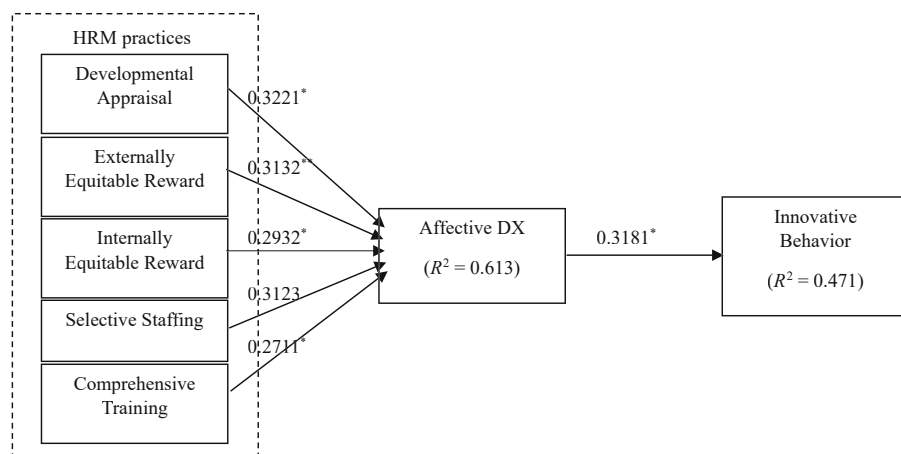
The prescriptions developed by Cenfetelli and Bassellier (2009) distinguish between the relative and absolute contribution of an indicator to its construct. Relative contribution is the relation between an indicator and a criterion while holding other predictors constant. It is the importance of an indicator compared to other indicators of the same construct. Absolute contribution is the relation between an indicator and a criterion, ignoring other predictors. In some instances, it is necessary to consider both perspectives, to develop a more accurate picture of an indicator's influence. For instance, an indicator may have a low or non-significant relative contribution to the construct. Despite this, it may still have an important absolute contribution. It is therefore recommended that when relative contribution (measured in terms of indicator weights) is low, absolute contribution (represented by item loadings) should also be considered.

Because five items in this study have a low relative contribution, it is necessary to consider their unique relations with their associated constructs. The absolute contributions for five items are significant. Their values are 0.732, 0.713, 0.722, 0.711, and 0.714, respectively. Thus, although the contributions of the indicators are relatively low compared to other indicators, they have a strong, bivariate relation to their respective constructs (Nunnally and Burnstein, 1984). Furthermore, there did not appear to be any patterns in wording, polarity, or content among the items that would account for the differences and no conceptual issues regarding the construct definitions were salient. Thus, there was no theoretical justification for removing the items, and rather than discarding the items and changing the meaning of the constructs, it was determined that the items should be retained. Finally, evidence of discriminant validity is presented when items correlate higher with their respective construct measures than with other construct measures and their composite values.

#### 4.3 Structural modeling

Because the model was comprised of reflective and formative constructs, bootstrap sampling was used to test the proposed relationships among the constructs (Gefen *et al.*, 2000; Cheung and Lau, 2008). Path coefficients and *t*-values were obtained through this procedure, and are depicted in Figure 2. The results indicate that all paths are significant at the  $p < 0.05$  level of confidence.

To ensure that affective DX mediates the relationship between each organizational culture type and innovative behavior, Baron and Kenny's (1985) steps for establishing mediation were followed. First, it was established that developmental appraisal, external or equitable reward, and comprehensive training are correlated with innovative behavior, but selective staffing is not. Second, it was determined that each is related to affective DX. Therefore, H2-1, H2-2, and H2-4 were supported, but H2-3 was not supported. Third, affective DX was found to be positively related to innovative behavior. Therefore, H1 was supported. Finally, HRM practices were then entered into the model, but some paths were statistically insignificant or other path coefficients decreased, which is partial mediation. This means that the impact of HRM practices on innovative behavior is partly through affective DX. Thus, as shown in Table 2, there is sufficient empirical support to conclude that affective DX mediates



**Note(s):** \*significant at  $p < 0.05$   
\*\*significant at  $p < 0.01$

**Source(s):** Figure by author

**Figure 2.**  
Structural equation  
modeling results

HRM practices	Dependent variables: innovative behavior	Dependent variables: affective DX	Dependent variables: innovative behavior (mediating variable: affective DX included)
Developmental appraisal	$\beta = 0.3222, p < 0.05$	$\beta = 0.2815, p < 0.05$	$\beta = 0.2924, p = 0.13$
Externally equitable reward	$\beta = 0.1843, p < 0.05$	$\beta = 0.3213, p < 0.05$	$\beta = 0.1569, p = 0.15$
Internally equitable reward	$\beta = 0.2817, p < 0.05$	$\beta = 0.3224, p < 0.05$	$\beta = 0.2419, p = 0.02$
Selective staffing	$\beta = 0.2123, p = 0.12$	$\beta = 0.3226, p = 0.12$	$\beta = 0.1553, p = 0.15$
Comprehensive training	$\beta = 0.2777, p < 0.05$	$\beta = 0.3210, p < 0.05$	$\beta = 0.2526, p = 0.02$

**Source(s):** Table by author

**Table 2.**  
Testing mediation  
effects of affective DX

partially the relationship between HRM practices and innovative behavior. Therefore, H3-1, H3-2, and H3-4 were supported, but H3-3 was not supported. The model's explanatory power was considered by observing the  $R^2$  of endogenous constructs. As shown in Figure 2, the model accounts for 60.9% of the variance in DX and 49.1% of the variance in innovative behavior. All of the hypotheses are supported. Finally, several factors were introduced as controls on DX. They include gender, age, work experience, and educational level. It was found that work experience was significant ( $\beta = 0.1881, p < 0.05$ ).

## 5. Conclusion

### 5.1 Discussion

DX, derived from user experience, focuses on developers rather than users, involving the interaction between development tools and developers in the software development process. (Nylund, 2020; AlOmar *et al.*, 2024). In the behavioral perspective of individual innovation,

the present study aimed to examine the linkage between HRM practices and innovative behavior in the software development process by focusing on this affective DX. This study illuminates HRM practices and identifies how HRM practices influence the motivation of software developers. Agreeing with the HRM practices and considering the characteristics of software developers, the author proposes HRM practices that increase their affective DX, positively affecting their innovative behaviors. The findings suggest three main conclusions. First, software developers' affective DX increases their innovative behaviors. Second, developmental appraisal, externally or internally equitable reward, and comprehensive training among all sub-factors of HRM practices increase software developers' affective DX. Finally, developmental appraisal, externally or internally equitable reward, and comprehensive training among all sub-factors of HRM practices increase software developers' innovative behaviors through their affective DX.

The results of this study supported that developmental appraisal, externally or internally equitable reward, and comprehensive training increase their affective DX, positively affecting innovative behavior. However, selective staffing has no effect. Selecting the staffing process means recognizing a high-quality, good job done based on objective criteria. Relevant researches suggest that it has a significant positive effect on organizational attitude (Wimalasiri, 1995; Paré *et al.*, 2001; Agarwal and Ferratt, 1999). The sample of this study is S/W developers who are growth-oriented, challenging, and learning new skills (Boehm, 1981; Chelsom *et al.*, 2005; Couger and Zawacki, 1978, 1980; Couger, 1992; Couger and Adelsberger, 1988; Couger and Ishikawa, 1995; Couger and McIntyre, 1987). As a result, they are not interested in acquiring high-quality, good jobs through selective staffing but give considerable thought to appraisal systems and rewards for their performance and want training for their growth. The results show that S/W developers pursue individual growth rather than success in their organizations.

#### *5.2 Research contributions and practical implications*

This study offers important insights and practical contributions to HRM, particularly in Korean software engineering. Korean companies' performance-based HR systems are influenced by U.S. "best practices" (Lee and Kim, 2006). In strategic HRM, three theoretical frameworks exist: universalistic, contingency, and configurational perspectives (Delery and Doty, 1996; Yu *et al.*, 2001). The research highlights how effective HRM practices, particularly the universalistic perspective, can motivate software engineers and enhance performance by aligning HRM with Korean companies' unique needs and cultures.

To extend these findings to other countries with low innovation orientation, numerous SMEs, or limited public support programs for innovation, several conditions must be considered. Firstly, assess if Korea's corporate culture and HRM practices apply elsewhere, as some countries emphasize individual growth over collective success. Secondly, countries with low innovation orientation might lack the capacity to invest in HRM, making it hard to provide fair compensation and comprehensive training. Thirdly, SMEs, having fewer resources than large enterprises, may struggle to enhance developers' affective experiences through HRM practices, requiring tailored strategies for SMEs. Fourthly, SMEs' flexible structures can promote innovation with customized HRM practices. Fifthly, in countries lacking public support programs for innovation, governments can support HRM practices through subsidies or tax breaks. Sixthly, industry associations can foster cooperation and resource sharing where public support is limited. Lastly, research indicates developers value personal growth over organizational success, which HRM practices should reflect. Additionally, a fair compensation system, aligned with each country's economic situation, is crucial to motivate developers and maintain fairness. Adapting these conditions locally can extend the study's results to other countries.

Although the findings of this study contribute to a better understanding of software developers' innovative behaviors, there are some limitations. First, although most relevant research has shown the direct effect of promotion and prevention goals on creativity, regulatory fit theory suggests moderating conditions for the promotion/prevention goal-creativity relationship. The findings don't consider the moderating conditions. Second, this study has a generalizability issue. It is difficult to say whether our findings can be generalized to other world regions. Since there are few studies on the subject, the extent to which the findings of this study can be generalized depends on its validation and replication in other settings and regions.

### 5.3 Future research directions

Future studies should explore several avenues for expanding this research. First, researchers should investigate moderating conditions affecting the relationship between HRM practices and the motivation of innovative behaviors in software engineers. Second, generalizing this study's results through replication in other regions and contexts, particularly in developing countries, is recommended. Third, more theoretical perspectives and core variables need examination. As the software industry's technology rapidly evolves, developers often lack confidence in new methodologies, making their self-efficacy crucial. Organizational learning can enhance this by keeping developers up-to-date with the latest practices. Investigating how organizational learning motivates software engineers is a valuable research question. Fourth, this study used a survey methodology and a cross-sectional sample for data collection. Future research should consider longitudinal studies to determine causal relationships between organizational culture types and software developers' motivation. Finally, this study focused on affective factors inducing innovative behavior, specifically examining DX as an affective antecedent. However, DX has three sub-factors, necessitating further investigation into their impact on innovative behavior. Comparative studies on these sub-factors' influence on innovation behavior are also necessary. By addressing these areas, future research can build on this study's findings and offer deeper insights into HRM and innovation in the software industry.

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**Corresponding author**

Youngkeun Choi can be contacted at: penking1@smu.ac.kr

Variables	Instrument item	References		
HRM practice	Selective staffing	How extensive is the employee selection process for a job in this unit? (e.g. use of tests, interviews, etc.)	Snell and Dean (1992)	
		How important is it to select the best person for a given job? In general, how long does it take to select someone for a position in this unit once the job becomes open? How many people are involved in the selection decision? How much money is generally spent in selecting people for a job? How many applicants are screened for each person hired for a job? How much importance is placed on the staffing process in this unit?		
	Comprehensive training	How extensive is the training process for members of your work unit? How much priority is placed on training employees in your unit? How formal or structured is the training process? What percentage of people have received training this past year? On average, how many hours of formal training does a typical member of your work unit receive per year? How many different kinds of training programs are available for members of your work unit to attend? How much money is spent on training individuals in your work unit? Do you feel training is viewed as a cost or as an investment?		
		Developmental performance appraisal		How much effort is given to measuring employee performance? How would you describe the performance standards in your unit? How much do employees participate in goal setting and appraisal? How often is performance discussed with employees? Do discussions focus on present performance or future performance? When performance is discussed, how much emphasis is placed on finding avenues of personal development for an employee? How closely are raises, promotions, etc., tied to performance appraisal? How would you describe the approach used to discuss performance?
				Equitable reward system
		Developer experience		
	Innovative behavior	You search out new technologies, processes, techniques, and/or product ideas You generate creative ideas You promote and champion ideas to others You investigate and secure funds needed to implement new ideas You develop adequate plans and schedules for the implementation of new ideas You are innovative		Lee and Pan (2021)
	Gender	Please indicate your gender		Scott and Bruce's (1994)
	Age	What is your age?		
	Work experience	How long have you worked at your current organization?		
Educational level	What is your job title?			
Instrument item	<b>Source(s):</b> Table by author			

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# Maximizing research impact: strategies for securing competitive funding in research and development centers

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Juana M. Ferrús-Pérez and Alejandro Escribá-Esteve  
*Department of Management, University of València, València, Spain, and*  
 Jose-Luis Perea-Vicente  
*Business Organization Department, University of Cádiz, Cádiz, Spain*

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## Abstract

**Purpose** – This study analyzes the effectiveness of research and development (R&D) organizations' strategies for obtaining competitive international funding and the role of research management offices (RMOs) in this process. It examines the internal factors that influence the proactivity and effectiveness of R&D centers and provides a theoretical model for improving the fundraising capacity and, ultimately, the competitiveness and sustainability of these institutions.

**Design/methodology/approach** – The study sample comprised Spanish public R&D centers in the health and biomedical sectors. Partial least squares were used in the analyses to ensure the robustness of the results.

**Findings** – Several independent variables showed a significant impact on the proactivity and effectiveness of R&D centers. The dispersed priorities of R&D managers reduce proactivity and fundraising effectiveness. Incentives and RMO workload increase proactivity, but workload alone also improves effectiveness.

**Originality/value** – This study focuses on the management of health and biomedical R&D centers. It examines the influence of internal factors, such as managerial priorities, RMO incentives and RMO workload, on competitive international funding. These findings have significant theoretical and practical implications for the development of internationally applicable management strategies to enhance the effectiveness of research funding acquisition.

**Keywords** International research funding, R&D centers, Research management office, Proactiveness, Managerial priorities, Fundraising

**Paper type** Research paper

## 1. Introduction

One guideline of the Lisbon Strategy is to improve the global competitiveness of the European Union (EU) by maximizing productive research and transforming it into value-added technologies and products (Presidency Conclusions, 2000). In public policy, promoting cooperation between firms and public research organizations is challenging. Various funding programs have been implemented internationally to encourage research and development (R&D) efforts and research partnerships (Grimpe, 2012; Jin *et al.*, 2022). Public funds largely support R&D activities as a key source for the prosperity and maintenance of public institutions. However, government funding for European public sector research has remained static in most countries in recent years, and public R&D entities have been encouraged to seek new funds. Since the 1980s, the EU has developed its own independent science, technology,

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and innovation policy, establishing several framework programs for R&D. The European Commission's Horizon Europe Program, which will run until 2027, provides competitive funding for international R&D activities (European Commission, 2021).

However, the success rates of different countries and sectors within the EU in securing competitive funding show discernible discrepancies. Spain particularly exhibits lower R&D investment levels than the European average, which constrain its capacity to compete effectively in the European stage (Europa Press, 2024; PEICTI, 2023). The current study addresses the gap in the existing literature by examining the factors that contribute to the success of Spanish public R&D centers, especially those in the biomedical and health sectors, in obtaining competitive European funding. This study is vital as it enriches the research on the challenges and strategies employed by Spanish R&D centers in these sectors to secure funding, essential for their sustainability and competitiveness.

Spain was selected for this study because of its distinct status within the EU. Notwithstanding the recent augmentation of national R&D budgets, Spain still faces considerable obstacles in attaining the EU average for R&D investment. The biomedical and health sectors were selected owing to their status as areas of intense competition and high investment. These sectors are critical for public health and innovation. The factors contributing to successful funding acquisition in these areas can provide valuable insights for other sectors and regions. Moreover, Spanish biomedical and health R&D centers have excelled in the generation of knowledge and significant outcomes in research policy (Hall *et al.*, 2022).

R&D areas are thematic knowledge units that can be divided into subareas and specific research lines encompassing several research groups. Most research in R&D centers has been developed within these areas through projects that bridge R&D with study objectives and societal impact. R&D areas have limited national funds for R&D activities and are in a highly competitive environment to achieve proper results and guarantee their operations and functional activities (Bazeley, 1998; Fang and Casadevall, 2015). Therefore, R&D areas must obtain external funds through competitive international programs to ensure their organizations' longevity (Bonaccorsi *et al.*, 2022; Wiebe and Maticka-Tyndale, 2017). In recent years, the capacity of public R&D centers to secure competitive funds has become crucial for the survival and sustainability of public well-being systems in Europe (Bazeley, 1998). Securing this funding from competitive funds for R&D projects is essential for the medium- and long-term development and sustainability of these centers (Cunningham *et al.*, 2014, 2022). This natural selection of R&D projects ensures efficient resource allocation. Previous studies have explored group effectiveness in R&D performance (Lin *et al.*, 2005) and the impact of managerial support structures on research groups (Kennedy *et al.*, 2009). However, they have rarely investigated the factors influencing proactivity in project application, the capacity to acquire competitive funds, and the supporting role of research management offices (RMOs) in this success (Caldera and Debande, 2010; Nepelski and Piroli, 2018).

Accordingly, the current study analyzes the effectiveness of R&D organizations' strategies in securing competitive international funding and the role of RMOs. It examines the internal factors influencing R&D centers' proactivity and effectiveness and provides a theoretical model for enhancing fundraising capacity, competitiveness, and sustainability. This study innovatively addresses the funding acquisition challenges faced by Spanish public R&D centers in the biomedical and health sectors by identifying key factors for effectively securing international funding. Understanding these factors is crucial for developing policies to improve Spain's research performance and achieve the European average amid growing competition for European funds.

The results of this study offer stakeholders (R&D centers, R&D areas, RMOs, and other institutions) insights into the variables that determine success in obtaining competitive international funds, thereby aiding internal analysis and performance improvement through appropriate measures. These findings will help optimize resource allocation, enhance innovation capacity, and boost competitiveness, ultimately improving the performance of the national public science and technology system.

## 2. Theoretical framework

The success of R&D areas in acquiring external funds depends on many external and internal factors. External factors are exogenous variables beyond the control of researchers in their R&D areas, whereas internal factors are more endogenous and can be modified (Laudel, 2006; McAlpine, 2020). These factors influence the quality of research proposals, likelihood of obtaining funding, and overall chances of scientists to acquire external funds.

Organizational support is an important internal factor. R&D centers provide R&D areas with resources and information to enhance efficiency and performance (Clausen *et al.*, 2012; Kennedy *et al.*, 2009). This organizational support comes from heads of R&D areas and RMOs, who influence application submissions to obtain public funding. According to attention-based view (ABV) theory, their decisions may differ depending on their focal issues (Ocasio, 1997). The intensity of their attention to these issues is related to managers' existing attentional drivers, that is, the social, economic, cultural, and cognitive factors that shape organizational decision makers' allocation of time, effort, and attentional focus (Grimpe *et al.*, 2022; Ocasio, 1997). Prior experience or expertise is often theorized as a driver of attentional focus that helps determine the key head of an R&D area who would be able to identify the set of priorities (Ocasio, 2011; Nicolini and Korica, 2021). Cognitive research acknowledges that performance is only partly determined by the selected target of attention as it also requires the study of attention intensity (Fiske and Taylor, 2008).

Heads of R&D areas in R&D centers set priorities and allocate resources for short-to medium-term activities, including the application for and acquisition of competitive international funds. Their decisions on priority tasks are crucial in shaping centers' proactivity in R&D challenges. According to ABV, the attention of heads of R&D area to certain activities is the main factor in determining the proactivity of their researchers and, by extension, the effectiveness of the R&D center. The ABV is an appropriate theoretical framework for analyzing proactivity in international project application and competitive fund acquisition as it explains how organizational decision makers' attention influences strategic behavior, especially in a competitive global environment (Brielmaier and Friesl, 2022). Similarly, cognitive research has shown that attention mechanisms impact outcomes (Knockaert *et al.*, 2015; Ocasio, 2011; Wilden *et al.*, 2022). The current study examines the prioritization of actions by heads of R&D areas as an internal factor affecting R&D centers' effectiveness. Without clear prioritization and undivided attention to tasks, R&D centers may see a decrease in the number and quality of project applications, potentially compromising their scientific excellence. With less time to meet excellence standards, R&D centers experience increased risk of mistakes and reduced effectiveness. Consequently, we propose a tentative explanatory framework supported by ABV theory as the prioritization of R&D activities by heads of the R&D areas may influence proactivity and, by extension, the effectiveness of R&D centers. The following hypotheses are formulated:

*H1a.* A dispersed or unclear set of priorities by heads of R&D areas decreases the proactivity of R&D centers in applying for competitive international public funds.

*H1b.* A dispersed or unclear set of priorities by heads of R&D areas decreases the effectiveness of R&D centers in acquiring competitive international public funds.

In the European context, institutional policies for public research organizations, such as the Spanish system, are often restrictive. Most of the analyzed R&D centers show similar patterns with minimal incentive policies. These centers share common characteristics, including staff recruitment, R&D area composition, and limited opportunities to contract excellent researchers or motivate personnel.

Self-determination theory (SDT) provides a useful approach for understanding the motivational bases for effective organizational behavior by explaining the association between

extrinsic incentives, intrinsic motivation, and performance (Deci and Ryan, 1985; Ryan and Deci, 2000; Taylor *et al.*, 1998). The literature reveals that organizations may boost trust by setting clear objectives and measurable project rewards and by choosing a staff approach that allows for familiar team members, long-standing team composition, and permanent team membership (Maurer, 2010). This finding is in line with SDT, which states that implementing a specific set of incentives may motivate and impact intention (Deci and Ryan, 1985; Manganelli *et al.*, 2018; Orazbayeva *et al.*, 2020). Thus, we expect that permanent contracts (job stability) and rewards designed by projects may increase trust among R&D area members, thus improving their performance in project achievements.

Career paths for university technology licensing officers are often limited and short term, necessitating immediate rewards to encourage desired behaviors (Pohle *et al.*, 2022). Appropriate incentives are also crucial for researchers as inventors and primary contributors to technology transfer (Aalbers *et al.*, 2013). For international project applications and fund acquisition, reflected as “performance” in the scope of our study, we focus on the motivation and reward policies designed for RMOs that support R&D groups (Huang, 2022). We also evaluate the potential increase in trust, proactivity, and commitment to strategic objectives for enhancing project achievement. SDT is the most appropriate theory to justify how incentives for RMOs in R&D centers can influence their proactivity and effectiveness. Given the significance of reward policies in enhancing performance and yield in research institutions (Pohle *et al.*, 2022), the rewards and motivations regarding competitive international project applications and accomplishments in R&D centers must be profoundly understood. Therefore, as RMOs are crucial in shaping the application process for competitive international public funding, we suggest the following hypotheses according to SDT while discussing the importance of setting reward policies to increase the motivation, commitment to strategic objectives (proactivity), and performance (effectiveness) of R&D centers:

*H2a.* RMOs’ incentives positively influence the proactivity of R&D centers.

*H2b.* RMOs’ incentives positively influence the effectiveness of R&D centers.

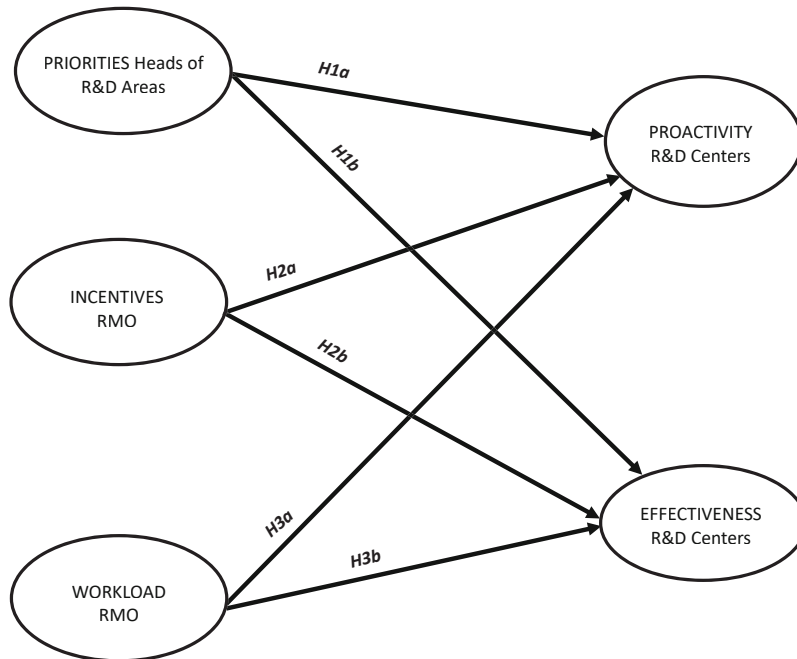
R&D centers’ support to R&D areas in terms of competitive funds is managed through RMOs. Experienced researchers supported by public infrastructure are much more likely to apply for and gain this type of funding. Therefore, supportive infrastructure reduces transaction costs and information asymmetries, and R&D centers that have established RMOs outperform those that have not (Sellenthin, 2009).

The importance of innovation and expected impact in European-funded competitive projects highlights the need for professional staff capable of handling funding application and management (Vidal *et al.*, 2015). RMO employees can reduce information asymmetry in the scientific knowledge market and improve communication and interaction with R&D areas. We can determine the RMO-related factors that may influence R&D areas as those that increase the requested amount of competitive international public funding and the resources gained by studying the number of people working at RMOs to guarantee proper service to R&D areas. We can also examine the workload of RMOs in terms of their roles and functions in assisting R&D area researchers and facilitating the processes established. According to this argument, the expectation is that appropriate support from RMOs during R&D centers’ application for competitive international public funding improves the proactivity and effectiveness of these centers. We observe that efficiently conducted and managed attention can boost proactivity and effectiveness while searching for funding opportunities and preparing and submitting competitive applications. According to ABV, the greater workload of RMOs can enable them to improve their capacity to allocate resources and routines toward the activities prioritized by R&D areas (Joseph and Wilson, 2018) for maximizing success in obtaining competitive funds. These ABV-based arguments support the idea that a well-managed workload can improve the operational capabilities of RMOs as supporting

structures in R&D areas. Thus, they reinforce the following formulated hypotheses and provide a robust theoretical framework for analysis (Figure 1):

*H3a.* RMOs' workload positively influences the proactivity of R&D centers in competitive international public funding applications.

*H3b.* RMOs' workload positively influences the effectiveness of R&D centers in competitive international public funding applications.



Source(s): Authors' elaboration

Figure 1. Proposed model

### 3. Research method

This section discusses the research methodology, particularly the sample and data collection and the measures used.

#### 3.1 Sample and data collection

The study sample comprised Spanish public R&D centers in the health and biomedicine sectors. These research fields are highly competitive, and most research activities are funded through competitive financial mechanisms (Milanés Guisado *et al.*, 2010). The focus on Spain was driven by the recognition that most of its research activities are undertaken by public R&D centers and that public funding is crucial for maintaining their infrastructure, personnel, and research development over time.

We identified the study population using secondary sources, including public and private databases, scientific publications, annual reports, and company reports. By accessing available scientific reports, we identified Spanish R&D centers in the health and biomedical fields that participated in competitively funded national and international projects from 2011 to 2016.

The final population consisted of 68 public nonprofit R&D centers and institutes located in Spain. The list of R&D centers was compiled by a panel of experts from the ISCIII European Office and European Office of the Spanish Ministry of Economy, Industry, and Competitiveness. These entities have their own R&D areas and RMOs. To obtain a representative sample with a high degree of consistency and viability in terms of data collection costs, we attempted to connect with the R&D centers. However, only 47 R&D centers (69.11% of the total population) were available for interview. A total of 27 out of the 47 R&D centers interviewed (39.71%) provided responses from all roles, including the CEO, research area heads, and RMO heads. Despite the reduced size, the final sample was heterogeneous and geographically representative and accurately reflected the broader population of public R&D centers in Spain.

We combined primary and secondary sources to collect data for empirical analysis (Figure 2). We conducted a thorough pretest to refine the questionnaires and reviewed the survey with a panel of experts in biomedicine and management research. Additionally, we engaged respondents by emphasizing the relevance of the study and the implications of the results.

### 3.2 Measures

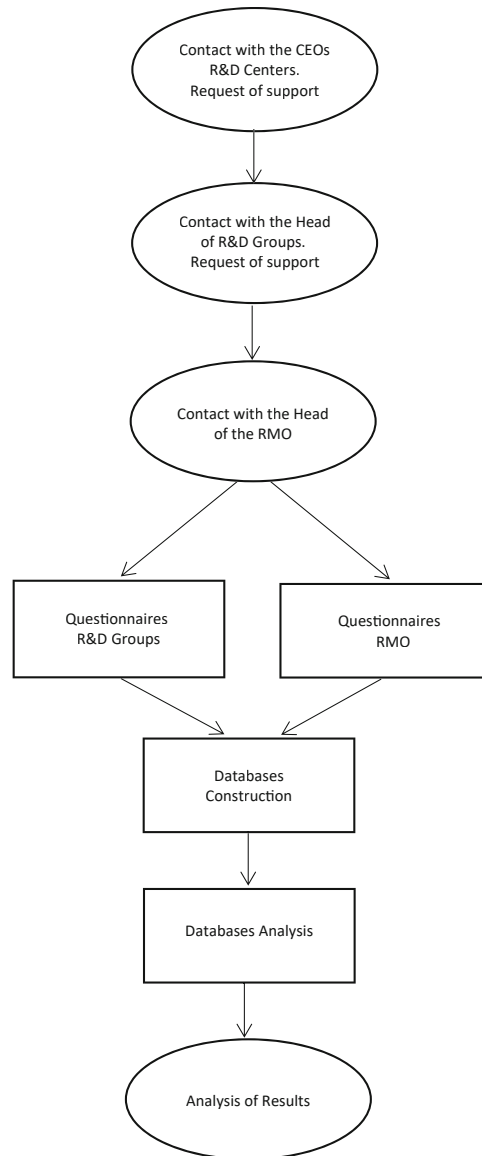
Our dependent variables are the proactivity (PROACT) and effectiveness (EFFEC) of R&D centers in raising competitive funds. We assessed the activities of each R&D center based on the number of competitive international public funding applications to diverse international agencies and funding programs made by its research staff from 2011 to 2016. We used a 5-point Likert scale ranging from “20 or less” to “more than 100” to assess the R&D center’s degree of competitive international public project applications.

We measured the effectiveness of each R&D center using the total amount of competitive international public funds it secured from 2011 to 2016. We employed a 5-point Likert scale ranging from “none” to “more than 36” to assess the R&D center’s degree of competitive international public projects.

In complex questionnaires such as ours, the use of numerical intervals reduces variance, facilitates data grouping, enables robust statistical analysis, and benefits respondents by not requiring exact answers. This approach increases response rates, reduces errors, and improves data quality by smoothing deviations, thereby providing more coherent and reliable data.

The independent variables of the study are as follows:

- (1) Priorities of R&D area heads (PRIOR): The scale for this independent variable was adapted from Clausen *et al.* (2012). We used a 5-point Likert scale ranging from 1 (“not a priority”) to 5 (“crucial priority”).
- (2) Incentives of RMOs (INCRMO): The incentives offered by an R&D center represent the policies adopted by the institution to increase the applications and receipt of competitive international public funding. Regarding motivating and promoting international research success rates, we collected data on the potential and different intrinsic and extrinsic incentives offered by each center to research managers when acquiring competitive projects. We adapted the scale of Linz and Semykina (2012) to fit our research context and used a 5-point Likert rating ranging from “not done” to “always done.”
- (3) Workload of RMOs (WORKRMO): Workload represents the activities that research managers perform to assist researchers and the types of services they provide to R&D areas. We calculated the workload of each RMO by dividing the total number of services developed by the RMO when researchers applied for competitive international public funding by the total number of people comprising the RMO. The content design for these data was derived from the annual scientific reports of most of the centers in 2013–2015 as at least 80% of them included these figures in their annual reports. We used a 5-point Likert scale ranging from “none” to “more than 35.”



Source(s): Authors' elaboration

Figure 2. Primary data collection process

A large number of research staff in a center can increase R&D activities and potential projects. In competitive international funding, the size of the R&D center is crucial as more members can increase opportunities to apply for and gain competitive funds and allow R&D area heads to allocate more resources to this effort. To better capture the impact of the independent variables on R&D centers' proactivity and effectiveness, we included the number of researchers (NRESEAR) as a control variable.

#### 4. Data analysis and results

This section summarizes the validation of the measurement instruments, estimation of the structural model, and detailed results.

##### 4.1 Validating the measurement instruments

SmartPLS (version 2.0) software was employed for the measurement and structural model analyses. We chose partial least squares (PLS) as our research method for two reasons. PLS aligns with the objectives and limitations of our research, namely, sample size considerations and predictive orientation. It is particularly effective in smaller sample sizes and is thus important given the scope and data available for our study. In contrast to other methods that typically require larger samples to obtain reliable results, PLS can provide robust results even with a limited number of observations. This feature maintains the validity and reliability of our research despite sample size restrictions (Chin *et al.*, 2003). Regarding the predictive orientation of PLS, the objective is to maximize the explained variance of dependent constructs, thereby enhancing the predictive relevance of the model. This feature is important in our study as we seek to understand and predict outcomes in a practical context (Tenenhaus *et al.*, 2005).

To assess the validity and reliability of the measurement model, we analyzed whether the theoretical concepts were properly measured by the observed variables. To evaluate the reliability of the individual variables, we examined the loadings of the indicators in relation to their respective constructs. In exploratory research, loadings between 0.6 and 0.7 are deemed acceptable while values exceeding 0.7 are highly satisfactory (Sarstedt *et al.*, 2014). We obtained a factorial structure of six factors, with each item having a loading greater than 0.7 on its designated factor and lower loadings on all other factors. Exceptions are some PRIOR items (349 and 3417), INCRMO items (211, 212, 216, 217, and 2111), and PROACT items (182, 183, 184, 185, 188, 189, 1810, 1811, 1812, 1813, and 1814), whose loadings with corresponding dimensions were lower than 0.7. We removed these items from their corresponding factors and obtained favorable results for the remaining items (Table 1).

INCRMO items 218 and 2110 showed multicollinearity problems in the multicollinearity analysis using SPSS version 26 and in the variance inflation factor (VIF) and tolerance revision for assessing statistical collinearity. Accordingly, we removed the two items such that multicollinearity was no longer a problem and that each pair of items had tolerance ratios higher than 0.2 and VIF <5 in accordance with Kleinbaum *et al.* (2013).

The reliability of the constructs was calculated based on both criteria. In all cases, the composite reliability index (CRI) values exceeded the optimal threshold of 0.7 (Chin and Newsted, 1999; Nunnally, 1994). To analyze convergent validity, we used the average variance extracted (AVE), which is an indicator of the variance captured by a factor relative to the variance due to measurement error (Fornell and Larcker, 1981). The AVE values exceeded 0.5 in all cases, indicating that more than 50% of the variance in each construct was due to their indicators (Table 2).

We used the Kaiser–Meyer–Olkin (KMO) test to assess model validity. The KMO index measures the adequacy of partial correlations between variables for factor analysis, indicating whether the data are suitable (Hutcheson and Sofroniou, 1999; Hair *et al.*, 2018; Kaiser, 1974). The overall measure of sampling adequacy (MSA) was 0.79, with all individual MSAs ranging from “acceptable” to “perfect” (Table 3). We calculated the model fit index to evaluate the model fit. The indices confirmed the model’s acceptability: normed fit index (NFI) = 0.92, Tucker–Lewis index (TLI) = 0.899, relative fit index (RFI) = 0.885, incremental fit index (IFI) = 0.927, and comparative fit index (CFI) = 0.919. A non-NFI, also known as the TLI, of 0.95 indicates that the model of interest improves fit by 95% and is preferable for smaller samples. The values should be > 0.90 (Byrne, 1994). The RFI is not guaranteed to vary from 0 to 1; a value close to 1 indicates a good fit. The IFI adjusts the NFI for sample size and degrees of freedom, and a value exceeding 0.90 indicates a good fit. The CFI, a revised form of the NFI, is not sensitive to sample size (Fan *et al.*, 1999) and compares the fit of a target model with the fit of an independent or null model. The acceptable value is > 0.90 (Byrne, 1994).

**Table 1.** Factors and items loading

Factor	Item	Description	Individual item loading
F1. PRIOR (Priorities of heads of R&D areas)	PRIOR341	To obtain higher long-term financing associated to projects	0.9804*
	PRIOR3410	To improve researchers' employment opportunities	0.9804*
	PRIOR3411	To increase collaborations with industry	0.9778*
	PRIOR3412	To develop education and training programs	0.8031*
	PRIOR3413	To obtain practical and applicable results from the developed research projects	0.8029*
	PRIOR3414	To obtain more support from other R&D areas	0.8029*
	PRIOR3415	To improve the research culture of the area and the center	0.8029*
	PRIOR3416	To increase the support from other local or regional R&D areas	0.7172*
	PRIOR342	To obtain more basal funds not coming from national or international projects	0.9807*
	PRIOR343	To increase the number of international scientific publications	0.9758*
	PRIOR344	To attract good researchers	0.7445*
	PRIOR345	To improve international collaborations	0.9782*
	PRIOR346	To develop a better scientific program	0.9774*
	PRIOR347	To obtain more support from the CEO and top management team	0.9799*
	PRIOR348	To improve the scientific leadership of the R&D area	0.9806*
F2. INCRMO (RMO Incentives)	INCRMO213	It provides the RMO members with more job security	0.8708*
	INCRMO214	It increases the promotion opportunities for the RMO members	0.8277*
	INCRMO215	It improves the appreciation and respect for the RMO members among the rest of the staff	0.9033*
	INCRMO219	It offers opportunities for RMO members to learn new things	0.8325*
F3. WORKRMO (RMO Workload)	WORKRMO	Number of activities undertaken by the RMO in the last year, in relation to the staff members of the office	1*
F4. NRESEAR (Number of researchers in the centers)	NRESEAR	Number of research staff in the centers	1*
F5. PROACT (Proactivity of the center)	PROACT181	7th FP - Cooperation-Health	0.8100*
	PROACT1815	7th FP - Cooperation-NANO 7th FP-IDEAS (ERC)	0.8783*
	PROACT186	7th FP - PEOPLE (Marie Curie Actions)	0.9160*
	PROACT187	7th FP - PEOPLE (Marie Curie Actions)	0.8708*
F6. EFFEC (Effectiveness of the center)	EFFEC	Number of international competitive projects acquired by the center in the last five years	1*

**Note(s):** \*All loadings are significant ( $p < 0.1$ )  
Items PRIOR (349 and 3417); Items INCRMO (211, 212, 216, 217 and 2111); Items PROACT (182, 183, 184, 185, 188, 189, 1810, 1811, 1812, 1813 and 1814) were eliminated (the values of their loads were below 0.7)

**Source(s):** Authors' elaboration

We calculated discriminant validity by comparing the square root of the AVE with the correlations between the factors to show that the correlations between constructs were less than the square root of the AVE (García-Rodríguez *et al.*, 2017; Hair *et al.*, 2019). The correlations in our study were less than the square root of the AVE, thus confirming discriminant validity (Table 4).

#### 4.2 Structural model estimation

After evaluating the psychometric properties of the measurement instruments, we analyzed the structural model using PLS. Previous studies (see García-Rodríguez *et al.*, 2017;

**Table 2.** Reliability and convergent validity of constructs

Factor	CRI	AVE	Cronbach's alpha
PRIOR (Priorities of heads of R&D areas)	0.985	0.818	0.9833
INCRMO (RMO Incentives)	0.918	0.738	0.8833
WORKRMO (RMO Workload)	1	1	1
PROACT (Proactivity of the center)	0.925	0.756	0.8924
EFFEC (Effectiveness of the center)	1	1	1
NRESEAR (Number of researchers in the centers)	1	1	1

**Note(s):** \* All loadings are significant ( $p < 0.1$ )

**Table 3.** Kaiser–Meyer–Olkin (KMO) factor adequacy

Factor	Item	Description	MSA for each item
F1. PRIOR (Priorities of heads of R&D areas)	PRIOR341	To obtain higher long-term financing associated to projects	0.83
	PRIOR3410	To improve researchers' employment opportunities	0.83
	PRIOR3411	To increase collaborations with industry	0.78
	PRIOR3412	To develop education and training programs	0.87
	PRIOR3413	To obtain practical and applicable results from the developed research projects	0.87
	PRIOR3414	To obtain more support from other R&D areas	0.89
	PRIOR3415	To improve the research culture of the area and the center	0.85
	PRIOR3416	To increase the support from other local or regional R&D areas	0.82
	PRIOR342	To obtain more basal funds not coming from national or international projects	0.76
	PRIOR343	To increase the number of international scientific publications	0.83
	PRIOR344	To attract good researchers	0.72
	PRIOR345	To improve international collaborations	0.86
	PRIOR346	To develop a better scientific program	0.83
	PRIOR347	To obtain more support from the CEO and top management team	0.84
F2. INCRMO (RMO Incentives)	PRIOR348	To improve the scientific leadership of the R&D area	0.76
	INCRMO213	It provides the RMO members with more job security	0.82
	INCRMO214	It increases the promotion opportunities for the RMO members	0.73
	INCRMO215	It improves the appreciation and respect for the RMO members among the rest of the staff	0.71
F3. WORKRMO (RMO Workload)	INCRMO219	It offers opportunities for RMO members to learn new things	0.76
	WORKRMO	Number of activities undertaken by the RMO in the last year, in relation to the staff members of the office	0.62
F4. NRESEAR (Number of researchers in the centers)	NRESEAR	Number of research staff in the centers	0.54
F5. PROACT (Proactivity of the center)	PROACT181	7th FP - Cooperation–Health	0.77
	PROACT1815	7th FP - Cooperation–NANO 7th FP–IDEAS	0.45
	PROACT186	(ERC)	0.77
	PROACT187	7th FP - PEOPLE (Marie Curie Actions)	0.69
F6. EFFEC (Effectiveness of the center)	EFFIC	Number of international competitive projects acquired by the center in the last five years	0.44

**Note(s):** Overall MSA = 0.79; Measure: 0.8 ≥ perfect for performing a FA; 0.6 to 0.7 = adequate; 0.4 to 0.5 = acceptable; Less than 0.4 = an AF is not recommended

**Source(s):** Authors' elaboration

**Table 4.** Discriminant validity coefficients

Factors	PRIOR	INCRMO	WORKRMO	PROACT	EFFEC	NRESEAR
PRIOR	<i>1</i>	0	0	0	0	0
INCRMO	-0.0579	<i>1</i>	0	0	0	0
WORKRMO	0.0553	0.3037	<i>1</i>	0	0	0
PROACT	-0.0953	0.3507	0.5447	<i>1</i>	0	0
EFFEC	-0.1126	0.3445	0.6303	0.796	<i>1</i>	0
NRESEAR	-0.0778	0.4271	0.6291	0.4685	0.516	<i>1</i>

**Note(s):** Values of the diagonal in italic: Square root of extracted variance. Values below the diagonal: Estimated correlation between factors

**Source(s):** Authors' elaboration

Morales *et al.*, 2019) have employed  $R^2$  values, which reflect the amount of construct variance explained by the structural model; and the Stone–Geisser test ( $Q^2$ ) to assess the predictive ability of the model (Chin and Newsted, 1999).  $R^2$  values can be broadly classified into three levels: substantial predictive power ( $R^2 = 0.67$ ), moderate predictive power ( $R^2 = 0.33$ ), and weak predictive power ( $R^2 = 0.19$ ). For the Stone–Geisser test, all values above 0 are considered acceptable (Table 5). This high level of predictive relevance indicates that the analyzed model is robust and stable under all observations (Chin and Newsted, 1999; Hair *et al.*, 2019).

**Table 5.** Structural model estimation

Dependent variables	$R^2$	$Q^2$
PROACT (Proactivity of the center)	0.355	0.240
EFFEC (Effectiveness of the center)	0.696	0.264

**Source(s):** Authors' elaboration

### 4.3 Results

The results in Table 6 confirm the significant impact of the independent variables on the proactivity and effectiveness of the R&D centers. H1a was supported ( $\beta = -0.099$ ;  $p < 0.05$ ), indicating that a dispersed or unclear set of priorities of R&D area heads decreases R&D

**Table 6.** Hypotheses testing

Relationship	Hypotheses	Standardized $\beta$	t-value bootstrap
H1a: Priorities heads of R&D areas → Proactivity of the center	Accepted	-0.099**	1.821
H1b: Priorities heads of R&D areas → Effectiveness (International projects gained by the center)	Accepted	-0.163*	1.523
H2a: RMO incentives → Proactivity of the center	Accepted	0.163**	2.08
H2b: RMO incentives → Effectiveness (International projects gained by the center)	Rejected	0.025 <sup>n.s</sup>	0.719
H3a: RMO workload → Proactivity of the center	Accepted	0.428***	3.002
H3b: RMO workload → Effectiveness (International projects gained by the center)	Accepted	0.260***	2.924
No. of researchers in the center → Proactivity of the center	Rejected	0.126 <sup>n.s</sup>	1.248
No. of researchers in the center → Effectiveness (International projects gained by the center)	Rejected	0.048 <sup>n.s</sup>	0.85
No. of researchers in the center → RMO workload	Accepted	0.629***	7.459

**Note(s):** \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

$R^2$  (workload of RMO) = 0.396;  $R^2$  (proactivity of the center) = 0.355;  $R^2$  (efficacy or international projects gained by the center) = 0.696

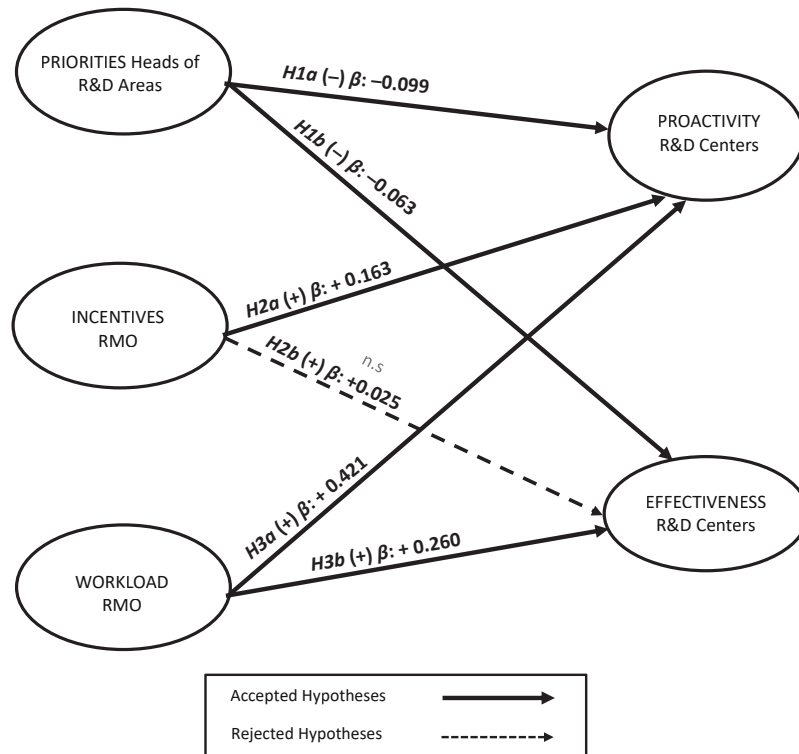
$Q^2$  (workload of RMO) = 0.395;  $Q^2$  (proactivity of the center) = 0.240;  $Q^2$  (efficacy or international projects gained by the center) = 0.264

**Source(s):** Authors' elaboration

centers' proactivity in asking for competitive international public funds. H2a ( $\beta = 0.163$ ;  $p < 0.05$ ) and H3a ( $\beta = 0.421$ ;  $p < 0.01$ ) were also supported. Thus, RMO incentives and workload positively influence the proactivity of R&D centers in competitive international public funding applications.

H1b was also supported ( $\beta = -0.063$ ;  $p < 0.1$ ), indicating that a dispersed or unclear set of priorities of R&D area heads decreases the effectiveness of R&D centers in acquiring competitive international public funds. H3b was likewise supported ( $\beta = 0.260$ ;  $p < 0.01$ ). Hence, the workload of RMOs positively influences the effectiveness of R&D centers. Meanwhile, H2b was not supported; therefore, we could not conclude that RMOs' incentives positively influence the effectiveness of R&D centers.

The control variable, the number of researchers, does not influence proactivity and effectiveness, but it does affect workload. The key results derived from the proposed model are illustrated in Figure 3, offering a comprehensive representation of the main relationships and outcomes.



Source(s): Authors' elaboration

Figure 3. Results

### 5. Discussion

This study presents evidence that internal factors can affect the proactivity and effectiveness of R&D centers. A clear set of priorities for R&D area heads, a reasonable workload for RMOs, and a specific set of incentives for RMO alignment can boost the proactivity and effectiveness

of R&D centers. One of the primary contributions of this study is the presentation of a theoretical model that suggests the influence of controllable internal factors by the main actors within public R&D centers on their success in acquiring competitive international public funding.

Applying for international projects is a long and complex process, with researchers facing significant challenges in adhering to international norms and bureaucratic requirements. The success of a proposal depends on factors such as annual program funds, types of funding actions, and allocated budgets. However, the good results obtained in previous framework programs by Spanish entities indicate that the acquisition of international public is extremely competitive and has a low success rate. Despite rigorous competition in which less than 10% of applications are successful, Spanish entities have historically secured a notable proportion of international public funding. In fact, 3,328 entities in Spain have obtained funding for their research and innovation activities (CDTI, 2021; European Commission: Directorate-General for Research and Innovation, 2019).

R&D areas that persistently apply for competitive international funding despite initial rejections can improve their proposal standards by incorporating feedback from reviewers and policy officers, refining their understanding of program rules, and enhancing the quality of their project memos. This persistence can increase their chances of success in future calls and deepen their knowledge of the funding process (Laudel, 2006; Shuman, 2019). However, while proactivity is associated with R&D center effectiveness, less productive areas may become less proactive over time, thereby affecting their success in securing competitive projects. For this study, we assumed that the most proactive R&D centers—those with the highest participation in competitive calls, that is, those with the largest number of project applications submitted to current international funding programs—are the most effective.

ABV highlights the role of managerial capacity in developing certain activity types in competitive international public projects. We extend the theory by demonstrating that an unclear set of priorities of heads of R&D areas regarding their promotion of competitive international public project applications is crucial to understanding how R&D centers perform and in which aspects they differ from others. The results demonstrate the relationship between the priorities established by R&D area heads and the success of their respective centers. The negative beta coefficient in H1a, that is, a unit increase in the dispersion of priorities corresponds to a decrease in proactivity levels, highlights the importance of focused strategic planning in R&D centers. If a group fails to prioritize its activities, it inadequately allocates resources toward competitive project proposals. Therefore, the number of project proposals and their quality are lower. In R&D centers, research areas handle many activities; however, if staff members are overwhelmed, they have less time to prepare high-quality international grant proposals that meet stringent excellence criteria, including consortium requirements. This deficiency increases the risk of mistakes and can undermine R&D centers' effectiveness because of potential project rejections.

We examined RMOs' role in promoting performance, focusing on staff motivation and intrinsic and extrinsic rewards. Regarding the promotion of international competitive research and rewards for research managers, we found that extrinsic rewards are rare in R&D centers. While incentives for RMOs boost the proactivity of R&D centers, they do not affect the number of projects awarded. Specifically, the services provided to the researchers are mainly aimed at fulfilling the grant application process during the pre-award phase (Bruggen, 2015). The lack of significant findings for H2b prompts a deeper examination of the nature of the incentives provided by RMOs and their direct alignment with funding success criteria. Table 7 outlines the RMO incentives associated with securing competitive international projects.

The results further revealed that a higher RMO workload positively impacts R&D centers' proactivity and effectiveness. An active RMO handles more tasks and maintains frequent communication and better relationships with researchers, thereby experiencing increased success in competitive projects. This dynamic workload improves RMO staff's knowledge of funding opportunities and procedures and consequently enhances their connections with

**Table 7.** RMO incentives when obtaining international competitive projects

Type of incentive	Average	Standard deviation
INCRMO211 It positively affects the salary of the members of the RMO	1.5	1.2
INCRMO212 It positively affects the salary of ALL researchers of the center, even those outside the group that obtains the international project	1.4	0.7
INCRMO213 It provides the RMO members greater job security	2.1	1.3
INCRMO214 It increases the promotion opportunities for the RMO members	1.6	1.1
INCRMO215 It improves the appreciation and respect for the RMO members among the other center staff	2.4	1.2
INCRMO216 It improves the recognition the RMO members receive from their superiors	2.7	1.3
INCRMO217 It provides the RMO members greater freedom in terms of time flexibility, autonomy, less supervision, etc.	1.5	1.1
INCRMO218 It enables the RMO members to reach worthy personal objectives	2.7	1.5
INCRMO219 It offers opportunities for the RMO members to learn new things	3.7	1.1
INCRMO2110 It allows the RMO members to develop things that make them feel good about themselves	3.3	1.3
INCRMO2111 It offers the RMO members good opportunities to develop their skills and abilities	3.6	1.1

**Source(s):** Authors' elaboration

colleagues. R&D center researchers ultimately gain more opportunities and become aware and proactive in applying for competitive projects.

## 6. Conclusion

This study aims to identify and analyze the factors that may exert a significant influence on the success of public R&D centers in the biomedicine and health sectors in relation to applying for and securing competitive international funding. We pay special attention to the role played by RMOs and R&D areas within R&D centers. We focus on internal factors, that is, the factors that can be changed and can boost the efficiency of R&D centers in obtaining such funding. Specifically, we analyzed the influence of the priorities of R&D area heads, the incentives and motivations within RMOs, and RMOs' workload relative to R&D centers' proactivity and effectiveness while considering, in all cases, the size of the centers.

Results have implications for business management as understanding and adjusting internal factors to leverage international programs is crucial for institutions seeking to secure competitive research funding in knowledge-based economies. Implementing these organizational factors may add value to the current literature on R&D area performance and research management services.

We also contribute to the advancement of ABV by reporting that the priorities of R&D area heads relative to their intention to apply for international projects are crucial in understanding how R&D centers perform and in which aspects these organizations differ from others. This understanding can allow them to conduct internal analyses and implement the necessary measures to improve their performance.

As for RMOs, studies about organization rewards associated with international project applications and acquisition by R&D centers are lacking. Our study expands previous results supported by SDT beyond the motivations of personnel in R&D organizations by analyzing rewards and motivations associated with the proactivity and effectiveness of R&D centers in applying for international projects. We also evaluate the increase in trust among team members and the improvement of results in project acquisition. We observe that project management services are crucial to researchers as support structures for R&D areas in the process of applying for competitive projects and in enhancing proactivity and effectiveness. These results

have practical implications because knowing how to implement measures to achieve better RMO performance is key for R&D institutions seeking to maintain their competitive advantage.

Our results indicate that the RMOs' variable workload, which refers to the number and type of tasks they develop, influences the relationships of research managers within R&D areas. It also improves the quality of services provided by RMOs, thereby positively affecting the proactivity and effectiveness of R&D centers. Our findings suggest that because of the dynamic portfolio of services of RMOs, R&D areas gain opportunities to be more proactive and consequently improve the overall effectiveness of R&D centers.

An interesting future research direction is to analyze the connection between RMOs and R&D areas, focusing on RMO staff's familiarity with the knowledge areas they support. Investigating the alignment and technical knowledge of RMO members relative to the work of research groups could be crucial as it may foster closer relationships and improve R&D performance. RMO staff's enhanced understanding of the projects they manage could lead to higher-quality services and better interactions, which positively influence the support that researchers receive. Future studies could also explore R&D centers in different countries or regions and perform cross-cultural comparisons to identify universal and context-specific factors that influence funding success. Longitudinal studies could monitor changes in fundraising effectiveness due to strategic or policy shifts to deepen our understanding of the causal links between internal management practices and funding outcomes. Another valuable research direction is to examine whether collaborative networks among R&D centers improve the success of funding applications through the sharing of best practices and resources.

One limitation of this study is the lack of comparative analysis with similar research, due to the absence of studies specifically addressing the effectiveness of public research centers in securing competitive international funding. Although related literature has explored R&D and innovation in various contexts, no study has focused on our specific research context. Hence, we were unable to conduct an in-depth comparison between our findings and existing knowledge. This limitation also hindered the analysis of how cultural, economic, or political differences might influence the applicability of the results. Further comparative studies would provide a broader understanding of the factors affecting the effectiveness of public R&D organizations in diverse international settings. Nevertheless, the novelty of this study paves the way for further research on the topic. Further studies are required to build a robust body of knowledge and enable more detailed comparisons and analyses. In essence, our study is the first step toward understanding the factors that influence competitive international funding for R&D centers, and it lays the groundwork for detailed and rigorous future research.

Another limitation of our study is the small sample size, which was necessary given the novelty of the topic and the complexity of the data collected. While concentrating on Spanish public nonprofit R&D centers provides valuable insights, expanding the sample to include a broader range of institutions, both geographically and across sectors, could improve the generalizability of the findings. Additionally, a larger sample size would enhance the statistical power of the analysis.

Moreover, the results from competitive research projects by Spanish institutions are not publicly accessible, unlike those in other European countries. This lack of transparency limits researchers' ability to conduct thorough studies. Given the high cost and time invested in such research, Spanish authorities should view it as a convenient and useful opportunity to supply academics, researchers, and public institutions with a vested interest in R&D project performance with official information that can help ensure the continuation of research and progress in this field.

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**Corresponding author**

Juana M. Ferrús-Pérez can be contacted at: [juanaferrus@gmail.com](mailto:juanaferrus@gmail.com)

