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The role of entrepreneurial ecosystems in the SME internationalization

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ABSTRACT

The Entrepreneurial Ecosystems (EE) articulate concepts from various streams of literature and are formed by multiple stakeholders and relate to different levels of analysis. Although the literature shows a growing relevance on the theme of EE, most studies reveal to be conceptual, and the existence of empirical studies with quantitative methodologies is still scarce. This study attempts to contribute to filling this gap by developing a dynamic model of EE and its impact on the small and medium-sized enterprises (SME) international performance by aggregating different levels of analysis. Based on a sample of 120 SMEs, the results suggest that macro (agents) and meso (different partners) level variables positively impact international performance. We also find that technology transfer has a negative moderating effect on the meso level relationship of EE with digital performance. Our study also contributes to a greater understanding of the Entrepreneurial Ecosystems, its internationalization and the digital performance effect.

1. Introduction

According to the OECD (2014), an entrepreneurial ecosystem (EE) is a set of interconnected entrepreneurial actors (both potential and existing), organisations (other firms, venture capital, for example), institutions (universities) and business processes (e.g., the entrepreneurial birth rate) that formally and informally come together to connect, mediate and govern performance within the local entrepreneurial environment. In this regard, and as argued by O'Kane et al. (2021), EE is composed of several layers that coexist and evolve simultaneously; Theodoraki and Messeghem (2017) use the macro level to describe the EE, the meso-level to describe the entrepreneurship support ecosystem and the micro level to describe the business incubator.

From these considerations, we deduce that there may be several models of EE, depending precisely on the characteristics of the environment where each ecosystem is inserted. From this need to attribute a systemic approach to entrepreneurship (Acs et al., 2014), the most diverse studies on EE have emerged (Alvedalen & Boschma, 2017; Malecki, 2018; Cavallo et al., 2019; Kahle et al., 2020; Theodoraki and Catanzaro, 2021; Johnson et al., 2022). These studies have essentially focused on the interactivity of attributes and strategic multilateral dynamics among the various EE actors (Theodoraki et al., 2018), local cultural specificities (Audretsch & Belitski 2017), ecosystem evolution (Mack & Mayer, 2016); processes (Spigel & Harrison, 2018); ecosystem governance (Colombelli et al., 2019); sustainability (Raposo et al., 2021), the multi-level approach (Theodoraki & Messeghem, 2017) and the relationship of EE with regional development (Audretsch & Belitski, 2017).

It is thus observed that all these studies have a common approach to EE: a systemic perspective of EE determined by multiple interactions between individuals and organisations that shape, being limited in a given space (Stam, 2015; Spigel, 2017; Stam & van de Ven, 2019).

However, despite the growing interest in this research stream, the international perceptual still suffers from sparse studies (Theodoraki and Catanzaro, 2021). We observe partial views of the relationship between internationalisation and EE in the study by Velt et al. (2018) on born globals, the research by Nylund et al. (2020) on multinationals, the study by Battisti et al. (2022) regarding cross-border platforms and the research by van Weele et al. (2018) who defend incubators as valuable tools to create global communities in local environments. We thus feel

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the lack of a holistic perspective that provides insight into the various levels (macro, meso, and micro) and dynamics of EE that positively relate to the internationalisation of firms (Theodoraki and Catanzaro, 2021).

It is widely held that internationalisation is considered essential for firms' survival, growth, and viability (Jones et al., 2011; Bannò et al., 2014; Jarvenpaa and Majchrzak, 2015; Schwens et al., 2018; Fernandes et al., 2020). There is also considerable consensus that the internationalisation process is fraught with risks and uncertainties, especially for small and medium-sized enterprises (SME) (Brouthers et al., 2009; Oura et al., 2016; Fernandes et al., 2020). It is so important that many governments have developed policies that support the internationalisation of firms and the creation of EEs that enable support for the internationalisation of firms (Lederman et al., 2010; Love & Roper, 2015). However, there is little information on which elements of EE facilitate international business activities (Theodoraki and Catanzaro, 2021).

To bridge these gaps, our research aims to study EE in different levels (macro, meso, and micro) and the mediating effect of digitalisation on SMEs' international performance. Empirically, we resort to a quantitative methodology of structural equations. Our research offers a new model of EE in an integrated way in light of SME internationalisation and the effects of digital transformation. Our research intends to contribute to a better knowledge of the international perspective at the level of EE, which, generally, its analysis is restricted to domestic contexts.

2. Theoretical background and hypotheses development

2.1. Entrepreneurial ecosystems

Since Schumpeter (1934), the impact of entrepreneurship on economic development has merited the attention of several researchers (Leibenstein, 1968; Baumol, 1990). Although the literature on economic growth is not consensual, it shows a trend towards the conclusion of the positive effects of entrepreneurship on it (Audretsch et al., 2006; Carree & Thurik, 2010; Fritsch, 2013; Bosma et al., 2018). And in this trend, several authors have already shown that entrepreneurship, like other biological organisms, proliferates in environments that have institutions promoting its growth (Sobel, 2008; Fritsch, 2013; Bosma et al., 2018).

Thus, entrepreneurship does not occur in a vacuum but rather in a particular location with specific characteristics (Feldman, 2001). In this way, the spatial issue underlies (Guzman & Stern, 2015; Alvedalen & Boschma, 2017). Thus if an ecosystem, in ecology and biology studies the interactions between living organisms and their environments (O'Connor et al., 2018). Given the interactions seen in economics, Moore (1993 and 1996) bridged ecology to management and first introduced the notion of ecosystems in the management literature.

Later, Isenberg (2011) initiated the entrepreneurship ecosystem strategy approach for economic development, and this approach constitutes a new and cost-effective strategy to stimulate prosperity for the author. Since then, there have been several authors who have engaged in the study of EE either in empirical studies (Acs et al., 2017; Autio et al., 2018; Spigel & Harrison, 2018; Raposo et al., 2021) or in systematic literature reviews (Alvedalen & Boschma, 2017; Brown & Mason, 2017; Cavallo et al., 2019; Malecki, 2018; Guerrero et al., 2021).

Several authors show us that the EE approach provides a complete view of the business environment: on the one hand, we get a glimpse of how context influences firms' behaviour, choices and performance (Autio et al., 2018; Autio and Levie, 2017), on the other hand, they provide insight into the spatial dimension because interconnectedness and interaction are facilitated by proximity and agglomeration (Audretsch & Belitski, 2017). However, these interconnections may not be limited to a particular space but overflow the ecosystem boundaries from local to regional and even national (Theodoraki and Catanzaro, 2021).

EE involve various types of actors, start-ups, venture capital, incubators, among others, that facilitate the entry, growth and exit of new firms (Daniel et al., 2018; Roundy et al., 2018; Jacobides et al., 2018; Stam & Van de Ven, 2019). Isenberg (2011) identifies six domains within EE: culture, policies and leadership, availability of adequate funding, quality human resources, venture capital and institutional supports. Thus, each ecosystem emerges under a unique set of conditions and circumstances. EE are thus, generic domains comprising hundreds of elements and interacting in highly complex and idiosyncratic ways.

2.2. Entrepreneurial ecosystems and international performance

Over the last decade, we have seen an increase in research on the internationalisation processes of firms (Hossain et al., 2016; Muralidharan & Pathak, 2017; Fernandes et al., 2020). One of the main underlying assumptions is that the internationalisation process of small and medium-sized enterprises (SMEs) differs significantly from established multinationals with limited resources and market power. One of these differences concerns the interactions established with other agents, in which case the entrepreneurial ecosystem assumes particular importance (Theodoraki and Catanzaro, 2021).

Compared to multinationals, SMEs generally rely more extensively on network relationships to pursue international opportunities (Zahra & George, 2002; Coviello, 2006). Not surprisingly, the role of networks in the internationalisation of small firms is prominent in recent research. The internationalisation process presupposes rational and objective decisions (Audretsch & Belitsk, 2017). In this sense, the classical economic literature focuses on large companies as the object of analysis for internationalisation (Rowden, 2001; Hollenstein, 2005; Buckley & Ghauri, 1999), as they have a greater capacity to overcome market, commercial and political risks and critical barriers in the internationalisation process. On the other hand, SMEs experience some difficulties, namely: lack of human, financial, technological and information resources (Hollenstein, 2005; Gemser et al., 2004). According to Hollenstein (2005), in addition to the severe limitations in terms of resources, there are also barriers to internationalisation regarding regulations, national laws, and market needs due to each nation's peculiarity.

The internationalisation of large companies motivates small ones to overcome the difficulties imposed on expanding their activities in international markets. In addition, technological advances drive the internationalisation of companies regardless of their size, segment and location. For SMEs to access new markets, they strategically opt to form cooperative alliances between companies that give them faster access to those markets (Freeman et al., 2006).

It should be noted that SMEs have had increased performance in contributing to the trade balance of their respective countries and that foreign sales of the SME niche were not affected by size (Chiara & Minguzzi, 2002). To access other markets, SMEs define strategies, considering the degree of involvement and the type of control they want to have in the international market. Most of this body of research focuses on the benefits of such networks, with only a few researchers (Chetty & Agndal, 2007) addressing the potential disadvantage of networks in SME context internationalisation.

It is widely acknowledged that international expansion presents more significant risks for small, resource-poor firms than large, established multinationals. Small firms are typically constrained by a narrower set of capabilities, limited access to market research and their inability to hire experts who can assist them in internationalisation processes. The risks associated with internationalisation are exacerbated by the fact that failure in the context of an international venture can have profound negative implications (Schwens et al., 2018).

According to Sapienza et al. (2006), early internationalisation can sometimes decrease the chances of survival among young firms. It can be concluded that there are significant potential benefits associated with early internationalisation. On the one hand, firms willing to take risks associated with taking risks abroad are exposed to new opportunities for learning and growth (Zahra & Hayton, 2008). Early internationalisation

benefits from the "learning advantages of novelty" in the faster form of adaptation and flexible organisation of routines. The ensuing outcome is often an improved ability to identify and exploit future international opportunities (Weerawardena et al., 2007; Autio et al., 2018; Musteen et al., 2014).

In this background, we formulate the following research hypotheses:

Hypothesis 1 (H1): Entrepreneurial ecosystems at the macro-level (diverse support agents) positively impact international performance.

Hypothesis 2 (H2): Entrepreneurial ecosystems at the *meso*-level (diverse partners) positively impact international performance.

Hypothesis 3 (H3): Entrepreneurial ecosystems at the micro-level (company characteristics) positively impact international performance.

2.3. Relationship between EE and international performance: Moderating role of digital transformation technologies

Technology changes the nature of competition, the industry structure and the boundaries of companies, exposing them to both completely new opportunities and threats, and is even responsible for the fourth industrial revolution and the digital transformation (Porter & Heppelmann, 2014; World Economic Forum, 2016; European Commission, 2017). To seize opportunities and minimise threats, companies may need knowledge that can only be obtained through cooperation with other agents (Williamson & De Meyer, 2012; Benitez et al., 2020).

Thus, the goal of competitive advantage with the use of technology through an individual operation, can be difficult and risky, requiring a network approach by the firm (Bryniolfsson and MCAfee, 2014; Tapscott et al., 2000). This approach is nothing more than belonging to an EE to achieve all the benefits of this relationship (Nambisan et al., 2019). Within the ecosystem, firms can jointly generate a competitive advantage that would not be achieved if they acted alone since the combination of the resources of all agents can make them more valuable, rare and difficult to imitate than they were in isolation (Dyer & Singh, 1998; Kahle et al., 2020). In this sense, Nambisan and Baron (2013) argue that the ecosystem can generate a synergistic effect providing firms with opportunities to innovate and grow that they would not otherwise achieve.

For Nambisan (2017), the concept of digital technologies can be seen as the result of three distinct but interrelated elements: i) digital artefacts (digital represents a digital component, an application or media content that is part of a new product or service and offers a specific functionality or value to the end-user), ii) digital infrastructures (is the set of digital technology tools and systems that offer communication, collaboration and computing capabilities), and iii) digital platforms (are sets of shared and common services).

Thus, the impact of technology and digital transformation on entrepreneurship is multifaceted and can be an enabler, moderator or even the outcome of entrepreneurial operations or business model (Steininger, 2018). Entrepreneurship thus represents a critical pillar for digital economic development (Shen et al., 2018) and underlines the need to pursue digital technology-based opportunity (Hosu and Iancu, 2016; Hervas-Oliver et al., 2021; Germain et al., 2022) through a business model framework (Standing & Mattsson, 2018). Thus, digital technology enables the creation of innovation communities, such as ecosystems (Chesbrough et al., 2014) and networks capable of generating value and benefits for the actors involved (Möller & Rajala, 2007).

Digital technologies lead to the democratisation of entrepreneurship (Aldrich, 2014) as it reduces the barriers between invention, knowledge sharing and the creation of new companies (Kelly, 2016). By adopting a knowledge-based stance, EE facilitates the exchange, transfer and acquisition of knowledge while initiating new business forms (Geissinger et al., 2018), leveraged by digital technologies (Le Dinh et al., 2018).

We thus present our fourth research hypothesis:

Hypothesis 4 (H4): The implementation of digital transformation technologies moderates the impact of entrepreneurial ecosystems on international performance at the a) macro-level, b) *meso*-level, and c) micro-level.

In Fig. 1, we present our conceptual model that reflects the relationships of the hypotheses presented.

3. Methodology

3.1. Data

To empirically validate our conceptual research model, we selected our sample of 120 SMEs from a database of 5,000 Portuguese internationalised manufacturing and service firms. The Portuguese start-up ecosystem is still young, but it is one of the best assets Portugal has, with small-scale but fast paced and steadily growing companies representing over 1 % of the country's GDP (IDC Report, 2021).

We created a random list of firms using a random number generation tool to select two random samples (60 industry and services) of internationalised SMEs. We contacted them by telephone to explain the study's objectives, validate whether they met the inclusion criteria (SMEs and Internationalized), and assess their interest in participating. If the company declined to participate (15 in total), it was passed on to the next randomly selected company. In the final stage we obtained a random selection of 60 firms in the manufacturing industry and 60 in the services sector.

Access to the questionnaire was restricted only to the invited companies and was answered by the company's top manager. Data were collected between April and May 2021. The dataset contains responses from 25 CEOs, 66 directors and 29 managers. Regarding the characteristics of the companies, the sample is composed of 77.5 % small companies and 22.5 % medium-sized companies. Table 1 shows a summary of the main characteristics of the sample.

After data collection, we compared early and late respondents, i.e. respondents who responded in the first few weeks and those who responded in the last few weeks, to assess non-response bias. The results showed no significant difference between the two groups, thus mitigating the risk of potential non-response bias. We also checked data for straight-lining patterns, which occur when a respondent marks the same response for almost all survey items. For example, if a 5-point Likert scale was used to rate the items, response patterns with only '1′ or '5′ (end response) or only '4′ (middle response) should be removed from the dataset. We did not find any questionnaire with straight-line patterns.

3.2. Measures

All measurement items were adapted from scales of well-established studies (Table 2). Two EE experts linked to internationalisation were invited to review the measurement items before the survey began. The experts in the field were asked to assess logical consistencies, ease of understanding, and contextual relevance. Based on their comments and suggestions, the measurement items were slightly modified. All survey items were measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 2 summarises the variables, respective measures and dimensions, and their authors.

3.3. Method

A structural equation model (SEM) was used to validate the hypotheses under study, and the estimation method used was the Partial Least Squares (PLS) method, a method currently widespread in the field of business sciences (e.g., Dash & Paul, 2021; Hair et al., 2020).

The use of PLS-SEM as an alternative to covariance-based SEMs (CB-SEM) was due to the items not following the normal distribution, an

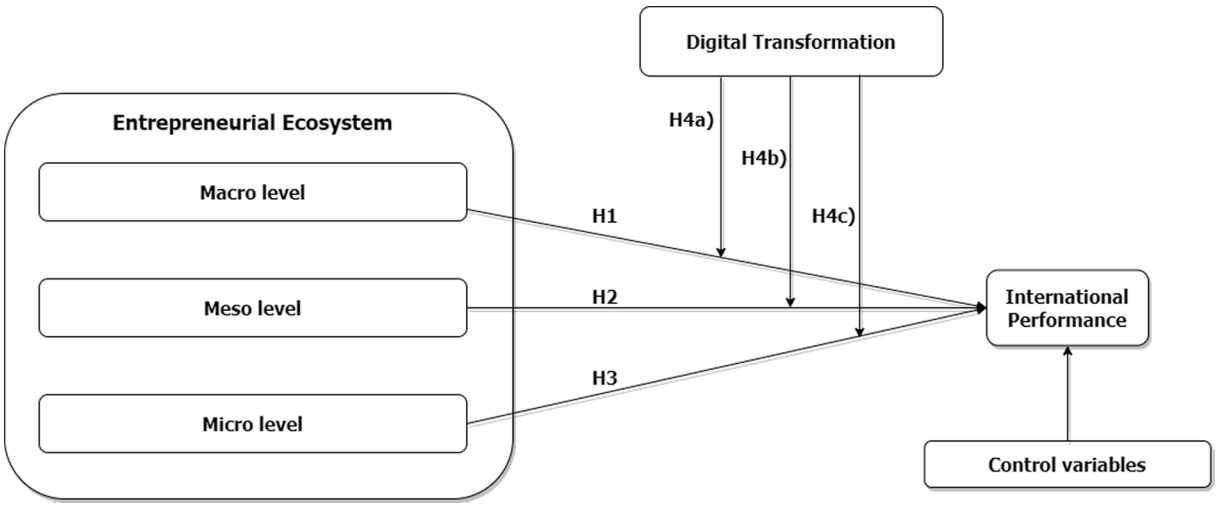

Fig. 1. Conceptual model.

Table 1
Sample demographic.

Characteristics		N	%
Sector	Manufacturing industries	60	50.0 %
	Services	60	50.0 %
Company size (no. of permanent employees)	< 50	47	77.5 %
	[50 a 249[	27	22.5 %
Time of activity (years)	< 1	1	0.8 %
	[1 e 5[	11	9.2 %
	[5 e 10[	15	12.5 %
	[10 e 20]	24	20.0 %
	> 20	69	57.5 %
Time of company establishment (Mean + SD (Min - Max)		27.9 + 20.3 (2–100)	
Time of internationalisation (years)	< 1	3	2.5 %
	[1 e 5[	27	22.5 %
	[5 e 10[	24	20.0 %
	[10 e 20]	32	26.7 %
	> 20 anos	34	28.3 %
Time of beginning of internationalisation (Mean + SD (Min - Max)		15.1 + 11.2 (1–46)	

assumption of the distribution of the data in CB-SEM, and the sample size not allowing for estimation based on CB-SEM (Hair et al., 2020; Teixeira et al., 2021; Veiga et al., 2021). PLS-SEM is considered particularly appropriate for this study as it has the best potential to estimate the relationships of all constructs simultaneously (Hair et al., 2020, 2019; Sarstedt et al., 2019). Furthermore, PLS-SEM is the preferred approach when the goal is the identification of directed constructs and the development of moderating effects (Dash and Paul, 2021; Henseler et al., 2014). The present study is an initial attempt to examine the moderating role of digital transformation on the importance of entrepreneurial ecosystems in the internationalisation process.

All calculations were carried out using SmartPLS software version 3.3.2 (Ringle et al., 2015) and IBM SPSS version 27.0 for Windows (IBM Corporation, New York, USA).

4. Results

4.1. Measurement model assessment

The measurement model is assessed by identifying the composite reliability (CR), convergent validity, indicator reliability and discriminant validity. Regarding CR, all values presented in Table 3 were higher than the standard value of 0.7 recommended by Hair et al. (2020), confirming the reliability of all constructs.

The average variance extracted (AVE) was employed to examine convergent validity.

In Table 4, all constructs presented AVE values higher than the threshold value of 0.5. The individual reliability of each item is measured by the size of the factorial loadings, which should be higher than 0.5, ideally higher than 0.7 (Hair et al., 2020). The factor loadings (presented in Table 2) were all above the suggested cut-off point. Finally, discriminant validity was assessed using the Heterotrait-Monotrait ratio (HTMT), which should be<0.85.

The results in Table 3 show that all constructs met the requirements of discriminant validity.

For the structural model's evaluation, we examine the estimated model's overall fit, path coefficient estimates, and statistical significance based on the bootstrap percentile, effect size f^2 and coefficient of determination (R^2) (J. Benitez et al., 2020). The first step in the analysis is to assess the overall fit of the estimated model by evaluating the discrepancy between the variance–covariance matrix of the empirical indicator and the implicit counterpart of the estimated model.

Table 5 presents three discrepancy measures (SRMR - standardized root mean squared residual, d_{ULS}, and d_G) and 95 % (HI95) and 99 % (HI99) quantiles of their corresponding distribution.

Benitez et al. (2020) suggest that all discrepancy measures should be lower than HI95 and that the approximate model fit given by the SRMR value should be lower than 0.08. Table 5 reveals that the quality of the model fits in this study and meets all the criteria. Thus, the model was not rejected at the 5 % significance level, providing empirical support for the proposed approach.

Table 6 includes the results for hypothesised relationship in the model.

The R^2 had a value of 0.685, indicating a good model fit. Furthermore, Cohen's f2 of the paths supporting H1 (0.501) and H2 (0.513) presented a high effect size. Regarding H5, the effect size presented was moderate (0.086) and the effect of DT capabilities (0.180) on international performance. Finally, the f^2 values associated with the remaining hypotheses indicate a weak effect on international performance.

The results reveal that macro-level entrepreneurial ecosystems positively and significantly effect international performance ($\beta = 0.566$; $p < 0.01$). We conclude that support agents play a crucial role in international performance within the EE. Our results align with other authors who argue that support agents play a crucial role in EE internationalisation, especially the support structures and agents that make up these systems (Theodoraki and Catanzaro, 2021). This relationship is significant in the case of SMEs, given the difficulties in accessing specific opportunities (Zahra, 2005; Coviello, 2006).

Table 2
. Overview of the variables.

Variável		Description	Scale	Authors
Entrepreneurial Ecosystems	Macro Level	Importance of support/incentives for internationalisation: i) Portuguese Agency for Investment and Foreign Trade (AICEP) ii) Institute for Support to Small and Medium-Sized Enterprises and Innovation iii) Portuguese Business Association iv) Business Associations v) Local/Municipal/ Regional; vi) Specific entities of the sector of activities vii) Chambers of Commerce; Portuguese Embassies and Consulates	Five-point Likert scale, 1 (strongly disagree) to 5 (strongly agree)	Acs et al. (2014); Alvedalen & Boschma (2017); Malecki (2018); Cavalo et al. (2019); Kahle et al. (2020); Raposo et al. (2021)
	Meso Level	Relevance of the following partners for the effectiveness of your company's internationalisation: i) Suppliers ii) Customers iii) Competitors iv) Consultants v) Universities vi) Research Centres		Cavalo et al. (2019); Kahle et al. (2020); Raposo et al. (2021); Fernandes et al. (2021)
	Micro Level	The importance that you attribute to each of these factors for the effectiveness of the internationalisation of your company: i) Seniority of the company ii) Size of the company; Specific skills of the employees iii) International experience of the employees iv) Strong entrepreneurial propensity and willingness to take risks on the part of key employees and company managementv) Formal contact network (other companies) ;vi) Informal contact network (friends, familiars members) vii) Territorial proximity to new markets viii) Linguistic proximity to new markets ix) Cultural proximity to new markets; x) Incentive/support system for internationalization xi) Business digitalisation xii) Easy access to financing xiii) Autonomy in decision-making by the person responsible for internationalisation		Chiara & Minguzzi, 2002; Coviello et al. 2006; Chetty & Agndal, 2007); Fernandes et al. (2021)
Digital transformation technologies		How relevant do you consider the following technological solutions to your company's internationalisation process i) Cloud Solutions; ii) Big Data; IoT/ Sensors; iii) 3D Printing iv) Virtual Reality/ Augmented Reality v) Robotics/ Automation; vi) Collaboration Tools vii) Business Intelligence; viii) Artificial Intelligence.		Bryniolfsson & McAfee (2014); Tapscott (2000); Nambisan & Baron (2017) ; Kahle et al. (2020)
International performance		Percentage of business (turnover) of the company that resulted from the internationalisation process	Turnover: < 10 %; [10 % a 24 %]; [25 % a 49 %]; [50 % a 74 %]; [75 %, or +	Acosta et al. (2019) Fernandes et al. (2021) ;Lobo et al. (2021)

We also find that *meso*-level entrepreneurial ecosystems positively and statistically significant international performance ($\beta = 0.569$; $p < 0.01$). We show that networking and resource sharing with ecosystem partners positively impact international performance. Also, several researchers considered the benefits of networks (Chetty and Agndal, 2007; Coviello and Munro, 1995). This benefit arises because the internationalisation process incorporates several risks and uncertainties, especially for SMEs; incorporating EE allow the process and international performance to achieve the desired results (Theodoraki and Catanzaro, 2021).

There was no statistically significant impact of micro-level entrepreneurial ecosystems on international performance ($\beta = 0.093$; $p = 0.495$). Notwithstanding the distinct characteristics that SMEs possess (Freeman & Schroder, 2006), these micro-level variables did not offer any results on this hypothesis. We can say that the various support agents provide access to the most diverse technologies, and there ends up being no impact of the use of existing technologies in companies.

We found no statistically significant moderating effect of DT technologies usage capabilities on macro-level EE' impact on international performance ($\beta = 0.040$; $p = 0.875$). Based on our findings, we could not verify that implementing digital transformation processes has no effect

Table 3
Measurement model evaluation.

	CR	AVE	Loadings
Macro Entrepreneurial Ecosystem	0,594	0,860	
MACRO1			0,86
MACRO2			0,80
MACRO3			0,71
MACRO4			0,73
MACRO5			0,75
Meso Entrepreneurial Ecosystem	0,683	0,863	
MESO1			0,88
MESO2			0,83
MESO3			0,71
MESO4			0,87
Micro Entrepreneurial Ecosystem	0,541	0,803	
MICRO1			0,79
MICRO2			0,80
MICRO3			0,64
MICRO4			0,70
Digital Transformation Capabilities	0,674	0,925	
DT1			0,78
DT2			0,87
DT3			0,83
DT4			0,71
DT5			0,85
DT6			0,87

Table 4
The Heterotrait-Monotrait (HTMT) ratio.

	Mesolevel	Micro-level	DT
Macro-level	0,755	0,514	
Meso-level	0,514	0,496	
Micr-level	0,274	0,103	0,157

Table 5
Results of the overall fit of the estimated model.

Discrepancy	Value	HI95	HI99
SRMR	0.071	0.080	0.089
d_{ULS}	0.614	0.754	0.908
d_G	0.501	0.541	0.708

Table 6
Structural model evaluation.

Predictor	Standardized Coefficient	p-value	Cohen's f^2	R^2
MACRO-LEVEL (H1)	**0.566**	**0.005***	0.501	0.685
MESO-LEVEL (H2)	**0.569**	**0.005***	0.513	
MICRO-LEVEL (H3)	0.093	0.495	0.017	
DT	**0.173**	**0.039***	0.180	
MACROxDT (H4a)	0.040	0.875	0.012	
MESOxDT (H4b)	**−0.250**	**0.023***	0.086	
MICROxDT (H4c)	−0.010	0.931	0.008	

* $p < 0.05$.

on the relationship between the characteristics of companies in the ecosystem and their international performance.

The results reveal a statistically significant negative moderating effect of DT technologies' user capabilities on the impact of *meso*-level EE on international performance (β = -0.250; $p < 0.05$). The negative effect of this relationship shows us that, for the companies in the ecosystem, the fact that the various agents have digital transformation technologies makes their own technologies lose importance.

At the macro-level, no moderating effect with statistical significance of DT technologies' user capabilities on the impact of micro-level entrepreneurial ecosystems on international performance was observed (β = -0.010; p = 0.931).

Table 7 shows the results concerning the percentage of business (turnover) of the company that resulted from the internationalisation process according to the company's characteristics.

There is a statistically significant association ($p < 0.05$) between the percentage of company business resulting from the internationalisation process, the time of internationalisation, and company size. Companies that have internationalised longer ago present higher turnover resulting from the internationalisation process and companies with>50 and<250 employees.

In Fig. 2 we present our validated model

5. Discussion

5.1. Theoretical implications

Our research presents several theoretical implications for this field of study. The first theoretical implication involves studying the relationship between EEs and internationalisation, offering a quantitative approach and contributing to the research already developed by Theodoraki and Catanzaro (2021).

We find that the support agents (macro-level) and the various partners (meso) enhance the best international performance of SMEs within the EE. A second theoretical implication has to do with the structural axis of the EE, and it is fundamental to identify and characterise the elements and actors that compose the ES to understand better the different dynamics established among them.

If entrepreneurship was placed at the core of the EE (Isenberg, 2011), more recently, Theodoraki and Messeghem (2017) use the macro-level to describe the EE, the *meso*-level to describe the entrepreneurship support ecosystem and the micro level to describe the business incubator. In this sense, O'Kane et al. (2020) show us that the EE is composed of several layers that coexist and evolve simultaneously, being fundamental that we propose different models for the study of the same phenomenon.

Our international approach provides a third theoretical implication. As this is a perspective still underdeveloped in several studies, we show that this is a variable to insert in the study of EE, given the importance and the challenge that internationalisation occupies in the current strategy of companies, especially SMEs.

Thus, we offer the theory an approach that supports studying EE as an evolutive and not static phenomenon. The international perspective opens the debate on the special axis in the context of the internationalisation support process by the actors of the EE. This debate assumes particular importance given the need to establish entrepreneurial strategies according to the specificities and attributes of the different territories. A global culture within the ecosystem allows contributing to support the internationalisation of companies.

Another theoretical implication is the moderating effect of digital transformation technologies. To the dynamic model of EE, organized in macro, meso, and micro levels, considering the international context, we insert the effect of technology, showing an even more dynamic perspective. With our results, we show that besides the positive effect of agents on international performance, we verify that technology is another variable that should be considered in the analysis of EE. Technology plays an essential role in moderating the relationship between EE and international performance. Therefore, it is a variable that can help the EE reach a successful international performance.

5.2. Practical implications

Our research also provides several practical implications for EE. An important tool for managers and policymakers in building successful entrepreneurial societies is EE (Theodoraki and Catanzaro, 2021). Our first practical implication is that our research shows managers a new

Table 7
Internationalisation process results (percentage of company turnover).

		Percentagem de negócios (faturação) da empresa que resultou do processo de internacionalização, no ano de 2020					p
		< de 10 %	[10 % a 24 %]	[25 % a 49 %]	[50 % a 74 %]	[75 % or +	
Sector	Manufacturing industries	13 (21,7)	7 (11,7)	14 (23,3)	7 (11,7)	19 (31,7)	0,637
	Services	15 (25)	12 (20)	12 (20)	4 (6,7)	17 (28,3)	
Time of activity (years)	< 1	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0,319
	[1 e 5[	5 (45,5)	1 (9,1)	1 (9,1)	1 (9,1)	3 (27,3)	
	[5 e 10[	3 (20)	2 (13,3)	2 (13,3)	1 (6,7)	7 (46,7)	
	[10 e 20]	4 (16,7)	6 (25)	5 (20,8)	2 (8,3)	7 (29,2)	
	> 20	16 (23,2)	10 (14,5)	18 (26,1)	6 (8,7)	19 (27,5)	
Time of internationalisation (years)	< 1	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0,000*
	[1 e 5[	13 (48,1)	6 (22,2)	1 (3,7)	2 (7,4)	5 (18,5)	
	[5 e 10[	4 (16,7)	6 (25)	7 (29,2)	1 (4,2)	6 (25)	
	[10 e 20[	4 (12,5)	4 (12,5)	12 (37,5)	2 (6,3)	10 (31,3)	
	> 20	4 (11,8)	3 (8,8)	6 (17,6)	6 (17,6)	15 (44,1)	
Size of the company	< 50	24 (25,8)	19 (20,4)	20 (21,5)	7 (7,5)	23 (24,7)	0,039*
	[50 a 249[	4 (14,8)	0 (0)	6 (22,2)	4 (14,8)	13 (48,1)	

* $p < 0.05$.

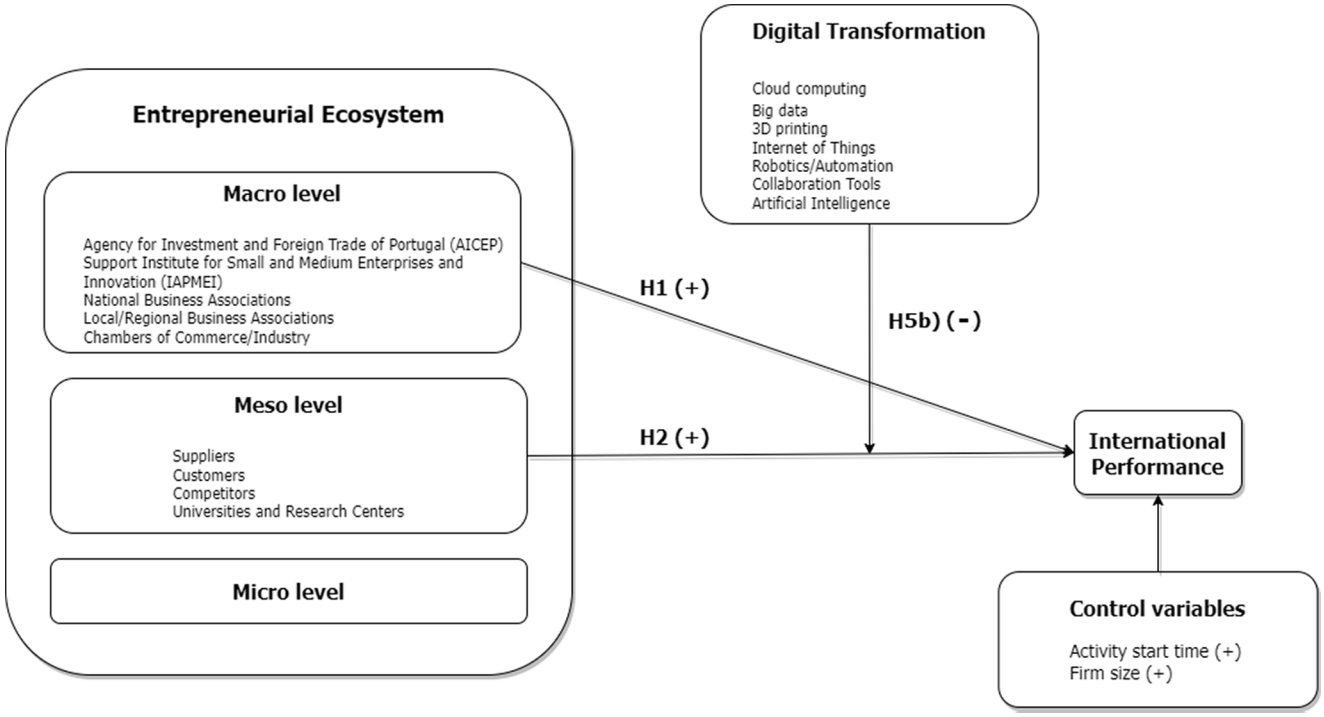

Fig. 2. Validated Model.

model of EE that is enhanced through the integration of an international perspective and the use of digital transformation technologies.

Consequently, our model offers a second practical implication; we show that business within EE is not limited to the domestic market but can be developed in an international context. We show that the process in the EE works circularly from inside out and outside in.

The third implication of our research is that our results show the importance of the actors supporting internationalisation and how they are embedded on the broader EE. Our model, therefore, represents a multi-level approach to internationalisation support by analysing each actor of the ecosystem that contributed to the better international performance of SMEs within that same ecosystem.

Finally, our results help to understand the EE components to adapt and integrate the strategies of each company in an efficient and effective long-term business development strategy, both within its territory and beyond its borders.

6. Conclusions

Our study proposes developing a dynamic model of EE aggregating different levels of analysis (macro, meso and micro) to assess its impact on SMEs' international performance and examine the mediating effect of digitalisation on international performance in these firms. For this purpose, we empirically explored the dimension of international EE performance and the moderating effect of digital transfer technologies.

We conclude that the support agents and the various partners within the ecosystem play a key role in better international performance. The macro and meso variables of EE positively affect SMEs' international performance, and technology also plays a vital role, positively influencing their international performance.

Notwithstanding our results, as other studies, also have limitations. The sample used is from only one country, limiting the results' generalisation and not comparing with other business and territorial relationships. We know of only one research (Theodoraki and Catanzaro,

2021) that considers these variables, although qualitatively.

In this sense, future research should develop new investigations on EE and international performance and involve samples from different countries in the studies so that the comparison can be broadly generalised to different territorial contexts. Another pertinent future line of research is to study the role of government through the international lens to assess the effectiveness of institutional support for the EE internationalisation.

Finally, we believe that our research brings to this academic field a rigorous and comprehensive theoretical framework for future research on SOEs and the international performance of firms.

CRediT authorship contribution statement

João J.M. Ferreira: Writing – review & editing. **Cristina I. Fernandes:** Writing – review & editing. **Pedro Mota Veiga:** Data and results analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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