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Antecedents of students' behavioural intention to use generative artificial intelligence: Quantitative research

Regina Lenart, Barbara A. Sypniewska, Jin Chen, Konrad Janowski

ABSTRACT

Objective: The article aims to identify factors that influence students' behavioural intentions to use generative artificial intelligence (GenAI).

Research Design & Methods: We proposed a research model based on the theory of planned behaviour, the technology acceptance model and a literature review.

Findings: The results show that attitude, perceived usefulness, perceived quality, and perceived support from higher education institutions positively impact students' behavioural intention to use GenAI.

Implications & Recommendations: The findings allowed us to propose two practical implications for academic teachers and managers of higher education institutions. Firstly, we recommend supporting students in terms of their knowledge, skills and conscious use of GenAI. Comprehensive education and other forms of training may be of use here. Secondly, we recommend that educational establishments clearly define their expectations regarding students' use of GenAI, particularly how and when they can safely use GenAI, not only during their studies.

Contribution & Value Added: Our study offers a new multilevel model of students' behavioural intentions to use generative GenAI. It enables the synthesis of our research results and the organisation of variables influencing students' behavioural intention to use GenAI, as well as the relations between them. Furthermore, as far as we are aware, we are the first to encompass aspects of the perceived quality and ethics of students using GenAI in our research.

Article type: research article

Keywords: generative artificial intelligence; GenAI; students; antecedents, intention; SEM model

JEL codes: L14, L29, M21

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INTRODUCTION

Since the launch of Chat GPT in November 2022 (https://chat.openai.com; retrieved on October 29, 2023), a conversational language model based on GenAI developed by Open AI, GenAI as 'a machine learning model that uses unsupervised and supervised learning techniques to understand and generate human-like language' (Lund & Wang, 2023, p. 1) has become one of the most intensively explored topics (Wach *et al*., 2023), in particular from the perspective of higher education institutions (HEI) (Gill *et al*., 2024).

Increasing numbers of studies show that GenAI can be particularly useful for students in obtaining teaching materials, providing personalized learning experiences, offering virtual personal tutoring, creating outlines, brainstorming ideas, assisting in creating educational content, learning a foreign language, translating texts, and writing assignments (Perera & Lankathilaka, 2023). Moreover, GenAI can prove significant in improving teaching and learning outcomes, expanding knowledge, saving time and achieving educational goals.

Despite the research intensity (Gill *et al*., 2024), the literature emphasises the need to look again at the reasons for using GenAI from the perspective of key stakeholders, students in particular (Gill *et al*., 2024). Such reasons are understood to be antecedents, *i.e.,* factors that precede and influence the results of a specific event. Antecedents represent pre-existing conditions and behaviours before an individual considers performing a specific activity. Previous findings regarding the antecedents of GenAI focus on research into public opinion, consumers, public health, government services, finance and professional developers (Singh & Singh, 2023). Although the antecedents of the intentions of students to use GenAI have gained attention, previous research has its limitations. These mainly refer to small sample sizes (Bonsu & Baffour-Koduah, 2023; Strzelecki, 2023) and use one selected theory (Bonsu & Baffour-Koduah, 2023; Foroughi *et al*., 2023; Raman *et al*., 2023; Strzelecki, 2023; Yilmaz *et al*., 2023). We conducted the research using a qualitative approach and quantitative research (Bonsu & Baffour-Koduah, 2023; Choudhury & Shamszare, 2023; Foroughi *et al*., 2023; Raman *et al*., 2023; Strzelecki, 2023; Yilmaz *et al*., 2023). These have their limitations, especially with regard to the specifics of qualitative research per se, but also relating to extant quantitative research, *i.e.,* number of participants (Bonsu & Baffour-Koduah, 2023), focus on the Anglo-Saxon (Choudhury & Shamszare, 2023), or Asian context (Foroughi *et al.,* 2023), the use of a single theoretical lens (Foroughi *et al*., 2023; Raman *et al*., 2023), state universities (Strzelecki, 2023), and students studying programming (Yilmaz *et al*., 2023).

Despite findings on factors that may influence students' intentions to use GenAI, there are still calls for research to reveal other factors (Bonsu & Baffour-Koduah, 2023). In response to the indicated challenges, we aimed to identify factors that influence students' intentions to use GenAI. In this study, we understand intention as 'the degree to which a person has formulated conscious plans to perform or not perform certain future behaviours' (Warshaw & Davis, 1985, p. 214). Unlike previous studies, which examined the antecedents of intentions to use GenAI among students on a single-level basis (Bonsu & Baffour-Koduah, 2023; Dwivedi *et al*., 2023; Foroughi *et al*., 2023; Raman *et al*., 2023; Strzelecki, 2023; Yilmaz *et al*., 2023), we perceive them on many levels at the individual, group, and organizational level. The literature recommends this approach for concepts that change and depend on different contexts (Kozlowski & Klein, 2000).

The literature has not yet provided guidance on selecting and applying appropriate theories that considering the intention to do something (Kwon & Silva, 2020). However, considering the formulated research question, we decided to choose two theories, *i.e.*, the theory of planned behaviour (TPB) (Ajzen, 1991) and the technology acceptance model (TAM) (Davis, 1989). We made this choice for two reasons. Firstly, these theories are the two most popular ones that are widely used to explain intentions regarding broadly understood technology (Kwon & Silva, 2020), such as GenAI. Secondly, the choice of the TPB resulted from the fact that it is widely used in research on intentions and behaviours related to the adoption of new technologies (Ajzen, 1991). However, it is necessary to treat this theory as a starting theory, as subsequent applications allow it to be extended to new contexts (Conner & Armitage, 1998). Therefore, we decided to use the TAM.

Our study is a response to the challenge presented in the literature regarding the identification of the antecedents to students' intentions to use GenAI (Dwivedi *et al*., 2023). Firstly, we adopted a multilevel approach, which the literature recommends in the case of antecedent research. This allows for the improvement of theoretical development and the understanding of concepts in various contexts. Secondly, our study considers aspects of the perceived quality and ethics of students using GenAI, which has so far been omitted in other studies, but has been postulated and recommended (Panagopoulou *et al*., 2023).

The subsequent part of this article is organized as follows. The first section of this paper provides an overview of the literature on antecedents of students' intention to use GenAI, research model, and hypotheses development. The next section covers the sample and data collection procedure, the adopted research tool, and data analysis. Next, the results section presents the descriptive statistics and matrix correlation results, the confirmatory factor analysis, the discriminant validity, and the PLS-SEM analysis. Finally, the conclusion summarizes the results, theoretical and practical implications, limitations, and potential future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Antecedents of Students' Intention to Use GenAI

Previous studies have explored factors that influenced students' intention to use GenAI, drawing on various theoretical frameworks. Foroughi *et al*. (2023) applied the extended unified theory of acceptance and use of technology (UTAUT2) to identify key determinants influencing the intention to use GenAI for educational purposes, including performance expectancy, effort expectancy, hedonic motivation, and learning value. Using the same theory as Foroughi *et al.* (2023), Strzelecki (2023) found that performance expectancy, habit, personal innovativeness, and hedonic motivation are positively associated with behavioural intention. Scholars have also found a weak positive effect of expected effort and social influence on behavioural intentions. Other researchers have used the TAM to explain why students use GenAI (Bonsu & Baffour-Koduah, 2023; Yilmaz *et al*., 2023). Based on mixed sequential research, Bonsu and Baffour-Koduah (2023) determined that students' perception of GenAI is not related to the intention to reach for it and use it. However, the experience of using technological innovations increases students' intention to use GenAI. In turn, adopting the perspective of the TAM, Yilmaz *et al*. (2023) found a positive perception of GenAI among students, as well as the importance of all the adopted factors on the behavioural intention of students. Taking the perspective of the perceived attributes of the diffusion of innovation theory, Raman *et al*. (2023) conducted research among 288 students. They found that relative advantage, compatibility, ease of use, observability and trialability significantly influenced the adoption of GenAI by students.

Moreover, the literature provides different results regarding the importance of age, gender, and study level in students' behavioural intention to use GenAI. For example, Bonsu and Baffour-Koduah (2023) found that students over 26 years of age showed a greater tendency to use GenAI than in the case of their younger colleagues. However, Yilmaz *et al*. (2023) found no significant differences for behavioural intention between different age groups of students. Regarding gender, according to Bonsu and Baffour-Koduah (2023), the intention to use GenAI is greater among male students than female students. Yilmaz *et al.* (2023) found that gender matters in students' behavioural intention to use GenAI. In detail, their findings are similar to those of Bonsu and Baffour-Koduah (2023) – male students showed stronger levels of intention to use GenAI. In turn, Raman *et al.* (2023) believe that gender does not matter for behavioural intention, but gender differentiates the reasons for using GenAI. According to the authors, male students will choose GenAI due to its compatibility, ease of use, and observability. In turn, ease of use, compatibility, relative advantage and trialability may be important for female students. On the other hand, Strzelecki (2023) states that gender does not matter in students' behavioural intention to use GenAI. With regard to study level, Bonsu and Baffour-Koduah (2023) state that the higher the level of study, the greater the intention to use GenAI. The results of the research conducted by Strzelecki (2023) do not confirm these findings, and the study level does not matter in students' behavioural intention to use GenAI.

Research Model and Hypotheses Development

To develop a robust model for the factors influencing students' behavioural intention to use GenAI, we conducted pilot studies. Initially, we compiled a list of potential antecedents based on the two theoretical frameworks used in our research, as suggested by existing literature, *i.e.*, the theory of planned behaviour (TPB) (Ajzen, 1991) and the technology acceptance model (TAM) (Davis, 1989). Moreover, we incorporated factors such as perceived quality (Niu & Mvondo, 2024), ethical perception (Paul *et al*., 2023), and HEI support (Stahl & Eke, 2024), as recommended in prior research. To measure those antecedents, we adopted established measurement scales from the TPB, TAM, and studies by Stone-Romero *et al*. (1997) and Michaelidou *et al*. (2021) (Table 3). To ensure respondents understood the term GenAI, we provided the adopted definition at the beginning of the questionnaire. We did not include a filtering question to differentiate between GenAI users and non-users, as our goal was to capture students' opinions, perceptions, and attitudes regarding their intention to use GenAI. A seven-point Likert scale was

used to assess all variables, ranging from '1 – strongly disagree' to '7 – strongly agree,' as McKelvie (1978) suggests that reliability is maximized with that scale.

We conducted the pilot study in April 2023 at a conveniently selected private higher education institution in one of Poland's largest cities. We hosted the questionnaire on the Webankieta.pl platform (https://www.webankieta.pl, retrieved April 1, 2023). The sample comprised 3000 people, with 60 fully completed questionnaires returned. To assess the reliability and suitability of our research tool, we performed the McDonald's omega reliability coefficient test (ω) (McDonald, 1999), which is considered more general than Cronbach's alpha and is a more optimal measure of reliability (Hayes & Coutts, 2020). The overall reliability of the tool was 0.939, indicating high reliability (McDonald, 1999).

Moreover, we tested the raw data for common method bias using Harman's single-factor test (Podsakoff *et al*., 2003). The results showed that the variance explained by the single factor was 61.80%, which was below the 70% threshold, indicating no common method bias. We assessed the composite reliability (CR) and convergent validity of the measurement using the average variance extracted (AVE) method (Hair *et al*., 2011). The CR for the antecedents – attitude, perceived usefulness, perceived quality, ethical perception, perceived subjective norms, and HEI support – exceeded the threshold of 0.7. Regarding AVE, the required threshold of ≥ 0.5 was met for attitude and perceived usefulness. We then conducted exploratory factor analysis (EFA) using the principal component method with Promax rotation and Kaiser normalization to explore the underlying data structure.

Before performing the EFA, we verified the statistical assumptions necessary for the analysis by conducting the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The KMO value was 0.915, indicating excellent adequacy (Kaiser, 1974), while Bartlett's test of sphericity was significant ($p < 0.001$), confirming that the data was suitable for factor analysis (Field, 2009). The EFA revealed that the 40-item tool with six factors had factor loadings of 0.40 or greater (Watkins, 2018) and explained 82.98% of the variance. This led to the final version of the questionnaire, which included the antecedents attitude, perceived usefulness, perceived quality, ethical perception, perceived subjective norms, and HEI support for further analysis. We excluded from further analyses two constructs that were included in TAM and TPB (mostly perceived ease of use and perceived behavioural control), because the factor loading was less than the predefined value. Next, following the multilevel approach (Kozlowski & Klein, 2000), we grouped the proposed antecedents into three levels: individual, group, and organizational.

Individual Level

The individual level refers to features associated with a given person. At this level, we adopted the following four antecedents: attitude, perceived usefulness, perceived quality, and ethical perception.

Attitude refers to a person's attitude towards certain phenomena, expressing their views and way of acting or behaving towards specific phenomena, events or people (Ajzen, 1991). Previous research shows that a positive attitude is recognized as a factor influencing the behavioural intention to use GenAI (Yilmaz *et al*., 2023), and is crucial to its successful adoption (Yilmaz *et al*., 2023). In light of the above considerations, we therefore expected that students' behavioural intention to use GenAI would depend on their attitudes.

H1: Attitude positively impacts students' behavioural intention to use GenAI.

Perceived usefulness refers to 'degree to which a person believes that using a particular system would enhance their job performance' (Davis, 1989, p. 320). Therefore, the decision to take action is primarily driven by the perceived advantages or the belief that one's needs will be satisfied. Previous studies suggest that perceived usefulness is linked to students' intention to adopt technology that can boost their productivity, efficiency, and effectiveness (Algahtani & Mohammad, 2015). According to Yilmaz *et al*. (2023), students are more likely to use GenAI if they believe it will improve their academic performance. Similarly, Bonsu and Baffour-Koduah (2023) found that students' behavioural intention to use GenAI is influenced by its perceived usefulness. These findings led us to the following hypothesis:

H2: Perceived usefulness positively impacts students' behavioural intention to use GenAI.

Perceived quality refers to customers' cognitive and emotional reactions to a specific project or service (Stylidis *et al*., 2020). As indicated by Xu *et al.* (2023), perceived quality positively impacts the

intention to use GenAI. In turn, Tlili *et al.* (2023) found that students perceived GenAI as a valuable element of educational transformation, but also showed concerns about the quality of the content it generated. Therefore, if potential users believe that GenAI will provide good quality benefits, this may have a direct impact on their intention to use it. These findings lead us to the following hypothesis:

H3: Perceived quality positively impacts students' behavioural intention to use GenAI.

Ethical perception refers to the degree to which a person can recognize whether a given behaviour is moral from their perspective or not (Dwivedi *et al*., 2023). From the perspective of students, concerns are highlighted about the quality of the obtained data, copyright infringement (Stokel-Walker, 2023) and the sharing of sensitive or personal data. In this regard, viewing GenAI from an ethical perspective seems to be important for students' behavioural intention to use it. These findings lead us to the following hypothesis:

H4: Ethical perception positively impacts students' behavioural intention to use GenAI.

Group Level

The group level pertains to how an individual views their own actions as well as those of others. At this level, we identified subjective norms, which involve a person's belief that significant individuals or groups (as perceived by the person) will endorse and encourage a particular behaviour (Ajzen, 1991). Previous research on GenAI has shown a significant and positive relationship between subjective norms and behavioural intention to use it (Foroughi *et al*., 2023; Strzelecki, 2023; Yilmaz *et al*., 2023). In this approach, if a person tends to adapt to the expectations of others to strengthen relationships with group members or other people important to them, they may develop the intention to use GenAI. With the above in mind, we hypothesised:

H5: Subjective norms positively impact students' behavioural intention to use GenAI.

Organizational Level

The organizational level refers to the scope of responsibility, authority or other activities from the point of view of the organization in which a given person is located. At this level, we adopted HEI support. This refers to the student's perception that the university acknowledges their efforts, appreciates their contributions, and prioritizes their overall well-being (Rhoades & Eisenberger, 2002). In this approach, we may associate HEI support with students' behavioural intention to use GenAI (Dwivedi *et al*., 2023; Stahl & Eke, 2024). Therefore, we hypothesised:

H6: Higher education institutions' support positively impacts students' behavioural intention to use GenAI.

Figure 1 shows our proposed research model.

RESEARCH METHODOLOGY

Sample and Data Collection

We conducted the main research using the final verified version of the questionnaire. We conducted the main research from May to June 2023 at a conveniently selected private higher education institution in one of Poland's largest cities. We distributed our online questionnaire to all part-time bachelor's and master's students, with a total sample size of 3 000 people. To determine the minimum sample size, we factored in the acceptable margin of error (5%) and the assumed confidence level ($\gamma = 0.95$; $\alpha = 1.96$; $d = 0.05$). Based on those parameters, we concluded that the minimum sample size needed was 341 participants.

We received a total of 1125 completed questionnaires, but we discarded 355 due to incomplete data. Ultimately, we included 770 valid questionnaires in the analysis, yielding a response rate of 25.67% and meeting the minimum sample size requirement. The majority of respondents were women (66.36%), over 25 years of age (44.30%), and first-year students (55.30%) (Table 1).

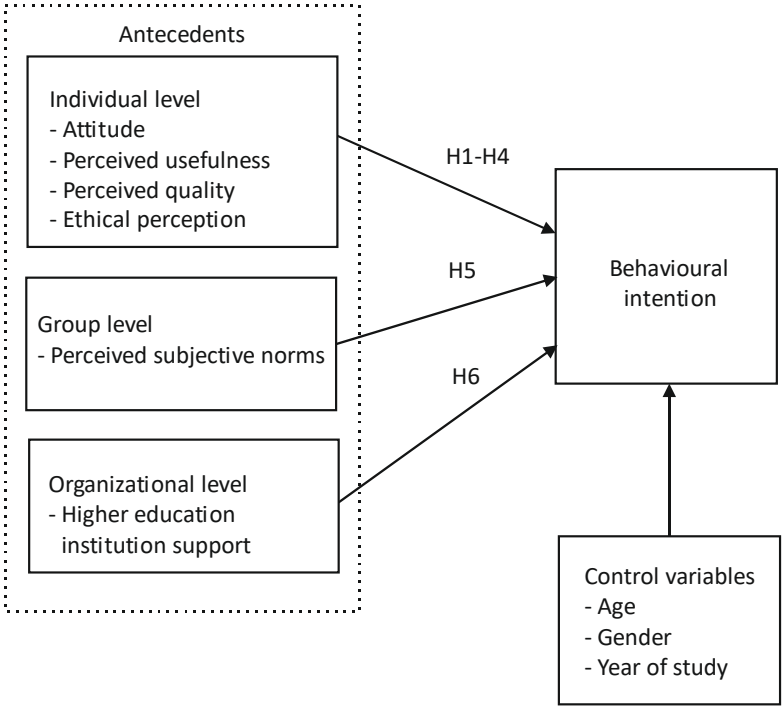

Figure 1. A theoretical multilevel model of students' behavioural intentions to use GenAI
Source: own elaboration.

Table 1. Respondents' main features

Demographic variables		Frequency (n)	Percentage (%)
Gender	Male	511	66.36
	Female	234	30.39
	I don't want to disclose my gender	25	3.25
Age	19-20	138	17.90
	21-22	149	19.40
	23-24	142	18.40
	> 25	341	44.30
Year of study	1	426	55.30
	2	107	13.90
	3	83	10.80
	4	85	11.00
	5	69	9.00

Source: own study.

Variable Description and Measurement

To measure the adopted antecedents of the intention to use GenAI among students divided into individual, group and organizational levels, using behavioural intention and control variables, we adopted an approach taken from the literature (Table 3). To measure age, we adopted the following categories: 19-20, 21-22, 23-24, 25 and above. Such categories are consistent with previous research conducted among students (Yilmaz *et al*., 2023) as the age category is emphasized by other researchers (Strzelecki, 2023). To measure the year of study, we adopted the range 1-5 in accordance with the higher education system (Bonsu & Baffour-Koduah, 2023).

Data Analysis

We performed correlation analysis, as well as convergent and discriminant procedures. We used correlation analysis to measure the association between the antecedents and students' behavioural intention to use GenAI. As part of the convergent and discriminant validation procedures, we performed

confirmatory factor analysis (CFA), McDonald's omega reliability coefficient, and Harman's single factor test. To test our hypotheses, we employed PLS-SEM (Hair *et al*., 2011). We chose this method, because it enables the estimation of theoretical constructs, their reliability and validity, as well as testing the directional relationships between complex constructs (Chin, 2010). We conducted the analysis using PS Imago Pro 9 and SmartPLS 4 software.

RESULTS AND DISCUSSION

Table 2 presents the descriptive statistics and correlation analysis results. The findings indicate that, out of the mean values, perceived usefulness had the highest mean (4.651), while perceived quality had the lowest mean (3.171). We also observed minor differences between the means for perceived quality (4.108) and HEI support (4.270). To examine the linear relationship between two variables and assess its strength and nature, we conducted a correlation analysis using the Pearson r correlation coefficient. As shown, not all antecedents positively correlated with behavioural intention, such as ethical perception (-0.033). It is also important to note the weak correlations for perceived subjective norms (0.288). A strong correlation was found in the case of attitude (0.701). To check for multicollinearity, we calculated the variance inflation factor (VIF) for each variable. The results ranged from 1.687 to 4.841, which aligns with the required tolerance range of 0.20 to 5.0 (Hair *et al*., 2011).

Table 2. Descriptive statistics and matrix correlation

No.	Variables	Summary statistics			Variable						
		Mean	SD	ω	ATT	PU	PQ	PE	SNO	POS	BI
1.	Attitude	4.394	1.456	0.853	1						
2.	Perceived usefulness	4.651	1.420	0.913	0.727	1					
3.	Perceived quality	4.108	0.919	0.897	0.410	0.444	1				
4.	Ethical perception	3.171	1.381	0.820	-0.012	-0.070	-0.061	1			
5.	Perceived subjective norms	3.601	1.216	0.821	0.265	0.363	0.373	0.078	1		
6.	Higher education institution support	4.270	1.320	0.753	0.570	0.638	0.510	0.052	0.497	1	
7.	Behavioural intention	3.420	1.651	0.904	0.701	0.639	0.466	-0.033	0.288	0.567	1

Source: own study.

To perform the reliability analysis, we calculated McDonald's omega reliability coefficient (ω) (Table 2). The overall tool achieved a value of 0.914, indicating very high reliability. Individual antecedents and behavioural intention also exhibited high internal consistency. Since we gathered data for all variables from a single source, we conducted Harman's single-factor test with Promax rotation (Podsakoff *et al*., 2003) to assess common method variance. The results revealed that the first factor accounted for only 28.233% of the data variability, indicating no risk of common method variance, as the explained variance was below 50% (Podsakoff *et al*., 2003).

We used confirmatory factor analysis (CFA) to evaluate the measurement model and assess the fit of the proposed factor structure (Table 3). We used the following criteria with the established thresholds: root mean square error of approximation (RMSEA) with a close fit < 0.05 (Brown, 2015), goodness-of-fit index (GFI) > 0.9, and adjusted GFI (AGFI) > 0.8 (Bagozzi & Yi, 1988). The overall fit indices for the measurement model were RMSEA = 0.020, GFI = 0.929, and AGFI = 0.910, indicating an adequate fit. Moreover, SmartPLS includes the standardized root mean square residual (SRMR) as a fit criterion for PLS path modelling, with a recommended value of less than 0.08 (Hu & Bentler, 1999). The SRMR for our final structural model was 0.072, indicating an acceptable fit.

The findings presented in Table 3 reveal that the factor loadings for the 40 items ranged from 0.188 to 0.914. In most cases, the loading factor exceeds 0.70 (Hair *et al*., 2011), indicating good reliability (Hair *et al*., 2011). However, a loading factor of 0.50 is also considered acceptable (Hulland, 1999). Based on these guidelines, we removed eight items (PE2, PE3, PE4, PE6, PE7, SNO5, SNO6, POS1). Next, we evaluated the composite reliability of the antecedents (CR) and the convergent validity of the measurement using average variance extracted (AVE) (Hair *et al*., 2017). After these adjustments, all con-

Table 3. Confirmatory factor analysis results

Variable	Indicator	Items	Factor loading	CR	AVE
Attitude (Ajzen, 1991)	ATT1	Using GenAI when studying has more advantages than disadvantages.	0.807	0.857	0.694
	ATT2	GenAI matters when studying.	0.840		
	ATT3	GenAI makes a difference in achieving better academic results.	0.845		
	ATT4	If there were any possibility, I would use GenAI.	0.839		
Perceived usefulness (Davis, 1989)	PU1	Speeding up the completion of my assignment will encourage me to use GenAI.	0.822	0.919	0.632
	PU2	Increasing the chances of getting a better grade for passing the subject will encourage me to use GenAI.	0.815		
	PU3	Speeding up the search for information requested by the lecturer will encourage me to use GenAI.	0.828		
	PU4	The need to look for information that is useful during my studies will encourage me to use GenAI.	0.770		
	PU5	Being able to quickly get answers to questions I may have while studying will encourage me to use GenAI.	0.817		
	PU6	The ability to access unlimited sources of knowledge will encourage me to use GenAI.	0.766		
	PU7	The possibility of saving time while writing final papers will encourage me to use GenAI.	0.826		
	PU8	The opportunity to save time while preparing for exams will encourage me to use GenAI.	0.710		
Perceived quality (Stone-Romero *et al.*, 1997)	PQ1	I believe that the information provided by GenAI is reliable.	0.822	0.907	0.769
	PQ2	I believe that GenAI ensures the security of the information I post.	0.912		
	PQ3	I believe that my personal data is protected when using GenAI.	0.861		
	PQ4	I believe that when I use GenAI, I can be confident in the privacy of the information I post.	0.909		
Ethical perception (Michaelidou *et al.*, 2021)	PE1	The use of GenAI does not violate generally accepted ethical principles at the university.	0.828	0.767	0.548
	PE2	All the data I receive from GenAI is real.	-0.759		
	PE3	I can sign as the creator of a study written by GenAI.	0.188		
	PE4	The use of GenAI influences human ethical behaviour.	0.328		
	PE5	The use of GenAI gives you permission to cheat while studying.	0.625		
	PE6	Lecturers should lower grades for students using GenAI.	-0.495		
	PE7	I believe that using GenAI is ethical.	-0.780		
	PE8	I find it absurd that some universities ban students from using GenAI.	0.782		
Perceived subjective norms (Ajzen, 1991)	SNO1	People who are significant to me will encourage me to use GenAI.	0.741	0.900	0.547
	SNO2	The lecturer's recommendations will encourage me to use GenAI.	0.789		
	SNO3	My college friends who also use GenAI will encourage me to use it.	0.555		
	SNO4	The opinions of my university friends will encourage me to use GenAI.	0.535		
	SNO5	My university's promotion of GenAI use will motivate me to use it.	0.451		
	SNO6	University regulations regarding GenAI use will encourage me to use it.	0.440		
	SNO7	The absence of a ban from my university will encourage me to use GenAI.	0.866		
	SNO8	People who are significant to me will encourage me to use GenAI.	0.855		
Higher education institution support (Eisenberger *et al.*, 1997)	POS1	The technical support offered by my university will encourage me to use GenAI.	0.270	0.828	0.725
	POS2	The chance to participate in a training course on how to use GenAI will motivate me to use it.	0.821		
	POS3	The university's expectations for students to use GenAI will encourage me to do so.	0.871		
	POS4	I will be encouraged to use GenAI by my lecturers' inclusion of GenAI in the curriculum.	0.856		
Behavioural intention (Azjen, 1991)	BI1	I think it is very likely that I will use GenAI to prepare for classes within the next month.	0.878	0.908	0.773
	BI2	I will recommend that my friends use GenAI to prepare for their studies.	0.914		
	BI3	I will make every effort to make the use of GenAI the norm during my studies.	0.888		
	BI4	My means of learning is by using GenAI.	0.836		

Source: own study.

structs exceeded the CR threshold of 0.7, demonstrating strong reliability (Hair *et al*., 2011). The square roots of the AVE for each construct were above the minimum value of 0.60, confirming that all constructs met the criteria for satisfactory convergent validity (Fornell & Larcker, 1981). Moreover, to assess discriminant validity, we applied the heterotrait-monotrait ratio (HTMT), which is considered more robust than the Fornell-Larcker criterion (Henseler *et al*., 2015). In our HTMT analysis (Table 4), all variables showed results of < 0.90, confirming adequate discriminant validity (Henseler *et al*., 2015).

Table 4. Discriminant validity

No.	Variables	ATT	PU	PQ	PE	SNO	POS	BI
1.	Attitude	1						
2.	Perceived usefulness	0.821	1					
3.	Perceived quality	0.464	0.506	1				
4.	Ethical perception	0.277	0.314	0.136	1			
5.	Perceived subjective norms	0.302	0.407	0.414	0.152	1		
6.	Higher education institution support	0.556	0.423	0.125	0.345	0156	1	
7.	Behavioural intention	0.795	0.742	0.516	0.236	0.311	0.457	1

Source: own study.

To assess the overall predictive power of the structural model, we calculated the coefficient of determination (R^2) (Chin, 1998). The values were as follows: attitude – 0.570 (moderate), perceived usefulness – 0.367 (moderate), perceived quality – 0.123 (small), ethical perception – 0.330 (moderate), perceived subjective norms – 0.319 (moderate), and HEI support – 0.688 (substantial).

For the overall assessment of model fit, we calculated the standardized root mean square residual (SRMR). The model estimation was 0.086, confirming an acceptable fit based on the reference point of 0.1 for SRMR. We applied structural equation modelling (SEM) to the measurement model (Table 5). To test the significance of the path coefficients, we used a nonparametric bootstrapping procedure with 5 000 samples (Hair *et al*., 2011).

Table 5. Results of PLS-SEM analysis

Hypothesis and path	Path coefficient	*T-statistic* (sig. level)	*p-values*
H1. Attitude -> behavioural intention	0.399	11.232	0.000
H2. Perceived usefulness -> behavioural intention	0.120	3.099	0.002
H3. Perceived quality -> behavioural intention	0.111	3.358	0.001
H4. Ethical perception -> behavioural intention	-0.067	0.934	0.350
H5. Perceived subjective norms -> behavioural intention	0.051	1.682	0.093
H6. Higher education institution support -> behavioural intention	0.198	5.473	0.000

Source: own study.

The results revealed that attitude (path = 0.399, T = 11.232, p < 0.005), perceived usefulness (path = 0.120, T = 3.099, p < 0.005), perceived quality (path = 0.111, T = 3.358, p < 0.005), and HEI support (path = 0.198, T = 5.473, p < 0.005) had the most significant influence on students' behavioural intention. Therefore, we found support for hypotheses H1, H2, H3, and H7. Moreover, we found that ethical perception (path = -0.067, T = 0.934, p > 0.005) and perceived subjective norms (path = 0.051, T = 1.682, p > 0.005) had no effect on students' behavioural intention, leading to the rejection of hypotheses H4 and H5.

To further validate our findings and assess their robustness, we conducted additional analyses of control variables such as age, gender, and level of study. We used a one-way ANOVA test for this purpose, allowing for the comparison of the means of two or more independent groups to determine if there is statistical evidence of significant differences between the groups (Ross & Willson, 2017). This test is suitable for analysing sub-samples with different numbers of respondents, as it has less stringent assumptions compared to parametric tests, making it applicable to various measurement scales.

The results indicated significant differences in students' behavioural intentions to use GenAI across the different age groups, F(28.133) = 73.825, p < 0.001. The Student's t-test for independent samples

revealed no statistically significant differences between women and men t(743)=-5.304, p>0.05, students aged 24 and younger versus those aged 25 and older t(285)=-0.696, p>0.05, and by level of study t(531)=-1.751, p>0.05. To further explore these findings, we performed bootstrapping using the Gabriel test. The results showed no significant differences between male and female students across specific age groups (19-20, 21-22, 23-24, 25 and above) (0.008; 5.27). However, the average behavioural intention was slightly higher for students aged 21-22 years (3.596) and 23-24 years (3.569) compared to students aged 25 and older (3.268) and 19-20 years (3.455), and for men (3.891) compared to women (3.213). We also noted small differences between third-year students (3.903) and first-year students (3.252).

Based on the TPB and the TAM, we aimed to identify factors influencing students' intentions to use GenAI. By examining antecedents at different levels individual (attitude, perceived usefulness, perceived quality, ethical perception), group (perceived subjective norms), and organizational (HEI support), as well as control variables like age, gender, and year of study, the study found support for four of the proposed hypotheses. Specifically, we confirmed that attitude (H1), perceived usefulness (H2), perceived quality (H3), and HEI support (H6) positively influence students' intentions to use GenAI. Conversely, ethical perception (H4) and perceived subjective norms (H5) did not affect students' behavioural intention to use GenAI, leading to the rejection of these hypotheses.

At the individual level, the findings indicated that attitude significantly impacts students' intention to use GenAI. This aligns with prior studies (Yilmaz *et al*., 2023). Furthermore, perceived usefulness positively affects students' intentions, which corroborates earlier research (Bonsu & Baffour-Koduah, 2023; Yilmaz *et al*., 2023). The results suggest that students were more likely to use GenAI when they perceive it as a tool that can help them complete assignments faster, search for information, get personalized answers quickly, and access unlimited knowledge sources, all contributing to better academic performance and time savings.

Perceived quality also plays a crucial role at the individual level. The study found that students' belief in the quality of information from GenAI influences their intention to use it, consistent with findings from other researchers (Tlili *et al*., 2023). This belief is often shaped by feedback from other users or academic publications on the topic.

However, ethical perception did not positively influence students' behavioural intentions to use GenAI, contrary to the expectations set by prior research (Stokel-Walker, 2023). This is likely due to the widespread admiration of GenAI's advantages at the time of the study. Ethical concerns, including issues like plagiarism or copyright infringement, have only recently gained attention (Stahl & Eke, 2024). This emerging concern represents a challenge for academic instructors, who now face the responsibility of identifying potential plagiarism (Khalil & Er, 2023). Researchers have called for further studies to better understand these issues and to guide future policy development (Stahl & Eke, 2024).

Secondly, at the group level, we found that perceived subjective norms do not have a positive impact on students' intention to use GenAI. Our findings did not confirm the previous findings of other researchers (Foroughi *et al*., 2023; Strzelecki, 2023; Yilmaz *et al*., 2023). However, our results are not surprising, and we can explain them by the fact that over half of our respondents (53.3%) were first-year students. Moreover, we conducted research among students following extra-mural studies, in which a considerable proportion of the classes were conducted online (80% remote learning). Face-to-face classes did not take place more than once a month. This means that our respondents had limited contact with their peers from the same year. Thus, their acquaintances from their studies could have had a limited impact on their decision to reach for GenAI. Finally, our results confirmed previous findings in the literature, which found that in the case of new technologies, subjective norms had a smaller impact on the intention to use them (Lee *et al*., 2010).

Thirdly, our results show that at the organizational level, HEI support had a positive impact on students' behavioural intention to use GenAI. These findings are consistent with Stahl and Eke (2024), who emphasize the importance of student support. Our research confirms that universities should conduct workshops and training on what GenAI is, how it works, and what its capabilities and limitations are. Discussions should be organized regarding the ethical aspects of using such tools in an academic context. This includes issues of plagiarism, academic dishonesty, and verifying information obtained from GenAI.

Including demographic variables in the models allowed us to confirm and extend previous conclusions from the literature. We found that age does not matter for students' behavioural intention to use GenAI. Our results confirmed the findings of Yilmaz *et al*. (2023). Our next result showed that gender does not matter for the behavioural intention to use GenAI among students, which confirms the findings of Raman *et al*. (2023) and Strzelecki (2023). Finally, our results showed that the level of study does not matter for the behavioural intention among students to use GenAI, which is consistent with Strzelecki (2023).

Ultimately, based on our research results, we propose a multilevel conceptual framework of students' behavioural intentions to use GenAI (Figure 2).

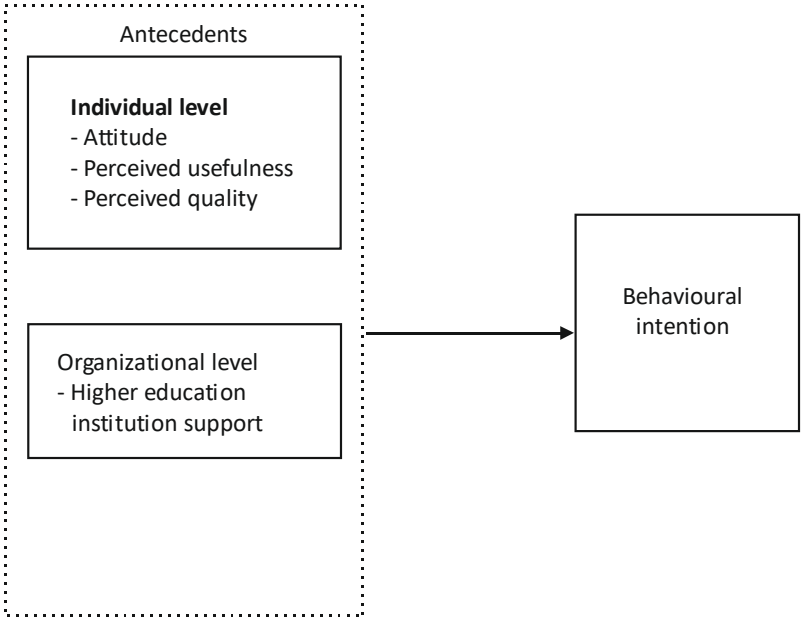

Figure 2. Multilevel conceptual framework of students' behavioural intentions to use GenAI
Source: own elaboration.

Our conceptual framework integrates students' behavioural intentions to use GenAI with its antecedents, which stem from our research findings. At the individual level, these are attitude, perceived usefulness, and perceived quality, while at the organizational level, it is HEI support. This framework not only consolidates the factors at both individual and organizational levels and their relationships with students' intentions to use GenAI, but it also serves as a foundation for future research. It offers a basis for further investigation that could deepen and expand the current understanding of students' behavioural intentions regarding GenAI usage.

CONCLUSIONS

Our research contributes to refining and developing theory on the antecedents to students' behavioural intention to use GenAI (Dwivedi *et al*., 2023) by developing a multilevel model of antecedents of students' behavioural intention to use GenAI. Our research showed that students' behavioural intention to use GenAI requires various factors and actions at various levels to intensify such intention. At the individual level, these are attitude, perceived usefulness, and perceived quality. Meanwhile, at the group level, students' intention to reach for GenAI is intensified by perceived subjective norms, while at the organizational level, this effect is achieved by HEI support. In summary, our study expands the current understanding of why students choose GenAI. From a theoretical point of view, our study contributes to and is the first step towards a multilevel approach to the antecedents of students' use of GenAI.

Our findings allow us to propose two practical implications for academic teachers and managers of HEI. These refer to the identified antecedents of the behavioural intention among students to use GenAI. Firstly, since attitude, perceived usefulness and HEI support are important for students' inten-

tion to use GenAI, it is important to provide them with support in terms of knowledge and skills. Therefore, there is a need to build and raise students' awareness of the critical use of GenAI. It is important to provide comprehensive training and other forms of improving competencies in the conscious use of GenAI. This may require universities to provide additional academic resources in the form of guides, instructional materials, videos or training to support critical use of GenAI.

Secondly, considering that perceived quality positively impacts students' behavioural intention to use GenAI, we recommend that universities clearly define their expectations regarding students' use of GenAI. These expectations may take the form of regulations or standards that address the benefits and risks of students' use of GenAI. Therefore, we encourage universities to explain to students how and when they can safely use artificial intelligence (Chan & Hu, 2023). Of course, we should also mention the threats of GenAI resulting from the indiscriminate use of GenAI, such as hallucinations, intellectual property infringement and the uncertainty of personal data security. Moreover, we believe that the academic community should start discussing comprehensive ways of identifying incidents of intellectual property infringement.

This study has several limitations that may serve as inspiration for future research. Firstly, the sample comprises Polish students from a conveniently selected private education institution located in one of the largest cities in Poland. This can be a limitation for the generalisation and application of the results. A limitation regarding the sample is that over half the respondents (53.3%) were first-year students. However, we conducted the research on a large sample, which increases the chances of counteracting and overcoming potential risks in sample selection. However, the context is important in research on behavioural intention, so future studies should be comparative, conducted in different countries, and consider different types of schools (public, private) and fields of study.

Secondly, our research referred to the opinions and observations of both male and female students, which could have influenced the conclusions drawn. In general, questionnaires measuring perception may be subject to errors of subjectivity and bias. Moreover, both the independent variables and the dependent variable were measured using the same scale, which may be subject to common method bias. This may lead to false conclusions. Therefore, to identify potential common method bias, we performed Harman's single-factor test (Podsakoff *et al*., 2003). Based on the result, we can conclude that there was no common method bias in our research (28.233%). Moreover, the results of the McDonald's omega reliability coefficient (ω) confirm the reliability of our tool. However, qualitative research may be helpful in the future to explore the opinions and perceptions of GenAI among students further. This would make it possible to identify and explain other reasons why students use GenAI. Moreover, perception changes over time, so future research should be longitudinal.

Thirdly, although we included control variables in our research (age, gender, level of study), our findings are not clear in this respect. Although men (66.36%) above 25 years of age (44.3%) dominated our sample, this does not constitute a threat to interpretation of the results. However, building on previous studies, future research could expand our findings to include personality traits and personality innovativeness.

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Conflict of Interest

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How does strategic orientation influence the business performance of small and medium-sized enterprises during the COVID-19 pandemic?

My Thi Tra Nguyen, Hung Trong Hoang, Tri Duc Tran, Anh Thi Nhat Tran, Hien La Phuong Hoang

ABSTRACT

Objective: The article aims to investigate the influence of strategic orientation (specifically market orientation, entrepreneurial orientation, and digital orientation) on small and medium-sized enterprises' performance during the COVID-19 pandemic.

Research Design & Methods: We surveyed 265 small and medium-sized enterprises and employed structural equation modelling (SEM) to test the hypotheses developed.

Findings: Research results show that during the COVID-19 pandemic, while market orientation and digital orientation had a direct positive impact on business performance (ß= 0.230, $p < 0.05$ and ß= 0.236, $p < 0.05$, respectively), entrepreneurial orientation did not (ß= -0.038 and $p > 0.05$). Moreover, competitive advantage mediated the relationship between entrepreneurial orientation (indirect effect = 0.102) as well as market orientation and business performance (indirect effect = 0.046). However, this did not apply to the indirect relationship between digital orientation and performance. Finally, competitive intensity positively moderated the influences of market orientation and digital orientation on business performance.

Implications & Recommendations: Based on the research findings, the study has provided SMEs with some implications to assist them in improving business performance. These consisted of the concentration on customers, competitors, and the development of an internal management information system. Moreover, during the COVID-19 pandemic, the understanding and application of digital orientation were essential. The competitive advantage of SMEs maximises when the enterprise orients toward entrepreneurial activities.

Contribution & Value Added: Our study contributes to the strategic management of SMEs by investigating the influences of strategic orientation on business performance. The study also expands its scope by examining the mediating and moderating role of competitive advantage and competitive intensity, respectively.

Article type: research article
Keywords: Strategic orientation; business performance; small and medium-sized enterprises; crisis
JEL codes: C38, L25, M21

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INTRODUCTION

Small and medium-sized enterprises (SMEs) play a critical role in the economies of Southeast Asian countries, as this type of enterprise accounts for between 89% to 99% of total businesses and between 52-97% of the total workforce (Aucky, 2019). For example, in Vietnam, SMEs represent up to 97.38% of the total number of businesses nationwide (The Ministry of Planning and Investment in Vietnam, 2022). This indicates that SMEs are the backbone of socio-economic development and job creation in many Southeast Asian countries, contributing significantly to the establishment of economic balance and structural transformation, as well as the optimization of economic resources.

However, the COVID-19 pandemic has had a strong and comprehensive impact not only on the economy in general but also on SMEs in particular. During the COVID-19 epidemic, the business models and methods of operation of enterprises have undergone significant changes. For some businesses, this is an opportunity to generate large profits, but for others, the COVID-19 pandemic has posed many prolonged difficulties and challenges. Even now, when the health of many businesses has not fully recovered, the aftermath and effects of COVID-19 continue to weigh heavily, particularly on SMEs' performance (The Ministry of Planning and Investment in Vietnam, 2022; Karas & Režňáková, 2021; Nathan *et al*., 2022). Moreover, SMEs face new challenges, such as higher operating costs, increasing debt, and management instability, requiring specific strategic directions to improve business operations. Although SMEs have flat, flexible, and agile structures, they are still limited in terms of access to capital, technology, human resources, and professional management expertise (Mahmood & Hanafi, 2013). Therefore, we aimed to help SME owners gain an overview of the impact of strategic orientation on business performance in the context of a crisis, the COVID-19 pandemic.

Over the past few decades, scholars have explored strategic orientation from various perspectives. Several studies have analysed the influence of entrepreneurial orientation (EO), market orientation (MO), or digital orientation (DO) on business performance. Some studies have also developed the topic by exploring the correlation between these orientations in different economies or industries. The results remain open-ended and have yet to reach a final conclusion because, in different cases worldwide, research findings lead to different conclusions (Van Egeren & O'Connor, 1998; Hakala, 2011; Lettice & Forstenlechne, 2014; Beliaeva *et al*., 2020; Alonso-Almeida *et al*., 2015; Selase *et al*., 2019; Papadopoulos *et al*., 2020; Pu *et al*., 2021). For instance, Van Egeren and O'Connor (1998) discovered that there is a strong positive relationship between MO and firm performance. Another research group identifies that a firm with higher MO scores can perform better than other peers with lower scores during an economic crisis (Lettice & Forstenlechne, 2014). However, Beliaeva *et al*. (2020) found that in the case of an economic crisis in Russia between 2015 and 2016, although EO had a positive effect on firm performance, MO did not. Thus, in the context of the COVID-19 pandemic, when economic crises occur due to a specific reason, whether any type of strategic orientation applied by SMEs has a consistent impact on business performance remains a question that many studies have yet to address. This gap motivates the authors to conduct this research to examine and measure the impact of various types of strategic orientation on business performance under the framework of the COVID-19 outbreak.

Moreover, to provide more specific managerial implications for business strategies in SMEs, we further expanded by considering the influence of competitive advantage (CA) on the relationship between strategic orientations and the performance of SMEs. Previous studies have emphasized that CA plays an important role in helping businesses to create more value not only for their customers but also for themselves. By having more value, businesses have more chances to win on the market and improve their performance. Moreover, we included competitive intensity (CI) in the model as a moderating variable to examine how competitive intensity affects the relationship between strategic orientation and the business performance of enterprises in the context of the COVID-19 pandemic. Although a number of studies have explored the moderating effect of CI, the effect of this factor on the correlation between MO, EO, or DO and business performance is still limited.

In the next part, we will present a literature review, in which we will not only explain the dimensions of each orientation but also the analysis of previous studies to develop our hypotheses. The next sections will demonstrate the research methodology, results, and discussion. Finally, we will summarise our findings in the conclusion, together with the limitations and future research suggestions.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

When discussing strategic orientation, studies have explored various dimensions, including market orientation, entrepreneurial orientation, digital orientation, learning orientation, technological orientation, environmental orientation, or strategy flexibility to adapt to different circumstances. We may explain the utilization and development of resources by businesses to formulate appropriate strategic orientation, aiming to enhance competitive advantage, innovation, and business outcomes with the resource-based

view (RBV) theory (Wadood *et al*., 2022). For each economy, each industry, or in different contexts, strategic orientation has varying degrees of impact or influence (Lee *et al*., 2014; Lumpkin & Des, 2001; Beliaeva *et al*., 2020). The relationship between dimensions of orientations has also been explored in various studies to demonstrate the impact of EO on MO (*e.g.,* Beliaeva *et al*., 2020; Seet *et al*., 2021) or EO on DO (*e.g.,* Kindermann *et al*., 2021). However, in this research, we delve deeper into the direct effects of three types of strategic orientation: MO, EO, and DO on business performance. These orientations are well-established strategies employed by SMEs in times of crisis, especially DO, during the social distancing context of the COVID-19 pandemic (Rupeika-Apoga *et al.*, 2022). Hence, we focused our resources on examining the role of these three orientations instead of all other strategies.

Entrepreneurial orientation (EO) was first mentioned in the research work of Peterson and Berger (1971). By the early 1980s, Burgelman (1983) and Miller (1983) defined EO as a strategy that businesses apply to survive and thrive in highly competitive markets. Entrepreneurial orientation is a tendency to identify new business opportunities, where businesses strive to be creative, take proactive decisions, and accept risks (Wach, 2015). When deciding to develop and introduce new products to the market, a business with EO tends to be willing to take risks and venture into the unknown (Lee *et al*., 2014). Proactiveness means anticipating in introducing of new products or services in the market (Beliaeva *et al*., 2020). Meanwhile, Covin and Slevin (1991) emphasized the role of innovativeness in the formation of EO, where innovation in products or services is always the business focus. In this case, managers particularly focus on R&D and are willing to adopt new approaches if they present great opportunities for the business. Lastly, the risk-taking factor involves active participation in new markets, investing in uncertainties with the possibility of uncertain outcomes (Lumpkin & Dess, 2001). In addition to these three factors, Lumpkin and Dess (1996) also consider autonomy and competitive aggressiveness, but competitive aggressiveness overlaps with the competitor orientation dimension that belongs to MO. Therefore, EO, with a scale consisting of the three main dimensions: proactiveness, innovativeness, and risk-taking, is more commonly applied (Keh *et al*., 2007; Rauch *et al*., 2009).

Entrepreneurial orientation positively impacts the company's operational efficiency (Morris *et al*., 1993; Lee *et al*., 2001). It also helps businesses identify resource allocation opportunities and adapt to changes in customer preferences more quickly than their competitors (Wale *et al*., 2013). Particularly for SMEs, scholars consider EO to play a crucial role and is closely related to the survival and growth of businesses in highly competitive markets (Shirokova *et al*., 2013; Wale *et al*., 2013). Therefore, in the context of the COVID-19 pandemic in developing countries, EO may have a positive impact on SMEs' business performance.

H1a: Entrepreneurial orientation positively influenced business performance in small and medium-sized enterprises during the COVID-19 pandemic.

Meanwhile, MO requires businesses to focus more on customers and meet their needs. Businesses tend to continuously change their resources to optimize customer value (Lee *et al.,* 2014; Narver & Slater, 1990). A business has a market orientation when it utilises all market information, identifies market gaps (Morgan & Berthon, 2008), and changes its products or services to satisfy or meet customer needs (Grewal & Patriya, 2001; Beliaeva *et al*., 2020).

Moreover, MO emphasises three factors: customers, competitors, and coordination between functional departments, and MO positively impacts business performance (Van Egeren & O'Connor, 1998; Hakala, 2011; Lettice & Forstenlechne, 2014). However, MO does not always have a positive impact on the existence and development of businesses. Depending on the context, when the impact of external factors varies, the influence of MO can lead to different results, which is why researchers continue to delve into this issue. For SMEs in emerging markets, in a study of 374 SMEs in South Korea, MO had no influence on innovation and operational efficiency (Lee *et al*., 2014). Or in the context of an economic downturn, SMEs with MO did not have a positive impact on business efficiency (Beliaeva *et al*., 2020), or only had a significant impact when the market experienced fluctuations in demand and high technology (Grewal & Patriya, 2001). Therefore, the influence of MO on the business performance will differ in distinct situations. During the COVID-19 pandemic, customer psychology and needs have undergone significant changes. This forces businesses to quickly adapt to meet customer demands. It

is also the way businesses apply to survive and overcome the crisis. Thus, this study aims to investigate whether MO positively affect the SME's performance, especially in the case of the COVID-19 pandemic.

H1b: Market orientation positively influences business performance in small and medium-sized enterprises during the COVID-19 pandemic.

Based on the theoretical frameworks of Henderson and Venkatraman (1999), Nambisan *et al*. (2019), and Kindermann *et al*. (2021), Rupeika-Apoga *et al.* (2022) indicates that digital orientation is associated with businesses focusing more on the digital marketplace, including the use of digital technologies. Digital technologies in this context specifically refer to social media, mobile applications, and digitalisation processes (Kindermann *et al*., 2021). To date, the application of digital technologies in the production process or the commercialization of products and services is essential (Gatinon & Xuereb, 1997). Especially, in the context of the COVID-19 pandemic strongly affecting traditional production and trade, digital orientation plays a vital role (Rupeika-Apoga *et al*., 2022). According to the OECD, digitisation opens up many opportunities for start-ups, and small and medium-sized enterprises (SMEs) in innovation and development. Applying digital orientation helps simplify organisation and communication within businesses, supports innovative capacity, and enhances labour productivity (Ardito *et al*., 2021; Akpan *et al*., 2020; Klein & Todesco, 2021; Rupeika-Apoga *et al*., 2022). In developed countries, we cannot deny the benefits that digitisation can bring to businesses. However, in newly emerging or developing countries, there is a lack of ability to apply advanced technology, especially leading technologies like cloud computing, AI, and VR, which have not yet reached their maximum potential. Furthermore, SMEs in developing countries acknowledge the importance of digital transformation during the COVID-19 pandemic. Therefore, the adoption of technology platforms in the business model has surged strongly in just a few months (Rupeika-Apoga *et al*., 2022). However, the digital transformation capabilities of SMEs remain limited (Akpan *et al*., 2020; Priyono *et al*., 2020). Based on these findings, the research proposes the following hypothesis:

H1c: Digital orientation had a positive impact on business performance in small and medium-sized enterprises during the COVID-19 pandemic.

Next, CA enables businesses to create value for customers that exceeds the costs incurred by the business. The value created by the business is what customers are willing to pay for, which can be in terms of price advantage or differentiation that other businesses cannot provide to customers. Therefore, a firm's CA can take two forms: cost leadership or differentiation. It helps businesses operate with superior efficiency, creating superior value for customers, and thereby enhancing the business's performance. In another study, Christiansen (2001) argued that a firm's resources and production processes contribute to creating a competitive advantage. Businesses will use their unique resources to create products and services of superior value for customers. Specific resources include product differentiation, market sensing, and responsiveness.

The goal of product differentiation is to create a competitive advantage for businesses based on the uniqueness and distinctiveness of their products. This differentiation strategy makes it difficult for competitors to replicate the business's unique products or ideas (Ma, 2022). With this advantage, businesses can achieve better profit margins, reduce price competition, build customer loyalty, and avoid substitute products. On the other hand, market sensing is the active process of gathering and distributing information about market needs and responses, such as market segmentation, competitor capabilities and intentions (Ramaswami *et al*., 2004). If a business has good market sensing, it will be able to identify market trends, thus better meet customer desires. Ultimately, market responsiveness is reflected in how well the business meets customer needs and responds to competitor actions. The businesses' ability to quickly respond and adapt to customer demands, along with the proactive development of timely strategies, helps retain customers and enhance their competitive position in the market.

Several studies have considered CA as a mediator affecting the relationships related to business activities worldwide. The research results from Mahmood and Hanafi (2022) on 165 women-owned small and medium enterprises (WSMEs) in Malaysia showed that CA plays an intermediary role between EO and business performance. These findings contribute to helping female owners/managers of SMEs to have better business orientation and develop competitive advantages so that they can survive in a

fiercely competitive market environment. Consistent with these findings, Sihite (2018) also explored CA as an intermediary variable to measure the impact of diversification strategy on the sustainable business activities of enterprises. The results from 43 enterprises showed that CA positively affects sustainable business activities, but the diversification strategy does not indirectly impact sustainable business activities through the intermediary variable of CA. Cahyono *et al*. (2023) also discovered that in SMEs within the halal agriculture sector, CA helps businesses improve their business outcomes and simultaneously serves as a mediator between supply chain management practices and business performance. Thus, we may note that CA has a positive impact on the enterprises' performance, but whether it acts as an intermediary or not depends on specific cases. At the same time, considering this factor as a mediator with other orientations, such as MO or DO, with business performance is still very limited, especially for SMEs. In this study, further exploration of the mediating relationship between market orientations and business performance of enterprises is proposed. Thus, we hypothesised:

H2a: Competitive advantage mediates the influence of entrepreneurial orientation on SMEs' business performance.

H2b: Competitive advantage mediates the influence of market orientation on SMEs' business performance.

H2c: Competitive advantage mediates the influence of digital orientation on SMEs' business performance.

Competitive intensity (CI), as identified by Porter (1980, 2008) is one of the five factors determining the attractiveness of an industry and reflects the competitive dynamics expressing the exchange of competitive movements. It signifies the fierceness of a market, wherein the number of competitors increases, and market opportunities shrink (Auh & Menguc, 2005). Assala *et al*. (2021) argue that CI is the degree to which rivals struggle to improve their market share. This is manifested through competitors attempting to position themselves strategically in the market through policies supporting efficient supply.

The consideration of CI as a moderating variable in the relationship between strategic orientation and business performance is a result inherited from previous theories (Auh & Menguc, 2005; Cadogan *et al*., 2003; Handoyo *et al*., 2023; Charles & Ochieng, 2023), where these authors argue that the environment regulates the effectiveness of organizational activities and businesses. In highly competitive environments, markets require firms to innovate, be proactive, and engage in risk-taking activities to adapt appropriately (Cui *et al*., 2005). Building on this foundation, Martin and Javalgi (2016) conducted a study to measure the moderation effect of CI on the relationship between EO and marketing capabilities as well as EO and firm performance, evidenced by Latin American International New Ventures. The results showed that while CI moderated the relationship between EO and marketing capabilities positively, it did not moderate the path from EO to firm performance. Therefore, in highly competitive markets, firms will need the necessary entrepreneurial orientation to leverage marketing capabilities, thereby achieving superior performance. However, CI is not useful in determining the level of EO needed to achieve superior performance when marketing capabilities are not present as an intermediate value for the EO-performance relationship. In the study by Tsai and Yang (2013), market turbulence and competitive intensity positively moderated the influence of firm innovativeness on firm performance. Furthermore, CI is also a factor that Handoyo *et al*. (2023) used to measure the moderating effect on the relationship between operational efficiency and businesses' outcomes. In other words, the study found that under conditions of intense competition, the impact of operational efficiency on production outcomes is enhanced. Intense competition is indeed a factor that drives operational efficiency and improves production in businesses. In a fiercely competitive environment, if businesses do not respond quickly in the competitive race, they may face many disadvantages that lead to unfavourable business results (Manalu *et al.,* 2023). During the COVID-19 pandemic, when resources become scarce and face numerous impacts, firms must confront many challenges and require change to survive. Consequently, we aimed to explore how CI transforms in an environment of heightened CI, such as the COVID-19 pandemic. We hypothesised:

H3a: Competitive intensity positively moderates the influence of entrepreneurial orientation on the business performance of SMEs.

H3b: Competitive Intensity positively moderates the influence of market orientation on the business performance of SMEs.

H3c: Competitive Intensity positively moderates the influence of digital orientation on the business performance of SMEs.

Figure 1 illustrates the conceptual model, depicting direct, indirect, and moderating relationships. Moreover, following prior studies (*e.g.*, Beliaeva *et al*., 2020; Seet *et al*., 2021), we added control variables, including firm age and firm size. Specifically, we determined firm age based on the number of years since the company was established. Furthermore, we based firm size was based on the number of employees at the company who participated in social insurance.

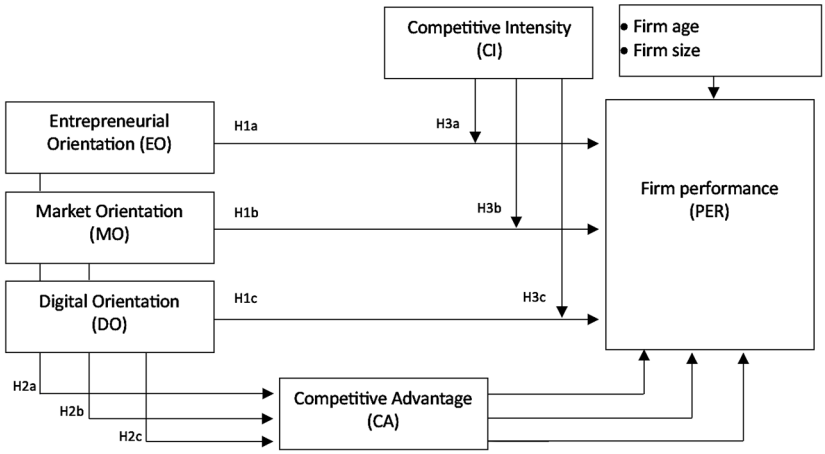

Figure 1. Conceptual model
Source: own elaboration.

RESEARCH METHODOLOGY

We selected Thua Thien Hue province in Vietnam as a research context for this research due to several reasons. The gross domestic product of this province in 2022 increased by 8.56% over the previous year, higher than its growth rate of 4.40 in 2021, in which the service sector made up for 47.56%, followed by industry and construction 33.12%, agriculture, forestry and fishery sector 10.77%, others 8.55%. The number of registered enterprises in this province was around 4.382 enterprises and increased 8.98% compared to 2020 of which non-state enterprises comprising for 98.47% (Thua Thien Hue Statistic Yearbook, 2022).

Before conducting the survey, we conducted a pilot test with 10 managers and enterprise owners to ensure the questionnaires' content. The questions in the interview focused on the main difficulties SMEs suffered during the COVID-19 pandemic and how these business owners overcame the challenges in this crisis period. Through their answers, this research can recognise which kinds of strategic orientation SMEs emphasised and applied in their strategy to improve the business performance in recent years. Moreover, these feedback and opinions helped in revising and developing the questionnaires.

The scales utilised followed a 5-point Likert scale, starting from 1 (strongly disagree) to 5 (strongly agree). Thus far, 5-point Likert scales have been widely used in previous studies such as Keh *et al.* (2007), Seet *et al.* (2021) and Wadood *et al.* (2022). Furthermore, reaching businesses can be quite challenging. A concise 5-point Likert scale instead of other ranges like 7-point or 10-point will help maintain respondents' interest to finish the questionnaire. Table 1 will demonstrate in details about the constructs used in this study.

In this study, we adapted the entrepreneurial orientation (EO) from Beliaeva *et al*. (2020), consisting of nine items divided into three dimensions: innovativeness, proactiveness, and risk-taking. Wales *et al*. (2013) also confirmed that these are the three primary dimensions widely used.

We adapted the measurement for market orientation (MO) used in this study from Beliaeva *et al*. (2020) with three dimensions. However, based on the characteristics of SMEs in Vietnam and the pilot tests, the study employed nine items instead of the original 15 to make the scale more concise. Other studies, such as Zhou *et al*. (2008) and Seet *et al*. (2021), have also adjusted the MO scale in their research. Thus, we explored MO with a primary focus on customer orientation, which includes a (1) commitment to meeting customers' needs, (2) developing business strategies to provide greater value for customers, customers' needs and concentrating on after-sale services, as well as (3) systematically measuring customer satisfaction on a regular basis. Next, we established competitor orientation with three items: (4) regularly discussing competitors' strengths and strategies, (5) focusing on existing customer groups to build competitive advantages, and (6) quickly responding to competitive actions that affect business development. Finally, we used three main items to define inter-functional coordination: (7) coordination among departments to meet the needs of the target market, (8) understanding the value of each employee, and (9) effective collaboration to share resources and information. We omitted the item 'sharing customer-related experiences between departments' due to its overlap with item number 9.

Regarding digital orientation (DO), we adapted the measurement scale based on the studies by Kindermann *et al.* (2021) and Rupeika-Apoga *et al.* (2022), recognizing that DO is a strategy where businesses focus more on the digital marketplace, including the use of digital technologies. Digital technologies encompass the use of the Internet, mobile applications, AI software, robots, big data, and blockchains. In addition to the five items used by Rupeika-Apoga *et al.* (2022) and considering the context of COVID-19 as well as the digital technology capabilities of local SMEs, we added an item related to the transition from traditional business models to online platforms. Furthermore, we also included the commitment to actively seek opportunities for applying digital technologies in the innovation process as the seventh item in the development of this DO scale (Khin & Ho, 2019).

This study measures competitive advantage (CA) using a twelve-item scale adopted from Mahmood and Hanafi (2022). However, since 'customer satisfaction towards products' and 'quick response to customer complaints' share the same interest with other items of the market orientation (MO) scale, we have deducted these two items. Therefore, we used the measurement for CA with 10 items across three dimensions: differentiation (3 items,) market sensing (3 items), and market responsiveness (4 items).

We measured the moderating variable competitive intensity (CI) with a five-item scale, adapted from Jaworski and Kohli (1993) and Tsai and Hsu (2014). We retained four items, which included general competition, promotional wars, readiness to compete with rivals, and price competition. Moreover, during the pilot test with 10 managers and owners of the enterprises, we observed that the intensity of competition in the market was also reflected in companies' efforts to attract top talent through various policies. Therefore, we included the fifth item 'compete to attract top talent' in the scale.

Revenue growth, profit, costs, and market share are four items used to measure the financial performance of businesses (Chen *et al.,* 2007). Financial ratios such as ROA, ROI, and ROE have not been formally measured by local SMEs, so this study did not utilize them. In addition to financial performance, Sihite (2018) states that a company's business outcomes also relate to non-financial performance, such as employee satisfaction. Therefore, in the context of the COVID-19 pandemic, the policies that businesses implement for their employees are essential.

Given time constraints and challenges in obtaining responses from business owners, we utilised a convenience sampling approach. The survey participants were business owners, founders or co-founders, or managers who had an influence on strategic decision-making for the company. The selected businesses must have fewer than 200 employees, as per regulations in Vietnam, where small and medium-sized enterprises (SMEs) are defined as those with fewer than 200 employees. Moreover, to ensure that the sample selection is relevant in the context of the COVID-19 pandemic, we chose businesses that were established before 2022. The sample size was determined according to Hair's recommendation, with a minimum observation-to-variable ratio of 5:1. With 45 variables, the minimum sample of this research is 45 * 5 = 225. 282 responses were collected, and 265 valid responses were used for data analysis. This sample size was sufficient for further analysis.

Table 1. Construct and observable variables

Construct	Number of items	Source
Entrepreneurial orientation (EO)	9	(Beliaeva *et al*., 2020; Wadood *et al*., 2022)
Market orientation (MO)	9	(Zhou *et al.,* 2008; Beliaeva *et al*., 2020)
Digital orientation (DO)	7	(Kindermann *et al*., 2021; Rupeika-Apoga *et al.,* 2022; Khin & Ho, 2019)
Competitive advantage (CA)	10	(Mahmood & Hanafi, 2022)
Competitive intensity (CI)	5	(Jaworski & Kohli, 1993; Tsai & Hsu, 2014)
Business performance (PER)	5	(Chen *et al*., 2007; Sihite, 2018)

Source: own study.

For the purpose of data analysis, as the scales used in this study were adopted from previous studies, this study employed a confirmatory factor analysis (CFA) to check the measurement models, and a structural equation model (SEM) with AMOS 26 to check the influence of strategic orientation on SME's business performance. Firstly, we analysed the issues of reliability and validity before employing a confirmatory analysis (CFA). We used the composite reliability (CR) coefficient and Cronbach's alpha (CA) are used. It should be ensured that CR should be 0.7 or higher and CA should reach at least 0.6 for the scale to be considered reliable (Hair, 2019). We tested the convergence validity by using the average variance extracted (AVE), which has to be greater than or equal to 0.5 (Fornell & Larcker, 1981). Moreover, we ensured the discriminant validity via confirmatory factor analysis. Secondly, based on random 1.000 bootstrapping sampling with a 95% confidence interval, we tested partial and full mediation effects using AMOS. Finally, with the help of the interaction technique, we also tested the moderating effects.

To minimize the possible bias caused by collecting data from a single source and improve reliability, we performed the common method bias (CMB) through the Harman single-factor test (Beliaeva *et al.,* 2020). Accordingly, if the extracted factor explains more than 50% of the variance, the CMB exists. In this study, the first factor explains 37% of the total variance; therefore, CMB is not a significant issue.

RESULTS AND DISCUSSION

Measurement Model

The analysis reveals that the index CMIN/df = 1.951, below the threshold of 3; CFI = 0.926, exceeding 0.9; RMSEA = 0.060, below 0.08. Consequently, the model fits well with the data (Hair, 2019).

We evaluated the reliability of the scale through three indices: composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha coefficient (CA). As depicted in Table 2, all CR values exceeded 0.7, and all AVE values surpassed 0.5. Coupled with CA exceeding 0.6, it confirms that the scales met the requisite standards (Hair, 2019).

We assigned each observed variable a weight exceeding 0.5, with *** denoting statistical significance in the estimation table. Moreover, referring to the data in Table 2, the AVE extracted variance of all scales fell within the range of 0.646 to 0.816, all exceeding 0.5. Hence, we can infer that the scale attains convergent validity (Hair, 2019).

All correlation coefficients between pairs of concepts are less than 1 and statistically significant ($p < 0.05$), indicating their deviation from unity. Furthermore, the square root values of AVE (diagonal and bold lines in Table 6) are higher than the correlation coefficients between constructs (values within the same row and column). Hence, we can deduce that all constructs achieve discriminant validity (Hair, 2019).

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Table 2. Results of estimating the composite reliability coefficient and average extracted variance

Variables	CR	AVE	CA	EO	MO	DO	CA	CI	PER
EO	0.945	0.684	0.944	**0.827**					
MO	0.948	0.669	0.948	0.414***	**0.818**				
DO	0.948	0.722	0.947	0.369***	0.545***	**0.849**			
CA	0.942	0.646	0.941	0.589***	0.429***	0.318***	**0.804**		
CI	0.917	0.689	0.917	0.360***	0.692***	0.540***	0.376***	**0.830**	
PER	0.957	0.816	0.956	0.284***	0.446***	0.425***	0.393***	0.744***	**0.903**

Note. * p < 0.050; ** p < 0.010; *** p < 0.001.
Source: own study.

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Hypothesis Testing

This study aimed to test three groups of hypotheses: testing direct effects of EO, MO, and DO on PER (H1a-H1c), testing mediation effects of CA (H2a-H2c) and testing moderating effects of CI (H3a-H3c) on those relationships. The Chi-square/df = 1.544 < 2, CFI = 0.966 > 0.9, and the RMSEA = 0.045 < 0.08 were considered good. Figure 2 shows the results of the test.

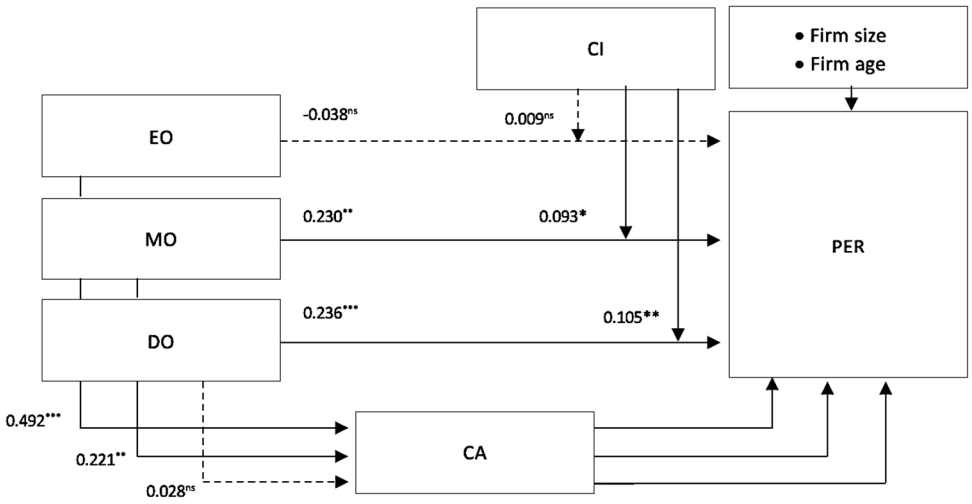

Figure 2. Structural equation modelling results
Source: own elaboration.

The results in the Figure 2 show that EO did not influence PER (ß= -0.038 and p= 0.598 > 0.05), which means that we rejected hypothesis H1a. However, MO and DO significantly influenced PER (ß= 0.230, p= 0.001 < 0.05 and ß= 0.236, p= 0.000 < 0.05 respectively). Therefore, we confirmed H1b and H1c.

In this study, firm age and firm size act as control variables. Based on the results of Table 3, while firm size had no impact on business performance, firm age had a negative impact. This means that in the context of the COVID-19 pandemic, the older the firm, the more its performance tends to decline. This result can probably be explained by the context of the COVID-19 pandemic, which

forced many firms to adapt and change quickly. However, older firms often have less innovative thinking, making it more difficult for them to adapt to the changes.

Next, this research examined the mediating role of CA in these relationships. Results from Tables 3 and 4 show that CA did not mediate the relationship between DO and PER, as its indirect effect was not significant (p= 0.677 > 0.05). On the contrary, CA had an indirect effect on the relationships between EO and PER (indirect effect = 0.102, p= 0.002 < 0.05) and MO and PER (indirect effect = 0.046, p= 0.001 < 0.05). Specifically, EO was fully mediated since its direct effect with PER was not statistically significant (p= 0.502 > 0.05), while MO was partially mediated because its direct effect with PER was statistically significant (p= 0.003 < 0.05).

Table 3. Structural equation modelling results of the model

Structural path	Co-efficient
EO -> PER	-0.038^{ns}
MO -> PER	0.230^{**}
DO -> PER	0.236^{***}
EO -> CA	0.492^{***}
MO -> CA	0.221^{**}
DO -> CA	0.028^{ns}
CA -> PER	0.207^{**}
Control variables	
Firm size -> PER	-0.175^{**}
Firm age -> PER	0.050^{ns}
Model fit indices	
$\chi 2/df$	1.544
RMSEA	0.045
CFI	0.958

Source: own study.

Table 4. Results of mediating impacts

Relationship	Direct effect	Indirect effect	Lower bound and upper bound of the indirect effect	Result	Mediation type
EO -> CA -> PER	-0.038^{ns}	0.102^{**}	(0.026; 0.182)	H2a: Supported	Full mediation
MO -> CA -> PER	0.230^{**}	0.046^{**}	(0.006; 0.105)	H2b: Supported	Partial mediation
DO -> CA -> PER	0.236^{***}	0.006^{ns}	(-0.026; 0.043)	H2c: Rejected	No mediation

Source: own study.

In the context of the COVID-19 pandemic, the economy experienced significant fluctuations, and businesses faced numerous challenges. Although opportunities existed, business had to possess a suitable strategic orientation, dedicated increased effort, engage in further innovation to align with customer and market demands, and adapt to ongoing market fluctuations. Based on an empirical investigation involving a sample size of 265 SMEs and using suitable research methods, the study quantified the impact of strategic orientation components on SMEs' business performance.

Coherent with some previous studies (Van Egeren & O'Connor, 1998; Lettice & Forstenlechne, 2014; Ardito *et al*., 2021), the results of this study indicate that MO and DO have a positive impact on the business performance. In other words, when SMEs focus on the market, specifically on customers, competitors, and inter-functional coordination, or when they consider digital orientation, business outcomes will be better. However, in this case, EO had no direct relationship with SMEs' performance. This finding is consistent with the research of Alegre and Chiva (2013) and Ngo (2021) who revealed that EO was a form of organizational capability, valuable but rare in the market and difficult to imitate. The COVID-19 pandemic has posed significant challenges for businesses, particularly in terms of a lack of resources, both human and financial. As a result, innovativeness, proactiveness, and risk-taking have faced many limitations. Moreover, the market is changing too quickly and is difficult to predict, leading businesses to focus more on safety and asset preservation rather than taking the necessary risks to

innovate, which prevents them from leveraging the advantages of EO. Meanwhile, EO is a type of orientation related to innovation and the willingness to face risks. Therefore, in the changing economic and social environment, SMEs do not perceive the direct positive impact of the EO.

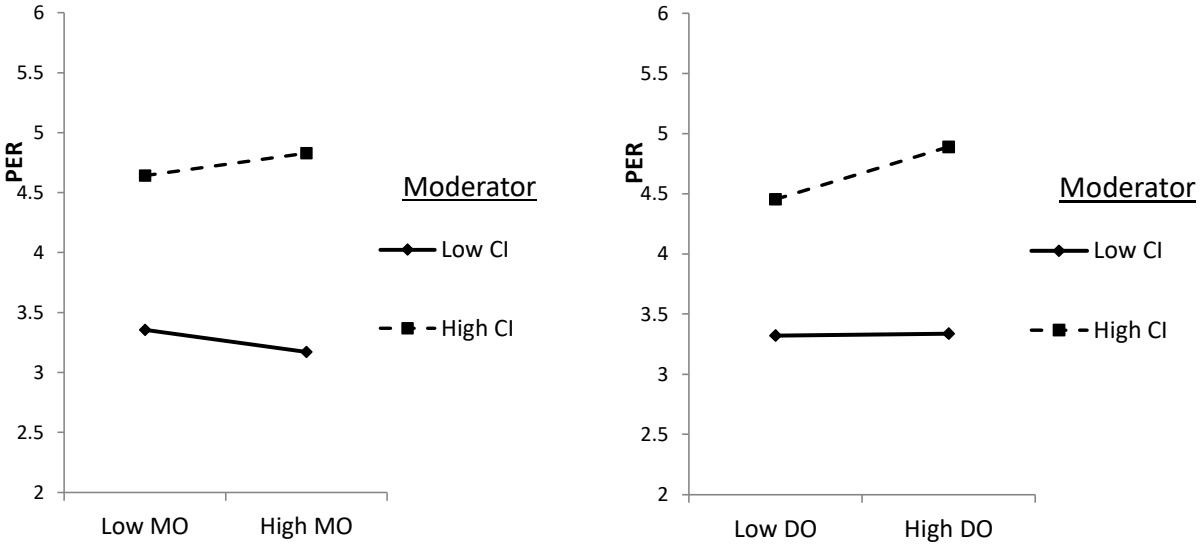

Figure 3. Moderation effects of CI on the relationship of MO, DO, and PER
Source: own elaboration.

Next, the research results also showed that CA mediated the relationship between EO and business performance, as well as MO and business performance. Moreover, SMEs perceive that EO and MO help them strengthen their company's market position compared to rivals in the same industry, thereby enhancing business outcomes. This result is in line with other previous studies such as (Talaja *et al*., 2017; Mahmood & Hanafi, 2013). In terms of theoretical concept, this is consistent with what the resource-based view (RBV) theory has developed, suggesting that a company's market position partly depends on the ownership of rare, difficult-to-imitate resources in the market (Barney, 1995). Meanwhile, EO provides businesses with the ability to innovate and create, thereby gaining a competitive advantage and increasing business efficiency. However, in this study, although DO directly impacted the business outcomes as presented above, CA did not play as a mediator in the relationship between DO and business performance. We could explain this by the current situation of SMEs in Thua Thien Hue Province, where the digital transformation capabilities of SMEs in this area are still very limited and not fully developed. Only when the COVID-19 pandemic emerged did SMEs realize the necessity of digital transformation. Specifically, there is still a lack of big data/AI applications, software application in inventory management/finance, or automation in the production and service supply process. Therefore, they have not fully utilised the advantages provided by DO, thereby enhancing competitive capabilities and business outcomes.

Finally, regarding the moderating role of CI on the relationship between the three types of strategic orientation and the business outcomes, the research results show that CI positively moderates the relationship between MO and DO on the business performance. This means that in an environment where CI becomes more severe, MO and DO have a more positive impact on SMEs' performance. Thus, these results partly demonstrate that during the COVID-19 pandemic, in the situation of increasing market competition intensity, if SMEs focus more on MO, meaning they concentrate more on meeting the needs of customers and the market, as well as adopting DO, then the business outcomes will improve. Meanwhile, CI does not moderate the relationship between EO and the business outcomes of enterprises. We may explain this by the fact that during the COVID-19 pandemic period, when the market experienced many fluctuations and it as difficult to predict what would happen, current businesses would choose safety over increasing capital to invest in risky projects. Martin and Javalgi's study (2016) on the impact of CI on the relationship between EO and PER supports this finding.

CONCLUSIONS

Drawing insights from survey responses from 265 SMEs in Thua Thien Hue Province, this study addressed inquiries regarding the impact of strategic orientation on business performance amid the COVID-19 pandemic. Utilising prior research as a foundation and integrating detailed interviews with local SMEs, the study identified three key orientations, *i.e.*, market orientation (MO), entrepreneurial orientation (EO), and digital orientation (DO), which are deemed significant in influencing business outcomes and commonly embraced by SMEs. Among these, MO and DO directly affected the business performance, while EO did not. However, when examining the relationship between these three types of orientations through the mediator CA, the results indicated that competitive advantage served as a mediator between EO and PER, MO and PER, but not for DO. In a highly competitive environment, the impact of MO and DO on PER became stronger in a positive way. However, CI did not moderate the relationship between EO and PER. The results of this study also contribute to clarifying the resource-based theory, as it becomes evident that SMEs possessing typical resources can leverage existing potentials, thereby enhancing the business outcomes (Monday *et al.,* 2015).

Based on the research findings, we propose SMEs to enhance and improve activities relating market orientation including: (1) establish key performance indicators (KPIs*)* to regularly monitor and track customer satisfaction; (2) discuss the strengths and weaknesses of competitors frequently; and (3) SMEs need to establish an internal management information system to tighten the management of each stage within each department. In today's era of technological development, there are numerous software programs and tools available to help SMEs' owners easily manage and share information internally accurately and quickly. Building an effective information management system also facilitates interdepartmental collaboration among employees, allowing them to address issues by understanding their root causes and finding solutions. Next, SMEs should continue implementing digital transformation activities and view digitial orientation as essential: (1) Employ advanced technologies such as accounting software or ERP system to improve labour efficiency (2) SMEs need to further understand the concept and application of big data as well as AI technology in the production process. Finally, the competitive advantage of SMEs will maximise when the enterprise orients towards entrepreneurial activities: (1) Enterprises need to be proactive and pioneering in introducing new business ideas and products to the market. (2) Enterprises need to maintain a calm attitude in facing risks and solving problems once they have accepted high profit business projects. (3) Consider investing more capital and put more effort into research and development (R&D).

Although the research results are consistent with earlier studies, this study still has some limitations. (1) Due to limited opportunities to meet SMEs' managers in Thua Thien Hue Province and low response rate, the study selected non-probability sampling, resulting in relatively low representativeness; (2) Despite considering the study in the context of the COVID-19 pandemic, each region and country faced different circumstances, environments, and business conditions. Therefore, the research results here require explanation and cautious comparison as they may vary depending on the context of different countries. (3) Measurement on business performance was subjective because most SMEs in Thua Thien Hue province did not consider about some financial indicators such as ROA, ROE, ROI. Regarding financial performance, they only take into consideration of revenue, profit and market share. Therefore, future studies should consider surveying with probability sampling methods, if possible, to enhance the representativeness. Scholars can evaluate the observable variables in the business performance measurement based on specific indicators such as ROA (Return on Assets), ROE (Return on Equity), and ROI (Return on Investment).

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Conflict of Interest

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Entrepreneurs' network characteristics and their perceived success in raising equity: Evidence from the business angel market

Justyna Zygmunt

ABSTRACT

Objective: The article investigates the nexus between the characteristics of entrepreneurs' networks and their perceived success in attracting funding from business angels.

Research Design & Methods: The article is based on a quantitative study. The data source was a survey of 40 Polish early-stage ventures that had secured angel funding. The ventures were identified by searching the Crunchbase database and the websites of Polish business angel groups. Several methods were used in the article: the chi-square test of independence with correction for Yates' continuity, the one-tail Fisher exact test, and Spearman's rank correlation coefficient.

Findings: The research results indicate that network size, contact frequency, and relationship quality are associated with entrepreneurs' perceived success in raising capital from business angels. It was also found that there are differences in the potential of entrepreneurs' network ties to contribute to this success. The results prove that more experienced entrepreneurs, in particular, are able to use their networks to facilitate their success in attracting angel funding.

Implications & Recommendations: While networks are generally perceived as beneficial, the article shows that maintaining and developing relationships with specific actors, in particular with business advisors, mentors, external equity investors, as well as lawyers, can be important for the success of a venture when seeking external equity funding. This may provide an incentive for entrepreneurs to strategically build network relationships that are effective and useful when raising capital from business angels.

Contribution & Value Added: While previous studies have not quantified the role that entrepreneurial networks can play in securing angel funding, this article makes an important contribution by providing empirical evidence on how entrepreneurs perceive their networks as useful in meeting their needs when raising equity from business angels.

Article type: research article

Keywords: entrepreneur; networks; business angels; equity; Poland

JEL codes: L14, L26, G32

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INTRODUCTION

To overcome the liabilities associated with being new and small (Stinchcombe, 1965; Freeman *et al*., 1983), nascent entrepreneurs interact with others in their external environment to gain access to needed resources (Salancik & Pfeffer, 1978). Networks, understood as 'the set of relationships or contacts that an entrepreneur has' (Sullivan & Ford, 2014, p. 501), are thought to have an important influence on entrepreneurial success. However, previous literature has documented inconclusive findings in this area. On the one hand, there is broad agreement that networks mitigate the impact of

knowledge gaps in new venture development (Niyawanont, 2023), enhance entrepreneurial competencies such as opportunity refinement and resource acquisition (Rasmussen *et al.*, 2015), and facilitate the scale and pace of a company's internationalisation process (Maciejewski *et al.*, 2022). On the other hand, scholars suggest that networks can be costly to maintain (Gargiulo & Benassi, 2000), may involve a significant risk of knowledge leakage (Pahnke *et al.*, 2015), and may not improve competitive position in certain industries (Wierzbiński *et al.*, 2023).

Given the high uncertainty surrounding new ventures, one of the greatest challenges nascent entrepreneurs face is securing external funding (Shane & Cable, 2002). As several studies have shown, despite drawbacks, one cannot deny the role of networks in this process. Previous research has found networks to provide legitimacy to external stakeholders (Stam *et al.*, 2014), to help identify funding sources, and to act as intermediaries by connecting new ventures with funders (Heuven & Groen, 2012). Their role appears to be particularly important in the early-stage funding market, which, in many cases, is the only source of external finance available to new ventures seeking to grow. The limited empirical evidence that exists suggests that the closer the network distance between early-stage investors, such as venture capital firms or business angels, and the new ventures in their network of connections, the more valuable they are and the better the chances of the latter being funded (Pasquini *et al.*, 2019).

This study focuses on early-stage ventures that have secured funding from business angels. We focused on the angel market because, although its importance as a source of funding for new ventures is well established (Mason *et al.*, 2017; Cowling *et al.*, 2021), the relevance of networks in the match between ventures and angels has so far received limited attention from scholars. This is probably because this market is largely opaque and invisible (Avdeitchikova *et al.*, 2008), making it difficult to gather reliable data. Recently, a few related articles have shed some light on the role of networks in the matching process between ventures and angels, but most of them examine only the investor side. Previous research has shown that angels use their personal networks to reduce uncertainty and information asymmetry when evaluating entrepreneurs and their ventures (White & Dumay, 2017). They also build co-investment networks through syndication with other angels to optimise the risk of their investment portfolios, especially when validating information about new industries they are considering investing in (Antretter *et al.*, 2020). Moreover, scholars have found that angels pay considerable attention to the characteristics of the entrepreneur's network when making investment decisions, as this can significantly impact the flow of resources to the venture and, thus, its performance (Cowling *et al.*, 2021).

The research gap is particularly evident on the entrepreneur side, which is somewhat surprising given that entrepreneurs generally struggle with a lack of knowledge about how to access the angel market (Landström & Sørheim, 2019) and what attributes they and their ventures need to possess to receive angel funding (Svetek, 2022). Learning from others who have been through the process before and getting external advice or validation can help reduce the challenges of identifying and understanding the business angel market. While it appears that entrepreneurs who use their networks are in a better position when approaching business angels, scholars have rarely explored this issue. The limited empirical evidence to date focuses largely on angel industry networks and suggests that entrepreneurs pay attention to their strength and nature when choosing which angels to approach (Granz *et al.*, 2021), as these may strongly determine the contribution of angels to the value added to the venture. Less is known about the extent to which entrepreneurs perceive their network as favourable and helpful in securing funding from business angels. This deficiency has led to calls for research to explore the relevance of entrepreneurs' networks when approaching business angels (Landström & Sørheim, 2019). Our article aims to fill this gap by investigating the nexus between the characteristics of entrepreneurs' networks and their perceived success in attracting funding from business angels. To achieve the objective, we used the CATI (Computer-Assisted Telephone Interviewing) method based on a survey questionnaire among early-stage ventures that had secured angel funding. We used the chi-square test of independence with correction for Yates' continuity, the one-tail Fisher exact test, and Spearman's rank correlation coefficient as data analysis methods.

Existing empirical studies have not quantified the role that entrepreneurial networks can play in securing angel funding. The answer to this question is important, given that less than 3-4% of ventures successfully attract angel funding (Mason *et al.*, 2017). The novelty and originality of our research lies

in revealing that network characteristics such as size, contact frequency and relationship quality can be associated with perceived success in raising capital from business angels. We shed light on which particular network ties facilitate this success, as we found that they are not equally important. We add to the entrepreneurial literature by clarifying how network involvement can influence an entrepreneur's ability to successfully raise capital from business angels, and should therefore be useful to entrepreneurs and policymakers. In particular, while the role of mentors and advisors in providing early-stage entrepreneurs with knowledge-based resources, identifying new opportunities and expanding their networks has been widely acknowledged (Sullivan, 2000; Ozgen & Baron, 2007), we contribute to the literature on the role of networks in early-stage venture financing by showing that, in the business angel market, their importance in raising equity capital may depend on certain characteristics of entrepreneurs' human capital and increases with their age and entrepreneurial experience. Our research also extends the knowledge on the extent to which the size of the entrepreneur's network matters for the valuation and the amount of capital from business angels that the entrepreneur is satisfied with. According to the literature, entrepreneurs can benefit from the expanded network when approaching investors (Shane & Cable, 2002) and subsequently increase their success rate in raising capital (Zhang *et al*., 2008). However, our research suggests that when it comes to attracting angel funding, it is particularly important for those entrepreneurs who have been through the process once before. Another contribution of our study is to extend research on the business angel market to a new geographical and market development context. While previous research on the business angel market has largely focused on mature markets, particularly in the UK and the US (Mason *et al.*, 2017; White & Dumay, 2017), the Polish market provides an interesting context due to its youth and its position as one of the markets with a higher angel investment to GDP ratio compared to more mature markets (EBAN, 2017).

The rest of the article is structured as follows. In the following section, the literature is reviewed and the research hypotheses are developed. Next, the research methodology is described and the results and discussion are presented. The final section provides concluding remarks and future research suggestions.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Most early-stage, high-growth, innovative ventures (Zygmunt, 2022) face financial constraints and challenges in raising external capital. While the successful raising of this capital is seen as critical to the development and survival of these ventures (Bilau & Sarkar, 2016), only a limited number of types of investors are willing to provide it due to the high level of ambiguity and uncertainty, and thus the likely high failure rate (Capizzi, 2015). One of these is business angels, wealthy individuals who make equity investments in unlisted companies to which they have no family ties (Mason & Harrison, 2008).

Previous research examining the success in attracting angel funding has largely focused on the investor side. In general, researchers suggest that what matters in the angels' decision to invest in a venture is that the entrepreneur/management team has certain characteristics, such as openness, honesty and trustworthiness, and a realistic approach to valuation and equity stake (Mason *et al.*, 2017). Scholars have also found that market potential and product readiness with a realistic route to market constitute important factors for angels when deciding whether to invest in an early-stage venture (Scott *et al.*, 2016). Moreover, according to the literature, even if the venture does not initially match their preferences, angels are more likely to invest in it if it has been recommended to them by another party whom they trust (Paul *et al.*, 2007). Recent research has enriched this perspective by providing evidence that the decision to invest in a venture may also depend on angels' human capital and cognition, such as previous professional and investment experience and decision-making style (Bonnet *et al.*, 2022).

While previous studies have looked mainly at the process of raising external capital from the investor side, issues related to the entrepreneur's perspective on the success factors in this process remain less explored. Our article is, therefore, positioned differently as we focus on how entrepreneurs perceive the characteristics of their networks as relevant to their success in attracting funding from business angels. In doing so, we draw on network theory, which suggests that involvement in networks can enhance the success of a venture (Rasmussen *et al.*, 2015), and on the evidence that one way in which entrepreneurs can compensate for a scarcity of financial resources is through networking (Heuven & Groen, 2012).

Scholars have found that networks influence venture financing decisions and help to overcome information asymmetries between entrepreneurs and potential investors (Shane & Cable, 2002). Furthermore, literature observes that entrepreneurs are likely to establish new network links in search of contacts who can act as intermediaries in accessing external finance (Jones & Jayawarna, 2010) and tend to use the legitimacy and reputation of their networks to enhance this access (Semrau & Werner, 2014).

Given that the business angel market is largely anonymous and invisible (Antretter *et al.*, 2020), it can be a challenge for entrepreneurs to understand the mechanisms that drive this market, in particular, how to properly prepare the funding proposal or how to deal with angels during the funding process. This may explain why as many as 73% of funding proposals are rejected outright by angels, and only a small proportion of those that make it past the pitch deck stage receive funding (Grilli, 2019). Therefore, we argue that networks are essential for entrepreneurs when they are constrained by a lack of, or limited, knowledge of how the business angel market works, how to assess the value of their ventures and how to negotiate the amount of capital the business angel will invest in the venture in return for equity.

Research on social embeddedness and social capital has accumulated strong evidence justifying the need to develop and maintain networks (McKeever *et al.*, 2014), and it is now widely accepted that entrepreneurship is embedded in networks of various kinds (Davidsson & Honig, 2003; Stuart & Sorenson, 2005). Building on previous research, which indicates that networks provide competencies, seen as knowledge and skills (Hayton & Kelley, 2006), that most entrepreneurs lack and need to build as they develop their ventures, we suggest that participation in networks can help overcome information asymmetries. Indeed, there is a strong emphasis on the importance of social ties in funding early-stage ventures (Shane & Cable, 2002). Lim and Cu (2012) argue that social ties help to alleviate issues arising from asymmetric information between early-stage equity investors and entrepreneurs, particularly when such ties are formed at the pre-funding stage. Networks may act as a primary source of knowledge useful in identifying and approaching business angels and providing valuable feedback (Drencheva *et al.*, 2022) and validation that entrepreneurs may need to increase their bargaining power when negotiating deals with angels. We suggest that network characteristics such as size and diversity, contact frequency and relationship quality, and the relevance and reliability of information from the network may be important for perceived success in raising external capital (Shane & Cable, 2002; Sullivan & Ford, 2014).

We may assume that the larger the networks, the greater the entrepreneur's chances of attracting angel funding, as larger networks are thought to increase the entrepreneur's access to various resources, including financial capital (Heuven & Groen, 2012). Indeed, as noted by Mollick (2014), the number of a founder's social network ties is positively associated with the amount of capital raised from investors. However, there is no consensus on whether such a relationship is linear. While some scholars claim that network expansion is beneficial as it limits dependence on particular network ties (Reagans & Zuckerman, 2008), others argue that increasing network size and relationship quality may lead to diminishing marginal returns in accessing financial capital (Semrau & Werner, 2014). We then suggest that an extensive network may not necessarily facilitate positive outcomes for entrepreneurs raising capital in the early-stage funding market. The rationale for this is grounded in the previous studies that prove that only a narrow set of ties are useful for new ventures (Zhang *et al.*, 2008). Therefore, the ability to access knowledge from the network and use it to leverage the chances of attracting funds from business angels may be severely limited, as there may not be many ties in the network who have been through the process before and could share experiences, provide feedback or, as observed by Heuven and Groen (2012), act as referrers, making it easier to approach an investor. Thus, we hypothesised:

H1: The network size is associated with the perceived success in attracting funding from business angels.

Access to a wide range of resources is also more likely when networks are diverse (Jones & Jayawarna, 2010). The use of different network contacts can contribute to the acquisition of diverse knowledge and feedback. It may be beneficial in closing the distance between equity investors and entrepreneurs (Pasquini *et al.*, 2019), thereby increasing the chances of securing funding. Stam *et al.* (2014) suggest that network diversity helps entrepreneurs manage their knowledge deficits by providing access to more diverse knowledge sets. Other scholars also argue that diverse networks improve

the reliability of information because the same information can be received by entrepreneurs from different sides (Heuven & Groen, 2012), allowing for its validation and relevancy assessment. Thus, we argue that entrepreneurs with a more diverse network appear to be better equipped to approach business angels and more successful in attracting their funding, and we hypothesised:

H2: The diversity of the network is associated with the perceived success in attracting funding from business angels.

The evidence is inconclusive as to whether the frequency of contact with the network is important for venture success. On the one hand, it is argued that it positively affects knowledge sharing and information asymmetry between ties (Florida & Kenney, 1988). According to previous research, contact frequency increases trust and commitment and is significant for high relationship quality (Semrau & Werner, 2014). This can greatly facilitate the exchange of information, which can be crucial in raising funds from business angels, including sensitive issues, in particular those concerning negotiated valuations or the amount of equity allocated in an angel round. On the other hand, while it is understandable that entrepreneurs may need to spend some time building their network, there are claims that they should be careful who they allocate their time to, as this may prevent them from developing contacts with valuable ties (Gargiulo & Benassi, 2000). Thus, we hypothesised:

H3: The frequency of contact with the network is associated with the perceived success in attracting business angel funding.

Network quality has been observed to be an intrinsic driver for early-stage ventures in the fundraising process (Huynh, 2016). Therefore, we expect that the quality of the relationship with the network is associated with success when raising funds from business angels. We draw on Drencheva *et al.* (2022), who argue that the venture's success strongly depends on the extent to which entrepreneurs approach the appropriate ties that can provide the necessary feedback of good quality. Relationship quality also involves trust, which facilitates the flow of information (Jaiswal-Dale *et al.*, 2022) and its use by entrepreneurs in their financial decisions. It also determines the accuracy and timing of information received from the network (Borgatti & Cross, 2003). Hence, we expect that establishing and maintaining a quality relationship with the tie is one of the keys to making use of the network and gaining knowledge about how the business angel market works, how to prepare for the funding process, and even when seeking introductions to early-stage equity investors (Lim & Cu, 2012), especially when one cannot access them directly and needs to develop trust-building mechanisms to increase legitimacy to obtain funding (Heuven & Groen, 2012). Therefore, we hypothesised:

H4: The relationship quality with the network is associated with the perceived success in attracting business angel funding.

The quality of business-relevant and reliable information that the network can provide is crucial for entrepreneurs (Huynh, 2016). The relevance of information should strongly influence the success in attracting angel funding. Indeed, it has been found that network's size and diversity do not protect against knowledge shortcomings, as knowledge of network ties comes from the individual experience of such ties (Sullivan & Ford, 2014). Thus, entrepreneurs who lack relevant knowledge about the angel market are likely to seek it within the current network and, if necessary, develop their network to manage information asymmetries to possess relevant knowledge (Kuhn & Galloway, 2015). Based on O'Reilly (1982), we also suggest that the reliability of information from the network may increase the likelihood of success in attracting angel funding, as it may provide a plausible basis for entrepreneurs to prepare adequately for business angel fundraising. The reliability and relevance of information seem to be fundamental in recognising how business angels work, how to successfully prepare a pitch deck and how to negotiate a deal with a business angel since entrepreneurs commonly face a lack of knowledge about how to access the angel market (Grilli, 2019). Therefore, we expect a link between network relevance, reliability, and funding success.

H5: The relevance and reliability of network information are associated with the perceived success in attracting business angel funding.

RESEARCH METHODOLOGY

Given the quantitative nature of the study, to investigate the nexus between the characteristics of entrepreneurs' networks and their perceived success in attracting funding from business angels, we chose a survey method using CATI among Polish early-stage ventures that had secured angel funding. The use of a quantitative approach allowed us to determine relationships (Stockemer, 2019) and is considered well-suited for providing information about the structure and patterns of social networks (Yousefi Nooraie *et al.*, 2020). It is widely employed in social network analysis. A recent review of studies on how entrepreneurs develop and use social networks demonstrated the dominance of the quantitative approach, with survey methods accounting for almost 70% of studies adopting this approach (van Burg *et al.*, 2012). We relied on CATI, which is well-suited when the question structure has many options (Choi, 2004).

We based the survey on the findings of the literature review. It consisted of several parts, which required the respondents' opinions on the following concepts: (1) key characteristics of the network, (2) the importance of networks in the business angel fundraising process, (3) approach to venture valuation, (4) networks after funding round, (5) the success in attracting angel funding, (6) general information about the respondent and the venture. We pre-tested the survey for clarity and layout (Collins, 2003) with two early-stage entrepreneurs. The Cronbach alpha is 0.791. Table 1 presents an overview of the variables used in the analysis. We measured success in attracting angel funding by three variables. Given the widely acknowledged difficulty of measuring success (Zajkowski *et al.*, 2022) and the fact that details of angel-entrepreneur contracts or negotiated valuations are, in most cases, confidential (Pasquini *et al.*, 2019), we followed Svetek (2022) and focused on entrepreneurs' perceptions. The variables included entrepreneurs' assessment of whether their expectations were met with respect to the following areas: (i) the valuation negotiated with the business angel, (ii) the equity stake taken out as a result of an angel round, (iii) the amount of capital invested in the venture by the business angels.

To characterise the network, we selected structural, relational, and information quality variables. Items included a set of listed network members, adapted from Kuhn and Galloway (2015) and Gao *et al.* (2023), with an option for respondents to insert a network member if not included in the previous items. We found the items complete, as none of the respondents used the option to add a source. For the structural dimension of the network, we considered the size of the network and its diversity. To operationalise network size, we followed Sullivan and Ford (2014) and asked respondents to rate the number of people they interacted with for business-related purposes over the past year. We measured diversity as the variety of contacts (Stam *et al.*, 2014). For the relational dimension of the network, we considered contact frequency and relationship quality. To measure contact frequency, we followed Heuven and Groen (2012) and asked respondents how often they interacted with network members for business-related purposes over the past year. We measured relationship quality by the regularity of contact with network members (business or otherwise) over the past year. For the quality of information within the network, we drew upon O'Reilly (1982) and Huynh (2016) and considered the perceived relevance and reliability of the network by the entrepreneur. We included several control variables. We controlled for age, as previous research suggests that people tend to have more contacts as they get older (Semrau & Werner, 2014). We also controlled for human capital, as entrepreneurs' previous work experience and education may indicate differences in skills and expertise. Following Manolova *et al.* (2006), we measured general human capital as the level of education. In line with prior studies, we measured task-specific human capital by the following variables: entrepreneurial experience, managerial experience, and industry experience. Based on Morris *et al.* (2012), we measured entrepreneurial experience as the number of years of being involved in previous venturing activities. Managerial experience was measured by the number of years of experience in senior management positions (Klyver & Arenius, 2022), while we measured industry experience by the number of years of experience in the sector in which the venture operated (Stam *et al.*, 2014). Consistent with Falik *et al.* (2016), we also controlled for entrepreneurs' experience in approaching business angels for funding, as we expect more experienced entrepreneurs to make less use of their network in this regard.

Table 1. Variables and items

Variables	Items
Perceived success variables	
Valuation	The valuation of the venture negotiated with the business angel was in line with what I had expected [5-point scale, anchored '1 = Definitely not' to '5 = Definitely yes']
Equity stake	The equity stake taken out as a result of an angel round was in line with what I had expected [5-point scale, anchored '1 = Definitely not' to '5 = Definitely yes']
Capital invested	The amount of capital invested in the venture by the business angels was in line with what I had expected [5-point scale, anchored '1 = Definitely not' to '5 = Definitely yes']
Network variables	
Network size	The number of people in the network relevant to my business in the last year [1 = up to five people; 2 = 6-10 people; 3 = 11-20 people; 4 = 21-30 people; 5 = more than 30 people]
Network diversity	The number of various business-relevant contacts in my network in the last year [1 = 1; 2 = 2-3; 3 = 4-6; 4 = 7-9; 5 = 10 and above]
Contact frequency	The frequency of contacting the network for business-related purposes in the last year [1 = none; 2 = less than once a month; 3 = once a month; 4 = several times a month; 5 = several times a week]
Relationship quality	The regularity of contact with network members (business or otherwise) in the last year [1 = none; 2 = less than once a month; 3 = once a month; 4 = several times a month; 5 = several times a week]
Information relevance	The relevance of business-related information from your network [5-point scale, anchored '1 = Definitely not relevant' to '5 = Definitely relevant']
Information reliability	The reliability of business-related information from your network [5-point scale, anchored '1 = Definitely not reliable' to '5 = Definitely reliable']
Controls	
Age	How old are you? [1 = 18-25 years old; 2 = 26-35 years old; 3 = 36-45 years old; 4 = 46-55 years old; 5 = 56 years old and more]
General human capital	
Level of education	What is your highest education level? [1 = primary school; 2 = lower secondary school; 3 = secondary school; 4 = uncompleted university degree; 5 = university degree]
Task-specific human capital	
Entrepreneurial experience	What is your experience in previous venturing activities? [metric, in years]
Managerial experience	What is your experience in senior management functions? [metric, in years]
Industry experience	What is your experience in the sector in which the venture operates? [1 = one year or less; 2 = two to five years; 3 = six to ten years; 4 = eleven to fifteen years; 5 = over fifteen years]
Experience in approaching business angels for funding	What is your experience in approaching business angels for funding? [1 = once; 2 = two to four times; 3 = five times or more]

Source: own study.

To select the appropriate method of data analysis, we first considered the nature of the data distribution. This approach arose from the growing debate about whether Likert items should be interpreted as interval or ordinal (Norman, 2010; South *et al.*, 2022). In turn, this determines the use of non-parametric or parametric tests. We performed the Shapiro-Wilk test and found that the data did not follow a normal distribution, so we turned to non-parametric tests (Kuzon *et al.*, 1996). Given the nature of the data and the sample size, we followed the methodological approach adopted in previous studies (Bilau & Sarkar, 2016). To compensate for deviations from the theoretical probability distribution if the total N assessed in the contingency tables is less than 40, we used the chi-square test of independence with correction for Yates' continuity to explore the relationship between two variables (with two or more categories). When expected cell frequencies were low (<5), we used the one-tail Fisher exact test (Sobel, 1995). In line with previous studies (Daszkiewicz, 2019; Klyver & Arenius, 2022), we used Spearman's

rank correlation coefficient (r_s) to determine the strength and direction of the association between variables. In line with the literature, we assumed that $0 \leq |rs| \leq 0.4$ indicates a weak relationship, $0.4 < |rs| \leq 0.7$ shows a moderate relationship, and $0.7 < |rs| \leq 1$ represents a strong relationship.

We based our research in Poland because it is an interesting research context. First, because it is a transitional economy. For a long time, it was centrally planned, and entrepreneurial activity was severely hampered. At the end of the 1980s, Poland began the transition to a market economy, which entailed radical changes in its structure. This lowered barriers to entry for the private sector (Zygmunt, 2018) and improved access to external finance, creating conditions for the development of entrepreneurial activity. Nowadays, the business environment in Poland is said to have grown rapidly over the last decade (Dość & Pattarin, 2024) but still lags behind more developed Western Europe (Lisowska, 2016). Second, focusing on the Polish business angel market offers an interesting context due to its relatively early stage, as it is claimed to have evolved significantly only following Poland's accession to the European Union in 2004 (Brzozowska, 2008). However, despite being small compared to older markets, it is gradually growing, with a reported 185% year-on-year increase in angel investment in 2021 (EBAN, 2022). According to the European Business Angels Network, between 2016 and 2020, the visible part of this market consisted of 500 business angels. It was worth an average of 14.7 million EUR, with an average of 48 funding rounds per year, including both initial and follow-on angel investments in ventures. Compared to other Central and Eastern European countries, the Polish visible market has the highest total business angel investment activity, both by amount and number of investments (EBAN, 2022).

The difficulty of sampling the market of business angels and their portfolio companies is well known (Mason & Harrison, 2008; Bilau & Sarkar, 2016) due to its large invisibility (Avdeitchikova *et al.*, 2008). This meant that we relied on non-probability sampling, which is in line with previous studies (Bonini *et al.*, 2018; Mason *et al.*, 2017). We used two sources to collect the sample for this study. Firstly, we identified ventures by searching the Crunchbase database. Crunchbase provides a comprehensive global database of companies, investors, funding rounds and more and is increasingly used as a data source for research on entrepreneurship, including the angel market (Alexy *et al.*, 2012; Dalle *et al.*, 2017). We filtered records by the company's location (Poland) and investor type (individual/angel, angel group). We then carefully analysed each company's records, eliminating those where the company was no longer active or funded solely by the owner(s), as Crunchbase's 'individual/angel' filter may also include such situations. As a second source of data, we subsequently searched the websites of Polish business angel groups for information on their portfolio of companies, based on previous observations (White & Dumay, 2017; Cowling *et al.*, 2021) that business angels tend to invest geographically close to their investee companies.

In total, we identified 110 ventures that had secured only an initial angel investment, as well as those that had also secured follow-on rounds. Firstly, an email invitation to all these ventures to participate in the study was sent with a cover letter. Next, it was followed with telephone calls to check their willingness to participate in the research. The data was collected between April and May 2023. The number of respondents from both sources was 40, giving an overall response rate of 36%. Whilst a higher response rate would be preferable, this is comparable to previous research on the markets of early-stage investing, even these highly mature (Wright *et al.*, 2004; Bonnet *et al.*, 2022). Given the specificity of the business angel market, it is not possible to assess representativeness as it is impossible to identify the entire population (Capizzi, 2015). However, regarding the characteristics of the Polish business angel market, the sample size could be assessed as large.

The respondents were 83% men, 48% under the age of 35 and 88% of university graduates with varying levels of experience in raising angel funding. The sample distribution reflects trends in early-stage entrepreneurial activity in Poland, with low levels of women entrepreneurship (GEM, 2023). The ventures were from the IT and automation industry (48%), services and trade (35%), and other industries (medical, food industry, furniture industry). 55% of them secured at least one follow-on round. The vast majority of ventures (70%) were no more than two years old when they received their first round of funding from business angels. Approximately 58% were developing products or services and were not generating revenue at the time.

RESULTS AND DISCUSSION

Table 2 shows the descriptive statistics of the variables used in the analysis.

Table 2. Descriptive statistics

Variables	Median	Mode	Range	Skewness	Kurtosis
Valuation	5	5	1	-1.05	-0.95
Equity stake	5	5	4	-2.71	8.35
Capital invested	5	5	4	-2.37	5.44
Network size	2	2	4	1.53	2.51
Network diversity	3	3	3	0.92	1.24
Contact frequency	2	1	4	0.51	-0.60
Relationship quality	2	2	4	0.22	0.36
Information relevance	3	1	4	0.25	-0.53
Information reliability	4	1	4	0.51	0.27
Age	3	3	3	0.24	-0.21
Level of education	5	5	1	-2.36	3.74
Entrepreneurial experience	7	7	13	0.78	0.07
Managerial experience	7	5	18	1.04	0.95
Industry experience	2	2	3	0.25	-0.74
Experience in approaching business angels for funding	2	2	2	0.18	-1.02

Source: own study.

For the perceived success variables, there is no variation in the median and mode, indicating that the middle and the most frequent response was 5 ('definitely yes'). This means that, for the most part, respondents perceived the equity stake taken out as a result of an angel round, the amount of capital invested in the venture by the business angels and the valuation of the venture negotiated with the business angel to be in line with their expectations. However, the range for 'equity stake' and 'capital invested' shows the diversity of respondents' answers (range 4), with a fairly homogeneous view on valuation (range 1). For the network variables, the descriptive statistics give a more varied picture. In particular, most respondents' network size was 6-10, and the number of various business-relevant contacts in their network was 4-6 (mode 2 and 3, respectively). Half of the respondents considered the information reliability of their network to be reliable, while the information relevance was rated less highly (median 4 and 3 respectively). Regarding task-specific human capital, most respondents had seven years of entrepreneurial experience, five years of managerial experience and two to five years of industry experience (mode 7, 5, and 2, respectively).

We examined the correlations and found evidence of a strong relationship between some of them (Table 3). Among the perceived success variables, we found a high correlation between the variables expressing the entrepreneurs' assessment of whether their expectations were met in terms of the equity stake taken out as a result of an angel round ('equity stake') and the amount of capital invested in the venture by the business angels ('capital invested'). In the group of network variables, we found a strong relationship between the size of the network and its diversity. We also found evidence of a high correlation between information relevance and relationship quality, as well as between information reliability, contact frequency, and information relevance. In the controls, we detected a strong relationship between industry experience, age and managerial experience. Therefore, we excluded the following variables from further analysis: equity stake, network diversity, information relevance, information reliability, and industry experience.

As there are several ways to capture perceived success in attracting business angels, hypotheses were independently tested for (i) the valuation negotiated with the business angel and (ii) the amount of capital invested in the venture by the business angels. Table 4 shows the results of the hypothesis testing concerning the contact frequency and relationship quality.

Table 3. Correlation matrix (Spearman's rank correlation)

Variables															
Valuation	1.00														
Equity stake	0.72*	1.00													
Capital invested	0.65*	0.82*	1.00												
Network size	0.53*	0.42*	0.48*	1.00											
Network diversity	0.25	0.20	0.19	0.70*	1.00										
Contact frequency	0.20	0.06	0.06	0.36*	0.53*	1.00									
Relationship quality	0.22	0.18	0.28	0.56*	0.55*	0.32*	1.00								
Information relevance	0.21	0.13	0.10	0.23	0.42*	0.82*	0.33*	1.00							
Information reliability	0.19	0.21	0.13	0.20	0.42*	0.71*	0.35*	0.94*	1.00						
Age	-0.05	-0.10	0.03	0.23	0.19	0.28	0.21	0.13	0.16	1.00					
Level of education	0.11	0.00	0.12	0.17	0.11	0.05	-0.11	-0.10	-0.12	0.23	1.00				
Entrepreneurial experience	-0.28	-0.30	-0.21	0.03	0.03	0.23	0.20	0.14	0.16	0.43*	-0.07	1.00			
Managerial experience	-0.23	-0.29	-0.22	-0.04	-0.24	0.07	0.12	0.03	0.04	0.49*	-0.06	0.64*	1.00		
Industry experience	-0.23	-0.26	-0.15	-0.01	-0.04	0.23	0.13	0.07	0.11	0.76*	0.13	0.66*	0.79*	1.00	
Experience in approaching business angels for funding	0.56*	0.39*	0.31	0.23	0.19	0.08	0.22	0.07	0.11	0.00	-0.03	-0.20	-0.17	-0.12	1.00

Note: *p<0.05
Source: own study.

The results presented in Table 4 are heterogeneous in support of the proposed association hypothesised in H3 and H4. Of all the network ties analysed, we found no evidence of significant associations for network ties such as suppliers, customers and accountants. The results for the remaining ties vary, as do the strength and direction of the relationships. In particular, the results show that hypotheses H3 and H4 are supported when examining the frequency of contacts and relationship quality with network ties such as family members, external investors (business angels, venture capital funds, and other external investors) and lawyers. However, the results indicate that these associations seem significant only for certain human capital characteristics of entrepreneurs. In particular, we found that age, university degree, and managerial experience tend to be important when it comes to the association of the contact frequency and relationship quality of the network with the perceived success in attracting angel funding. Moderate, positive Spearman's rank correlation coefficients suggest that perceived success in attracting angel funding increases with a higher contact frequency and relationship quality with equity investors. We found that contact frequency and relationship quality are especially significant for entrepreneurs who are older ($rs = 0.42$, $p<0.01$ and $rs = 0.40$, $p<0.01$, respectively in terms of perceived success in the valuation negotiated with the business angel), and have high entrepreneurial ($rs = 0.62$, $p<0.10$ and $rs = 0.66$, $p<0.10$ respectively) and managerial experience ($rs = 0.51$, $p<0.05$ and $rs = 0.54$, $p<0.10$ respectively) when it comes to whether the amount of capital raised from the business angel met their expectations. For family members, results are inconclusive. Specifically, we found that contact frequency is associated with lower perceived success in attracting angel funding for angel-backed ventures, while relationship quality seems to have the opposite effect. We found this to be

Table 4. The results of hypothesis testing for contact frequency and relationship quality (the chi-square test of independence with correction for Yates' continuity, the one-tail Fisher exact test, Spearman's rank correlation coefficient)

Variables	Valuation		Capital invested	
	Contact frequency	Relationship quality	Contact frequency	Relationship quality
Family members	(1) #** -0.57 rs** (2) 5.99 a** -0.51 rs* (3) # -0.54 rs** (4) #* -0.50 rs**	(3) #** 0.56 rs** (4) # 0.35 rs*** (5) # 0.40 rs***	(1) #*** -0.57 rs** (2) 4.14 a** -0.45* (3) #*** -0.41 rs*** (4) #*** -0.45 rs** (5) #*** -0.49 rs**	(3) #*** 0.66 rs* (4) #*** 0.39 rs*** (5) #*** 0.57 rs**
Non-business friends	(1) #*** -0.57 rs** (2) #*** -0.30 rs***		(1) #*** -0.57 rs**	
Entrepreneurs from the same industry	(1) # 0.41 rs*** (3) # 0.45 rs***	(1) # -0.39 rs*** (5) # -0.46 rs**	(1) #*** 0.48 rs*** (3) 3.43 a*** 0.59 rs** (4) # 0.51 rs***	
Entrepreneurs outside the industry		(1) # -0.39 rs*** (5) # -0.46 rs**		
Business advisors, mentors		(1) 3.15 a*** 0.50 rs** (2) #** 0.35 rs** (3) 2.80 a*** 0.46 rs**	(1) #*** 0.47 rs**	(1) 4.84 a** 0.60 rs* (2) 3.10 a*** 0.39 rs** (3) 3.30 a*** 0.52 rs** (5) # 0.44 rs***
Business angels, venture capital funds, and other external investors	(1) #*** 0.42 rs*** (3) 3.67 a*** 0.54 rs** (4) #*** 0.41 rs**	(1) #*** 0.40 rs*** (3) 3.79 a*** 0.52 rs** (4) #*** 0.40 rs** (5) #*** 0.44 rs***	(1) 3.06 a*** 0.52 rs** (3) 4.75 a** 0.63 rs* (4) 3.62 a*** 0.51 rs**	(1) 3.58*** 0.53 rs** (2) #*** 0.31 rs*** (3) 6.24 a** 0.66 rs* (4) 4.85 a** 0.54 rs* (5) #** 0.52 rs**
Lawyers	(1) 6.38 a** 0.70 rs*		(1) 5.24 a** 0.68 rs*	

Note: *p<0.10, **p<0.05, ***p<0.01. a the chi-square test of independence with correction for Yates' continuity, # the one-tail Fisher exact test, rs Spearman's rank correlation coefficient. Controls: (1) age; (2) level of education; (3) entrepreneurial experience; (4) managerial experience; (5) experience in approaching business angels for funding.
Source: own study.

particularly significant for younger and less managerially experienced entrepreneurs in respect of contact frequency and for those with less entrepreneurial experience regarding relationship quality. Frequency of contact with lawyers was found significant ($p<0.05$), which supports hypothesis H3. The results provide evidence of a positive, moderate relationship between frequency of contact with lawyers and perceived success in raising external equity for younger entrepreneurs ($rs = 0.6$, $p<0.10$ and $rs = 0.68$, $p<0.10$ for valuation and capital invested, respectively).

The results show no association between the quality of relationships with non-business friends and perceived success in attracting funding from business angels. Therefore, hypothesis H4 is not supported for this particular tie. However, we found a significant association for contact frequency with this tie ($p<0.01$). Spearman's rank correlation coefficients indicate a negative relationship ($rs = -0.57$, $p<0.05$) between the frequency referred to and the perceived success in securing business angel funding for younger entrepreneurs. In contrast, the results suggest that contact frequency with entrepreneurs from the same industry and other industries was not significantly related to perceived success given the valuation negotiated with the business angels. Thus, there is no support for hypothesis H3. Similarly, when perceived success in attracting angel funding was conceptualised as the amount of capital invested in the venture by the business angels, the results of the hypothesis tested show that the quality of the relationship with entrepreneurs from both the same and different industries does not seem to play a role in this success. We found no support for hypothesis H4 for these network ties. The Spearman's rank correlation coefficients are significant for younger entrepreneurs and those with less experience in approaching business angels for funding. Contrary to our expectations that contacts with business advisors and mentors would benefit entrepreneurs in raising external capital, results for the valuations proved to be significant only for relationship quality ($p<0.10$), supporting hypothesis H4.

Table 5 shows the results of hypothesis testing for the network size.

Table 5. The results of hypothesis testing for the network size (the chi-square test of independence with correction for Yates' continuity, the one-tail Fisher exact test, Spearman's rank correlation coefficient)

Variable	Valuation	Capital invested
Network size	(1) #** 0.40 rs*** (2) #** 0.35 rs** (3) #*** 0.41 rs*** (5) #** 0.60 rs*	(1) 3.58 a*** 0.53 rs** (2) 3.85 a** 0.42 rs** (3) 3.30 a*** 0.52 rs** (4) #** 0.43 rs** (5) #** 0.67 rs*

Note. *p<0.10, **p<0.05, ***p<0.01. a the chi-square test of independence with correction for Yates' continuity, # the one-tail Fisher exact test, rs Spearman's rank correlation coefficient. Controls: (1) age; (2) level of education; (3) entrepreneurial experience; (4) managerial experience; (5) experience in approaching business angels for funding.
Source: own study.

We found network size to be significantly associated with entrepreneurs' perceptions that valuations and the amount of capital negotiated with business angels met their expectations, supporting hypothesis H1. Given the characteristics of the entrepreneurs, as expressed through their human capital, the analysis shows that respondents consider network size as enhancing their perceived success in attracting angel funding by these entrepreneurs from angel-backed ventures who are older ($rs = 0.4$, $p<0.01$ and $rs = 0.52$, $p<0.05$ for valuation and capital invested respectively), have more entrepreneurial experience ($rs = 0.41$, $p<0.01$ and $rs = 0.52$, $p<0.05$ for valuation and capital invested accordingly) and have a university degree ($rs = 0.35$, $p<0.05$ and $rs = 0.42$, $p<0.05$) for valuation and capital invested respectively). Managerial experience was not found to be significantly associated with the perception of success in raising capital from angels concerning the valuation agreed with them. However, we found that, in terms of the amount of capital secured from business angels, entrepreneurs with higher managerial experience regard network size as significant ($rs = 0.43$, $p<0.05$). Moreover, the analysis

also provides evidence that those entrepreneurs who have only one experience of approaching angels recognise the importance of network size in attracting business angel funding ($r_s = 0.60$, $p<0.10$ and $r_s = 0.67$, $p<0.10$ for valuation and capital invested respectively).

Our results provide evidence for the hypotheses that there is the nexus between the characteristics of entrepreneurs' networks and their perceived success in attracting funding from business angels. As previous studies have shown (Adler *et al.*, 2002; McKeever *et al.*, 2014), entrepreneurs' embeddedness differs by environment and community, and therefore the impact of each relationship on entrepreneurial behaviour is likely to vary (Shane & Cable, 2002). Our results support the general idea that entrepreneurs build large networks to access various resources (Sullivan & Ford, 2014). However, in line with Zhang *et al.* (2008), we argue that not all ties are equally important in early-stage fundraising. Consisted with Semrau and Werner (2014), we found that relationship quality affects access to financial capital. Indeed, we contribute to the network theory by finding that relationship quality matters for entrepreneurs' perceptions of whether their deal with business angels met their expectations. Specifically, we found that the relationship quality between entrepreneurs from early-stage angel-backed ventures and business advisors and mentors appears to significantly contribute to an increasing perceived success in raising equity, both in terms of the valuation negotiated with the business angel and the amount of capital secured from them.

Our results also contribute to the literature on the role of networks in early-stage venture financing by demonstrating that the frequency of contacts with entrepreneurs from the same industry is significantly associated with perceived success in attracting angel funding, while no such pattern was found for entrepreneurs outside the industry. We argue that it demonstrates trust in interactions with entrepreneurs from the same industry, which needs to be built to compensate for a lack of or limited knowledge about how the business angel market works. We suggest that entrepreneurs from the same industry are more likely to provide the most relevant knowledge, particularly regarding the angels' criteria for industry specificity in the funding process. This supports Kuhn and Galloway's (2015) observation that entrepreneurs from the same industry are highly capable of providing contextually specific knowledge and resources. This is also consistent with Huynh (2016), who argues that trust within a network supports sustainability and reduces risk. However, we were somewhat surprised by the diminishing effect of relationship quality with entrepreneurs from the same industry on the valuation negotiated with business angels. They appeared not to provide reliable information that might be relevant to such negotiations. We are not sure what mechanisms govern this result. It may be attributed to the general observation that valuation practices are confidential and not easily disclosed (Hordijk & van de Ridder, 2005). It may also be related to a common perception that the valuation of early-stage ventures by equity investors is more of an art than a science (Köhn, 2018), suggesting that the benchmark to the valuation previously negotiated by entrepreneurs in the same industry and their feedback on the valuations may not play a significant role when negotiating the valuation with business angels.

Our results for frequency of contact with family members and non-business friends seem to be consistent with the literature (Klyver & Arenius, 2022), which suggests that close social ties may reduce the likelihood of success in entrepreneurial actions, especially when entrepreneurs have low social skills. However, we found a positive effect of relationship quality with family members on entrepreneurs' perceptions of whether their deal with business angels met their expectations, both in terms of valuation and amount of capital raised. We attributed this to the observation that strong ties, into which the family is categorised, are mainly effective in providing motivation, while they alone do not facilitate access to finance unless reinforced by weak ties (Heuven & Groen, 2012), and therefore suggest that being encouraged by family is important in early stage equity fundraising. We also contribute to the entrepreneurship literature by providing evidence that the quality of the relationship with business advisors and mentors is related to the entrepreneurs' perception of whether the valuation agreed with business angels met their expectations, which was particularly evident for younger entrepreneurs. This confirms previous findings that using professionals to access resources mainly concerns younger founders (Jones & Jayawarna, 2010). However, our results suggest that the same applies to more experienced entrepreneurs, particularly those with high entrepreneurial experience. We argue that this is mainly due to the anonymity and invisibility of the angel market, which makes it necessary

even for experienced entrepreneurs to use their network to reduce information asymmetry and acquire knowledge about the mechanisms of the business angel market.

In terms of practical implications, our results suggest that the frequency of contacts with entrepreneurs from the same industry can be beneficial in attracting business angel funding. Therefore, we extend Davidsson and Honig's (2003) proposal that entrepreneurs should develop and foster networks of all kinds, especially intrafirm relations, by implying that entrepreneurs should seek advice, particularly, within their industry when raising external equity. Our results also suggest that relationships with external equity investors, business advisors and mentors, and lawyers may be particularly important when raising funds from business angels. While the business angel market in Poland is at a relatively early stage with high growth potential, we suggest that the quality of relationships with specific ties should be established and maintained by early-stage entrepreneurs seeking equity funding. In doing so, we highlight an important role for entrepreneurship policy, which should aim at creating effective conditions for the development of entrepreneurial networks that would support early-stage entrepreneurs in raising capital from equity investors.

CONCLUSIONS

In contrast to previous studies, which have mainly focused on the perspective of equity investors, in particular, their investment criteria (Paul *et al.*, 2007), reasons for declining to invest in an early-stage venture (Mason *et al.*, 2017) and syndication (Antretter *et al.*, 2020), this article addresses the other side of the external capital raising process. We aimed to examine whether and to what extent entrepreneurs perceive the characteristics of their networks as relevant to their success in attracting funding from business angels. As hypothesised, the characteristics of entrepreneurs' networks are associated with their perceived success in raising funding from business angels. Therefore, this study makes an important contribution by providing empirical evidence on how entrepreneurs perceive their networks to be useful in meeting their needs, which arise when they face a lack of knowledge about how the angel market works. However, we found differences in the potential of entrepreneurs' networks to contribute to this success, and that not all network ties are equally important. We also found that more experienced entrepreneurs, in particular, are able to use their networks to facilitate their success in attracting angel funding.

Developing a better understanding of how entrepreneurs perceive the characteristics of their networks as relevant to their success in raising funding from business angels is important from an academic and policy perspective. Despite the growth of network and business angel studies, there is still a paucity of research empirically examining the importance of networks for entrepreneurs in raising capital from business angels. Understanding the extent to which certain network ties can potentially be conducive to attracting business angel funds that entrepreneurs would be satisfied concerning valuation and amount of capital raised may incentivise entrepreneurs to strategically build network relationships to be effective and useful in securing capital from business angels. While networks are generally perceived as beneficial (Rasmussen *et al.*, 2015; Pasquini *et al.*, 2019), our findings show that maintaining and developing relationships with specific actors, in particular such as business advisors and mentors, external equity investors, as well as lawyers, can be important for the success of a venture when seeking external equity funding. As such, entrepreneurs should examine how they can best facilitate contact frequency and relationship quality among their networks. Developing entrepreneurial networks, especially those involving actors involved in early-stage equity funding, need to be promoted, so that entrepreneurs can enhance their knowledge of how the business angel market works to effectively raise funds from angels.

We acknowledge the limitations of study, which may provide avenues for future research. The first set of limitations relates to the characteristics of the sample. While the response rate is similar to that reported in previous studies of early-stage equity investment, the sample size might be perceived as modest, particularly when compared to studies of mature markets (Cowling *et al.*, 2021; Bonnet *et al.*, 2022). However, the sample size could be because the analysed market is emerging and still growing, and consequently, the number of angel-backed ventures is not yet large. The sample size could also result from sampling bias. Although we followed the approaches used in previous research to identify

angel-backed ventures (Blaseg & Hornuf, 2024), some studies have suggested that relying on data from Crunchbase or angel group websites does not allow for the full spectrum of business angels to be captured (Svetek, 2022) and therefore does not provide a picture of all ventures that angels have backed. As a result, sample may be biased by undercoverage and self-selection. We also recognise that study focuses on only some characteristics of entrepreneurs' networks. Our data also do not allow for assessing the absorptive capacity of entrepreneurs (Scutto *et al.,* 2017) and possible behavioural changes over time, which may, e.g., affect the ability of entrepreneurs to utilise feedback and advice (Wierzbiński *et al.*, 2023) from their networks when approaching business angels. Therefore, we encourage future studies to complement our findings by considering these dimensions related to networking in early-stage funding markets. It is also important to acknowledge that sample includes ventures from one specific country. Our research results are therefore anchored in a national context and may be heterogeneous depending on market maturity, entrepreneurial culture and ecosystem (Tenca *et al.*, 2018). Hence, we propose that future studies should uncover the extent to which the nexus between the characteristics of entrepreneurs' networks and their perceived success in attracting funding from business angels is likely to vary across countries. Moreover, while study focuses on early-stage ventures that have successfully raised funding from business angels, we suggest that a more complete picture could be obtained by examining ventures rejected by angels. However, given the challenges of identifying successful ventures (Avdeitchikova *et al.*, 2008; Bilau & Sarkar, 2016), it is extremely difficult to find reliable data on the latter, as such information is usually kept secret by ventures and would-be investors. Future research that could identify such ventures would be a step forward in understanding of the network effect in getting funded by business angels.

The second set of limitations is methodological. While survey research is considered an important technique for collecting information about individuals (Stockemer, 2019), it may not allow for a comprehensive portrayal of the relevance of entrepreneurs' networks in the equity funding process. We suggest that future research using other methodological approaches, such as, e.g., in-depth interviews (Brown *et al.*, 2018) or situated observations (Kaffka *et al.*, 2021), may help to provide additional insights on this topic. Furthermore, due to sample characteristics, we used Yates' correction and Fisher's exact test. However, we acknowledge that we may have failed to detect some associations and, therefore, suggest the use of other methods, notably when a larger sample size is available. Although we based the variables on the previous studies, it is important to note that there may be concerns about how we measured them, given the different approaches in the literature, e.g., in terms of network size or relationship quality (Semrau & Werner, 2014). This may suggest further testing of the proposed hypotheses using different sets of measures, particularly those from social and dynamic network analysis.

Finally, to improve the overall understanding of the challenges faced by entrepreneurs in raising capital from angel investors, we recognise the need for additional research. In particular, we suggest that further studies should investigate the extent to which the human capital of entrepreneurs has an impact at the stages of the fundraising process. Previous studies emphasise the importance of entrepreneurs' motivation (Naiki & Ogane, 2022) and industry and founding experience in fundraising (Ko & McKelvie, 2018). However, prior studies often overlook that different stages of the fundraising process may require certain human capital characteristics. Therefore, it would be interesting to assess whether entrepreneurs with certain characteristics use their networks differently at various stages of raising capital from business angels (e.g., when choosing which business angels to approach, or during the selection, evaluation, and deal negotiation processes). The latter appears to be particularly important, as deal terms and pricing affect the extent to which entrepreneurs pass control of their ventures to business angels (White & Dumay, 2017) and the expected profits at exit (Gornall & Strebulaev, 2020). It would also be interesting to recognise the degree of importance that entrepreneurs attach to their network in relation to other considerations when seeking funding from business angels, such as being affiliated with reputable investors (Denis, 2004) or the potential benefits that business angels may bring to their ventures (Granz *et al.*, 2021). Future studies can also uncover which factors moderate the effects of entrepreneurs' networks on their success in attracting angel funding, e.g. how entrepreneurs position themselves and manage their network relationships (Gargiulo & Benassi, 2000; Gao

et al., 2023) to increase the likelihood of passing through the pitch deck stage, which most ventures fail to get past (Grilli, 2019), to enter the next stages of the fundraising process.

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Entrepreneurship as a driver of economic development

Tatia Zarkua, Wim Heijman, Irena Benešová, Mikhail Krivko

ABSTRACT

Objective: This study aims to analyse the relationship between entrepreneurship and economic development. Quantified through the gross domestic product (GDP) per capita, across selected developed and developing countries. The research seeks to clarify how variations in entrepreneurial activity, as measured by the Global Entrepreneurship Index (GEI), relate to GDP per capita, thereby contributing to the broader understanding of the economic impacts of entrepreneurship.

Research Design & Methods: This study adopted a quantitative approach, employing a cross-sectional ordinary least squares (OLS) model to explore the relationship between entrepreneurship and GDP per capita. Spanning the 2015-2019 period, our analysis incorporated data from 98 countries. Recognising the potential endogeneity concerns associated with specific independent variables, we implemented the instrumental variables (IV) approach, employing the two-stage least squares (2SLS) method to mitigate this potential bias.

Findings: Our findings suggest that differences in GDP per capita between countries are significantly associated with variations in entrepreneurship. This highlights the importance of entrepreneurship as a driving force for GDP per capita. According to the 2SLS model, we found a positive relationship between the global entrepreneurship index (GEI) and GDP per capita. On average, a one-percent increase in GEI is associated with a 3.04% increase in GDP per capita.

Implications & Recommendations: This study underscores the significant potential of entrepreneurship to drive economic development across diverse nations, regardless of their development stage. The findings demonstrate a positive and statistically significant association between higher levels of GEI and increased economic development. Therefore, policymakers have the potential to create an environment conducive to both entrepreneurship and sustainable economic development by implementing supportive policies and investing in key areas.

Contribution & Value Added: This study provides valuable insights into the relationship between entrepreneurship and economic development. It highlights the importance of creating an enabling environment supporting entrepreneurship through infrastructure, education, market development, and innovation investment. Further research is needed to explore the nuances of this relationship and develop effective policies to promote sustainable and competitive economic development.

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INTRODUCTION

Entrepreneurship is central to driving economic development across countries in today's dynamic global landscape. Economists have recently focused their research on identifying and understanding the key roles entrepreneurship plays in the economy (Acs, 2010; Sardana, 2016). The primary reason for investigating entrepreneurial activities is their potential to yield economic benefits for entrepreneurs and investors, contributing significantly to the overall economic prosperity of the nations in which they operate.

A vast body of economic literature has identified numerous factors that may influence GDP per capita, encompassing economic and non-economic determinants. These factors have been explored in theoretical (Porter & Stern, 2001; Shane, 2003) and empirical studies (Stel, 2006; Van Praag & Versloot, 2007; Block *et al*., 2016). Furthermore, numerous economists consistently acknowledge the significance of entrepreneurship in fostering economic growth (Brown & Ulijin, 2004; Vasconcelos & Oliveira, 2018; Galindo-Martin *et al*., 2020).

However, a significant research gap exists in comprehending the intricate relationship between entrepreneurship and its impact on GDP per capita. While several studies have attempted to explore how entrepreneurship affects countries' GDP per capita, a conspicuous scarcity persists in the economic literature. It is essential to clarify that entrepreneurship is the central phenomenon under study, while GDP per capita is used as a proxy to measure economic development. The confusion between phenomena and variables often arises because GDP per capita reflects the outcome of various economic activities, including those driven by entrepreneurship, rather than the entrepreneurial process itself. Not only is there a scarcity of understanding of the impact of entrepreneurship on economic development within specific country clusters, but also in a comparative context in both developed and developing countries. The existing limitation poses a significant challenge to achieving a comprehensive understanding required for guiding policymakers, entrepreneurs, and businesses. In turn, this hampers informed decision-making aimed at promoting entrepreneurial activities and fostering economic development. Thus, research that rigorously examines the efficacy of entrepreneurship on GDP per capita extends beyond individual countries or country groups, encompassing comparative analyses among developed and developing countries, fostering a more nuanced understanding of this intricate relationship.

This study addresses this gap and investigates how entrepreneurship affects GDP per capita in developed and developing nations on a global scale. Considering all the factors outlined above on entrepreneurship and GDP per capita across various country contexts, this article aims to empirically analyse entrepreneurship's impact (measured by the Global Entrepreneurship Index (GEI)) on GDP per capita in selected countries. Through an in-depth examination of these interconnections, we intend to provide valuable insights into the key drivers of economic development (expressed as GDP per capita) and offer recommendations that can be utilised by policymakers and entrepreneurs alike.

Our study presents a novel contribution by employing a specific combination of instruments to explore the relationship between entrepreneurship and GDP per capita. While similar variables have been employed in different economic contexts, no prior research has integrated this set of instruments to establish their statistical association with the GEI, measured in elasticities. By using elasticities, we provide more nuanced insights into the relative responsiveness of GDP per capita to changes in entrepreneurship, offering a more precise and policy-relevant interpretation.

The rest of the article is structured as follows. Section two will cover the literature review on entrepreneurship, innovation, and competitiveness within the context of entrepreneurship and economic development, with a focus on empirical studies. Section three will present the data sources, variables, and methods. Section four will address the key findings of our empirical research and discussion. Finally, section five will summarise our conclusion.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In today's global economy, entrepreneurship is recognised as a crucial factor in boosting GDP per capita and driving overall economic advancement. Due to its significant economic impact, the intricate relationship between entrepreneurship and GDP per capita has long captivated scholars and policymakers. This literature review critically analyses extensive research on the symbiotic interplay between entrepreneurship and GDP per capita. By synthesising diverse perspectives and empirical findings, the review seeks to explain the mechanisms through which entrepreneurial activities contribute to economic advancement, exploring the multifaceted dimensions of this dynamic interplay.

The term 'entrepreneurship' traces back to 1766 when French economist Richard Cantillon coined it in his work 'Essay on the Nature of Trade in General' (Long, 1983). Cantillon associated entrepreneurship with trade to distinguish it from financial activities. He defined an entrepreneur as an individ-

ual undertaking all the risks of starting a business, making investments, covering expenditures, and anticipating returns (Van Praag, 1999).

Austrian economist Joseph Schumpeter (1883-1950) considered entrepreneurship a central element in the economic development mechanism (Śledzik, 2013). He emphasised the strong connection between innovation and entrepreneurship, asserting that the entrepreneur's special function is to utilise a new combination of production factors for innovation, forming the basis of economic development (Hagedoorn, 1996). Schumpeter identified five ways to drive economic advancement: creating new products, innovating production and sales, adopting new market strategies, finding new resources, and restructuring industries (Kotsemir & Abroskin, 2013).

Schumpeter believed that for entrepreneurs to make a profit, they need to be innovators. In his opinion, innovation was one of the main driving forces of competitiveness and economic development (Aiginger *et al.,* 2013; Śledzik, 2013; Malerba & McKelvey, 2020). According to Schumpeter, innovation is a 'process of industrial mutation that incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one' (Śledzik, 2013).

Noteworthy, there is a lack of proof based on empirical data. This fact results mainly from the difficulty in specifying the role of innovation and entrepreneurship and validating its measurement for empirical modelling.

Empirical studies reveal a significant relationship between entrepreneurship and GDP per capita and between entrepreneurship and innovation (Galindo & Méndez, 2014). Researchers established a positive correlation between entrepreneurial activity and innovation in developed countries (Block *et al*., 2016; Crudu, 2019; Loukil, 2019). They believe heightened entrepreneurial activity fosters innovation development (Van Stel *et al*., 2005; Crudu, 2019). Moreover, several empirical studies indicate that the role of entrepreneurship in the economy is rooted in the substantial job creation by small- and medium-sized enterprises, contributing positively to GDP per capita (Wong *et al*., 2005; Haltiwanger *et al*., 2013; OECD, 2017). However, some research suggests a negative impact of entrepreneurship on real GDP, GDP per capita, and overall economic development (Carree *et al*., 2007). Scholars offer diverse explanations for this negative impact, including risks posed by start-up entrepreneurs, the influence of uncertainty avoidance levels in countries, and methodological shortcomings in measuring the impact of new entrepreneurial start-ups (Wennekers *et al*., 2010; Cumming *et al*., 2014). Admittedly, many studies overlook innovation and confirm that entrepreneurial motivations vary across countries (Shane, 2009; Crudu, 2019). In developed countries, people pursue entrepreneurship for self-improvement, while in developing countries, it is often driven by necessity due to a lack of alternative employment opportunities. For most countries, fast-growing entrepreneurs are a key source of GDP formation, innovation and technology, productivity growth, and employment (Bygrave & Zacharakis, 2011; Reyes & Useche, 2019). Entrepreneurs are the leading force for economic and social progress (Broughel & Thierer, 2019). Moreover, the European Central Bank explains that innovation is one of the essential drivers of economic progress (European Central Bank, 2017; Pradhan *et al.,* 2017), and Porter and Stern (2001) state that 'Innovation – in the form of new products, processes, and ways of managing – is essential to economic development'.

Notably, in a modern economy, innovation's role is expanding daily (Courvisanos & Mackenzie, 2014). It provides entrepreneurs with the opportunity to attain a leading market position. Beyond enhancing company profits, innovation holds significance for the national economy (Maradana *et al*., 2017). Innovation has the potential to reshape enterprise structures and exerts a profound impact on competitiveness and economic development at both micro- and macro-economic levels (Ketels, 2006; Atkinson, 2013; Dedahanov *et al.*, 2017; Fyliuk *et al*., 2019).

Various studies highlight successful global entrepreneurship cases, reinforcing the strong connection between innovation and entrepreneurship, jointly influencing economic development (Wennekers *et al*., 2010; Brem, 2011; Stoica *et al*., 2020). However, opinions among researchers vary, suggesting that the impact of entrepreneurship and innovation, whether positive or negative, depends on a country's development level (Hong & Sullivan, 2013; Maradana *et al*., 2017; Almodóvar-González *et al*., 2020). In 1990, Porter asserted that 'today, innovation is the only way to maintain a competitive advantage,' although observational studies yield mixed results on the role of innovation and entrepre-

neurship in economic progress. Drucker (1998) later emphasised innovation as a crucial element in entrepreneurial activity, contending that innovative leaders motivate others to achieve their company's objectives and generate even more innovative solutions.

Practitioners interested in measuring the impact of entrepreneurship on economic development might face significant challenges, but proxies can provide insights. The global entrepreneurship index (GEI) from the World Bank is a widely used indicator for gauging entrepreneurial activity and innovation levels in a country's economy. However, as far as we know, no prior studies have definitively established a link between GEI and economic development. This research aims to address this gap by employing GDP per capita as a proxy for economic development across a diverse dataset of countries.

Therefore, to achieve our aim, we developed a hypothesis that will guide our future empirical examination based on those stated in the previous sections:

H0: Entrepreneurship positively and significantly impacts GDP per capita.

RESEARCH METHODOLOGY

As previously stated, in this study, we aimed to explore the relationship between entrepreneurship and GDP per capita, utilising data from the global entrepreneurship index (GEI) and the global competitiveness index (GCI) reports. We assessed 98 developed and developing countries (Appendix 1). We selected these 98 countries based on data availability for the variables pertinent to this study within the 2015-2019 World Economic Forum (WEF) reports (WEF, 2020). Moreover, we narrowed the selection to 98 countries due to consistent data availability across all variables used in our analysis, ensuring robustness and reliability in our findings.

We selected the GEI due to its comprehensive coverage of various aspects of entrepreneurial activity and its widespread use in academic research (GEDI, 2019; Kremer, 2019; Bonyadi & Sarreshtehdari, 2021; Inacio *et al*., 2021). It evaluates entrepreneurial processes across more than 130 countries annually, offering insights into individual country performance on national and global scales. Meanwhile, the GCI provides a valuable framework for assessing the broader entrepreneurial environment through its analysis of local populations' entrepreneurial beliefs, capabilities, and aspirations within existing socioeconomic structures. This is facilitated by evaluating 14 key 'pillars' of regional ecosystem stability. We utilised the 'Methodology and Computation of the Global Competitiveness Index 2017-2018' to ensure a standardised and comprehensive approach that aligns with our study period. This methodology facilitates consistent cross-country comparisons and helps to measure the economic conditions that influence competitiveness and economic development.

However, the primary focus of our study was not merely the descriptive aspects of GEI and GCI but instead – the causal relationship between entrepreneurship and GDP per capita. The core of our analysis involved testing this relationship using an instrumental variables (IV) approach, designed to address potential endogeneity concerns and confounding variables that may affect the estimation of this relationship.

Scholars widely recognize the dependent variable in our study, GDP per capita (constant 2010 USD), as a key indicator of economic development (Van Den Bergh, 2009; Cohen Kaminitz, 2023; Bazaluk *et al*., 2024). While GDP per capita reflects the overall economic performance of a country, it is essential to emphasise that it does not directly measure entrepreneurial activity or innovation. Instead, GDP per capita is a proxy for the economic outcomes to which entrepreneurial activities contribute. The distinction lies in that GDP per capita captures the results of various economic processes, including those driven by entrepreneurship, rather than the entrepreneurial processes themselves.

The independent variables in our study, except for the GEI, include measures that capture various critical dimensions of a country's economic environment: infrastructure, health, primary education, higher education and training, market size, business sophistication, and innovation. We selected these indicators, sourced from the 'Methodology and Computation of the Global Competitiveness Index 2017-2018,' for their relevance in measuring the economic conditions that influence competitiveness. Although these variables are not components of the GEI, they are essential in explaining the broader

economic context in which entrepreneurship operates. The GEI, which serves as a central variable in our analysis, evaluates the health and quality of entrepreneurship ecosystems across different countries. Moreover, while 'Infrastructure,' 'Health and Primary Education,' 'Higher Education and Training,' and 'Business Sophistication' are indeed broad economic phenomena, in our study, they were rigorously operationalised into specific, quantifiable variables. This operationalisation, supported by a well-established methodology and empirical validation, ensured that these phenomena were accurately and reliably represented in our analysis, allowing for robust and meaningful conclusions about their impact on economic performance.

In Table 1 we explain the dependent and independent variables used in this research and their definitions.

Table 1. Description of the variables considered in the analysis

Variables	Definition Dependent Variable	Source
GDP per capita (2015-2019)	GDP per capita is a fundamental economic indicator that measures the average income or standard of living of a country's population. It is calculated by dividing a nation's gross domestic product (GDP) by its total population.	World Economic Forum; Foundations of descriptive and inferential statistics 2019; World Bank (WDI)
Independent Variables		
Global entrepreneurship index (GEI)	A composite index measuring entrepreneurial attitudes, abilities, and aspirations at the country level.	The Global Entrepreneurship and Development Institute (GEDI Institute)
Infrastructure	This variable assesses the quality of a country's infrastructure, including transportation, communication, energy, and public services, which are essential for economic functioning.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Health and primary education	These variables measure the effectiveness of a country's health system and primary education. It includes population health indicators, the quality of primary education, and access to these services.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Higher education and training	Higher education and training evaluate the quality and accessibility of tertiary education and workforce training, considering factors such as the relevance of education to workforce needs and the extent of staff training.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Market size	Market size assesses the potential domestic demand within a country, considering factors like population size and purchasing power.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Business sophistication	Business sophistication evaluates the innovation, efficiency, and technological readiness of a country's business sector, including the use of technology and market efficiency.	Methodology and Computation of the Global Competitiveness Index 2017-2018
Innovation	Innovation measures a country's capacity to generate new ideas, technologies, and products that contribute to economic development.	Methodology and Computation of the Global Competitiveness Index 2017-2018

Source: own study.

While the GEI and GCI indicators focus on different aspects of economic performance – GEI on entrepreneurial attitudes, abilities, and aspirations, and GCI on macroeconomic conditions that influence these entrepreneurial capacities – there is a potential for conceptual overlap. However, in our methodology, it is crucial to acknowledge the absence of overlap between selected variables within the panel dataset.

This non-overlapping nature arises from various factors, including changes in data collection methodologies and variations in variable definitions, temporal dynamics, the dynamic economic context, and potential policy and regulatory shifts. To navigate these complexities, we conduct a detailed examination of each variable for each year. This tailored analysis captures each variable's unique characteristics and contextual influences over time. Furthermore, we conduct robustness checks to ensure the accuracy of our methodology, even when dealing with non-overlapping variables.

Therefore, to ensure that our analysis does not suffer from this overlap and to test our hypothesis, we employed a rigorous methodology beginning with a correlation analysis to explore the associations between the dependent and independent variables. Following this, we conducted an extensive analysis using cross-sectional linear regression models. To ensure an accurate estimation of regression coefficients, we applied the ordinary least squares (OLS) method (Oksanen, 1991). This approach was designed to thoroughly investigate the complex relationship between entrepreneurship and GDP per capita across diverse economic contexts, encompassing developed and developing countries.

For the cross-sectional analysis, we utilised a log-log OLS regression model to estimate the relationship between the independent variables and GDP per capita for each year within our study period. This model included 98 observations for each year, corresponding to the 98 countries in our sample. The log-log specification allowed us to interpret the estimated regression coefficients as elasticities. Below, we present the general equation for the fixed effects (FE) or random effects (RE) model:

$$lny_i = \beta_0 + \sum_{i=1}^{n} \beta_i lnx_i + \sum_{j=1}^{m} \gamma_j + \varepsilon_i \quad (1)$$

In equation (1), y_i – represents dependent variable (GDP per capita); x_i – independent variables; γ_j – entities fixed or random effects; n – number of independent variables; m – number of entities (countries); β_0, β_i – regression coefficients; ε_i – error term.

We recognised the importance of considering all relevant instrumental variables that could impact the GEI. To this end, we conducted a comprehensive multicollinearity test on the independent variables (Appendix 3). The results revealed significant multicollinearity, posing the risk of biased and inefficient estimates in an OLS framework. Specifically, the high variance inflation factors (VIFs) showed that all variables, except GEI, exhibited very high VIFs and correspondingly low tolerance values. This finding made it necessary to adopt an alternative method. Consequently, we chose the two-stage least squares (2SLS) approach (Greene, 2008), as it effectively addresses both multicollinearity and potential endogeneity issues.

Furthermore, recognising the potential for endogeneity or measurement errors — mainly since most of the independent variables, aside from GEI, are based on subjective survey data from business executives—we opted for the IV approach. We chose the instruments based on their established relevance in previous studies and their theoretical significance in explaining GEI. An essential contribution of this analysis lies in the IV approach used to address endogeneity concerns. Specifically, we employed external instruments that are both theoretically and empirically grounded, ensuring they meet the relevance and exclusion restriction criteria. We selected these instruments because they strongly correlate with the endogenous regressors but are uncorrelated with the error term in the outcome equation, providing a credible identification strategy.

Therefore, as the first step in the 2SLS method, we regressed GEI on four instrumental variables: infrastructure, health and primary education, higher education and training, and market size, all in log-log form. Innovation and business sophistication variables were excluded due to their lack of statistical significance. In contrast, the selected instruments produced highly significant p-values, confirming a strong correlation with GEI. However, after further analysis, we found that excluding the higher education and training variable improved the Sargan over-identification test results. Based on this finding, we decided to omit higher education and training from the final list of instruments. This adjustment enhances the accuracy and reliability of our model, ensuring that the remaining instruments provide a stronger and more focused explanation of the relationship between GEI and economic outcomes.

Our approach offers a novel contribution by combining these specific instruments in the context of entrepreneurship and GDP per capita. While prior studies have used similar variables in different economic contexts, our research uniquely integrates these specific instruments and establishes their statistical association with the GEI. We have thoroughly tested each instrument to demonstrate its link to the GEI, setting our study apart from others.

The unique combination of these instruments within a panel IV 2SLS framework allowed us to control for endogeneity while addressing both country-specific and time-specific effects. This approach has not been explored in previous literature, adding significant value to our analysis. By applying this particular set of variables, which has never been tested together, we offer new insights into

the relationship between entrepreneurship and GDP per capita across 98 countries, enhancing the robustness and depth of our findings.

Moreover, we provide a more focused and statistically robust model that avoids potential over-identification by excluding innovation and business sophistication from the instrument set due to their lack of statistical significance in the first stage. This refined selection contributes to the novelty of our approach and offers a clearer understanding of the specific channels through which entrepreneurship affects economic growth.

Furthermore, we enhanced the analysis by employing a panel data approach, with 490 observations across 98 countries over five years. The panel specification allowed us to control for both time and country-specific effects, addressing unobserved heterogeneity and improving the robustness of the results.

$$lnx_1 = \theta_0 + \sum_{j=1}^{n} \theta_j lnz_j + \nu_i \quad (2)$$

$$lny_i = \beta_0 + \beta_1 \widehat{x_1} + \varepsilon_i \quad (3)$$

In equation (2), z_j – represents instrumental variables (infrastructure, health and primary education, and market size); θ_j – regression coefficients; ν_i – error term. We believe that these instruments, backed by theoretical justification, contribute to the novelty of instrumentalisation, offering a more reliable approach to addressing potential biases arising from omitted variables and measurement errors.

Equation (3) contains fitted values of the dependent variable from equation (2). In this model specification, independent variables from the study dataset can serve as instruments. The estimated value of the coefficient $\beta 1$ serves to test the hypothesis.

Additionally, we validated the selected instruments through rigorous tests, including the Hausman, Sargan, and weak instruments tests. We used the Hausman test (Hausman, 1978) to determine whether the OLS or IV estimator provided more efficient and consistent results. The Sargan over-identification test evaluated whether the number of instruments was excessive. Furthermore, the weak instruments test determined whether the instruments were sufficiently strong. These tests were also valuable in identifying which variables should be used as regressors (in equation (3)) in the model and which should serve as instruments (regressors in equation (2)).

While we acknowledge that the IV strategy has limitations, including potential concerns regarding unobserved confounding factors, we have carefully considered threats to the exclusion restriction. The combination of theoretical justification, empirical testing, and robustness checks, such as the Hausman test, Sargan test, and weak instruments test, demonstrates that the chosen instruments provide a reasonable approach to addressing potential endogeneity concerns.

Although there is always a risk of unobserved confounding factors, our approach is reasonable given the available data and theoretical considerations. Future research might explore alternative instruments or methods to further strengthen the identification strategy.

RESULTS AND DISCUSSION

As delineated in the methodology section, we analysed 98 countries, comprising both developed and developing countries, across the timeframe spanning from 2015 to 2019. Consequently, the ensuing models present the outcomes observed across this comprehensive cohort of 98 countries.

The correlation matrix (Appendix 2) revealed notable relationships among different variables, shedding light on their interconnectedness and potential influence on GDP per capita and entrepreneurial indices.

Specifically, we found a strong positive correlation between GDP per capita and GEI. This correlation suggests that higher entrepreneurial activity, as the GEI indicates, tends to be associated with increased GDP per capita. It implies that a conducive environment for entrepreneurship may contribute positively to a country's economic wealth.

Infrastructure indicators and various educational components (Health and Primary Education, High Education and Trainings) exhibited strong positive correlations. This suggests their interde-

pendency and underscores the importance of robust infrastructure and a well-educated workforce in fostering economic development and entrepreneurship.

Along with Innovation, Market Size and Business Sophistication demonstrate strong correlations. This indicates that larger markets, sophisticated business environments, and innovative capacities tend to coincide. These factors are essential for supporting entrepreneurial activities, fostering competitiveness, and positively influencing economic development.

The moderate to strong positive correlations observed among different variables accentuate the multifaceted nature of economic development and entrepreneurship. They highlight how various elements intertwine and potentially impact a country's economic prosperity, from infrastructure to education, market dynamics, and innovation.

Understanding the correlations between these variables offers valuable insights for policymakers and stakeholders. It underscores the importance of creating an enabling environment that supports entrepreneurship through investment in infrastructure, education, innovation, and market development. Enhancing these aspects collectively may contribute to fostering economic development and entrepreneurial activities.

In conclusion, the correlation matrix illuminates the intricate relationships between different factors and their potential implications for economic development and entrepreneurship. It suggests that a holistic approach, addressing various interconnected aspects, may be crucial in fostering a conducive environment for entrepreneurial and sustainable economic development.

Before conducting further analysis and putting our models through their tests, we had to acknowledge that the GEI index exhibits characteristics related to individual and institutional factors in product or process innovation (GEDI, 2019; Szerb *et al*., 2018; Kremer, 2019). Therefore, we decided to omit the independent variable Innovation to avoid inaccuracies in our calculations and analyse the findings of our models afterwards.

The cross-sectional model estimation for our variables is shown in Model 1 for each year (Table 2). We estimated Model 1 in log-log form, in which the interpretation of coefficient estimates was elasticities. As we see for all counties included in the analysis, various independent variables can significantly impact GDP per capita: GEI and infrastructure, as well as market size, are all significant variables to consider. However, for the entire period, health and primary education and higher education and training were determined to be statistically insignificant. This could be because each country had its combination of characteristics. As a result, these variables did not apply to all countries.

Following the constant, the dynamic of the coefficient changed over time. It was statistically significant for the entire period. On the other hand, the coefficient has experienced a slight decrease since 2017.

Estimates for the GEI independent variable demonstrated a positive and highly significant influence on GDP per capita (constant 2010 USD) at the level of the entire sample of countries for each year. This discovery was similar to other scholars (Aparicio, 2017; Guerrero *et al*., 2020). Since 2016, there has been a declining trend in the ratio, which reached 0.260 in 2017. The coefficient began to increase in 2018, and in 2019 it reached 1.095. We believe that the impact of entrepreneurial activities on economic development does not occur suddenly but instead develops over time. As a result, we conclude that long-term entrepreneurship strategies are necessary since the influence of entrepreneurship on economic development changes over time.

The coefficient for infrastructure fluctuates over time. From 2015 to 2017, the coefficient was positive and statistically significant. Even though the coefficient decreased throughout 2018, eventually falling to 0.509, it remained statistically significant. Coefficients were negative and statistically insignificant in 2019. These findings demonstrate that infrastructure investments, particularly those made during the early stages of development, can considerably contribute to economic development.

In recent years, particularly in 2015, 2016, and 2017, the health and primary education coefficient was negative and statistically insignificant. However, starting in 2018, the ratio began to rise. By contrast, when comparing 2018 to 2019, the ratio rose by 67%. Based on recent findings, we may conclude that our independent variable is becoming an important driver of GDP per capita for each country.

In the case of higher education and training, the results show that the ratio varies from year to year. Furthermore, in 2019, the coefficient reached 0.644, which was the highest value in the entire

period. We may explain such results by the fact that interest in this field is growing among the countries, and they expect a higher impact on GDP per capita. As a result, countries are increasing their investments in higher education and training.

Table 2. Cross-sectional model (OLS) coefficient estimations, dependent variable: GDP per capita

Variables	2015	2016	2017	2018	2019
const					
Coefficient	5.67732	6.40475	7.71894	6.07401	6.55182
p-value	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
GEI					
Coefficient	0.863549	0.862178	0.259984	0.821288	1.0954
p-value	0.0012***	0.0006***	0.0827*	0.0003***	<0.0001***
Infrastructure					
Coefficient	0.917319	0.69329	0.87359	-0.500908	-0.165489
p-value	0.0397**	<0.0001***	0.0469**	0.0018***	0.3832
Health and primary education					
Coefficient	-0.468438	-0.599172	-0.316416	0.190103	0.234469
p-value	0.3751	0.1864	0.5545	0.7081	0.465
Higher education and training					
Coefficient	0.410751	0.390164	0.487401	0.424038	0.644244
p-value	0.4266	0.3995	0.367	0.4238	0.118
Market size					
Coefficient	0.19943	0.153022	0.116835	0.264169	0.333875
p-value	0.3049	0.3712	0.5522	0.1613	0.0515*
Business sophistication					
Coefficient	-0.172075	-0.147765	0.0106365	0.396757	-1.28814
p-value	0.7801	0.7697	0.9868	0.5021	0.0125**
Observation	98	98	98	98	98
R-squared	0.922292	0.941605	0.917923	0.932145	0.930498
F (10, 87)	103.2579	140.2863	97.29865	119.5152	116.476
Adjusted R-squared	0.91336	0.934893	0.908489	0.924346	0.922509
P-value (F)	7.38E-44	3.20E-49	7.83E-43	2.11E-46	5.96E-46

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019. Own elaboration based on calculations in R-studio.

Except for 2019, market size has never had a statistically significant impact on GDP per capita. However, during the specified period, the ratio was positive. In comparison to 2018, the ratio increased by 26% in 2019. As a result, we predict that broadening the market size field will significantly affect the rising GDP per capita in the selected countries

According to business sophistication, the coefficient's dynamic was unstable and changed over time. The tendency for coefficients to grow began in 2017. However, the ratio fell rapidly in 2019, eventually becoming negative and statistically significant. We believe that further investment in this field will lead selected countries towards economic progress.

The need for countries to stimulate various disciplines, including health and primary education, higher education, and training, as well as market size and business sophistication, could be a probable explanation for these findings. Furthermore, it appears that if these countries had initially increased their investments in these sectors, they would have significantly contributed to faster GDP per capita outcomes. In both the short and long run, investments can significantly impact the GDP per capita.

Table 6 presents the multicollinearity statistics for the variables used in our analysis. The multicollinearity analysis reveals significant concerns, particularly for Infrastructure, Health and Primary Education, Higher Education and Training, and Business Sophistication, which exhibited very high VIFs and low tolerance values. These findings indicate substantial overlap among these predictors, which could potentially

bias the coefficient estimates and inflate standard errors. In light of these results, careful consideration was given to selecting instruments and variable inclusion to ensure robust and reliable model estimates.

Further, Hausman test results revealed a significant difference between OLS estimates and the consistent estimates from the 2SLS approach, highlighting concerns about potential endogeneity in the model. This suggests that the entrepreneurship variable, as measured by GEI, may be influenced by GDP per capita, potentially distorting the true relationship between these variables. Although the residuals from the regression did not meet the normality assumption – likely due to the relatively small sample size of countries – the coefficients remained statistically significant, and the adjusted R-squared values were satisfactory. The Hausman test's low p-value indicated that OLS estimation was inconsistent, leading us to favour the 2SLS approach.

In response to these concerns, we adopted the IV approach using 2SLS, which allowed us to address endogeneity effectively. The four instruments – infrastructure, health and primary education, higher education and training, and market size – were validated based on their strong correlation with GEI. As mentioned in the methodology section, innovation and business sophistication were deemed statistically insignificant and excluded from the analysis. We chose these instruments to ensure consistency and reliability in addressing endogeneity and provide a credible identification strategy. The 2SLS methodology proved superior to OLS, offering a more robust explanatory framework and improving the model's ability to capture the nuanced relationship between GEI and GDP per capita. Given the multicollinearity issues identified in our preliminary analysis, we deliberately avoided including control variables in the second stage to prevent exacerbating multicollinearity and compromising the reliability of our estimates.

To clarify, our primary goal with the 2SLS approach was to address endogeneity concerns and improve the robustness of our estimates. In the first stage, we regressed the GEI on the selected instrumental variables to obtain the predicted values of GEI, which we then used in the second stage. This approach intended to isolate the variation in GEI exogenous to the outcome equation.

Incorporating control variables in the second stage could provide an additional robustness check. However, introducing additional regressors might result in the risk of spurious regression and would only be justified if there is a significant concern regarding omitted variable bias. Since the GEI has shown a statistically significant link to the dependent variable, and the regression errors follow a normal distribution, reducing the risk of omitted variables, we have opted to include only the GEI as the regressor in the second stage. At the same time, testing the inclusion of further regressors may be conducted in future research. This would be especially important in identifying potential ways in which changes in GEI impact GDP per capita.

While the Sargan test raised some concerns about the validity of all instruments, the high F-statistic indicated that the instruments used in the model possessed sufficient explanatory power. This effectively mitigated concerns about instrument weakness. However, excluding the variable for higher education and training significantly improved the results of the Sargan over-identification test. Therefore, we decided to exclude this variable from the list of instruments in the final model. This indicates that higher education was less associated with the GEI than other instruments. In other words, this suggests that health and primary education, infrastructure, and market size have a more significant link to the GEI and, by extension, to GDP per capita than higher education and training. It is also possible that these three instruments serve as prerequisites, while higher education only impacts the GEI in their presence. These aspects present interesting opportunities for further research. Especially, this finding is relevant for the research focusing on potential paths in which indicators of entrepreneurial activity impact economic development.

As a result of this shift towards the IV 2SLS methodology, our analysis gained robustness, leading to a more convincing and academically grounded examination of the intricate relationship between entrepreneurship and GDP per capita. The outcomes from (Table 3) further strengthened our confidence in the assertion that the IV 2SLS approach offers a more comprehensive and reliable means of unravelling the nuanced dynamics between these pivotal economic determinants.

According to Model 2, there was a positive link between GEI and GDP per capita (constant 2010 USD) at the 95% alpha level. The coefficient equals approximately 3 (which means a 3% increase in GDP per capita when GEI increases by 1%). This model was estimated for all the selected countries.

After conducting multiple analyses for selected countries and using all other variables instead of GEI as an independent variable, we concluded that GDP per capita has a statistically significant relationship with GEI. In contrast, it does not exhibit such a relationship with any of the other examined variables. Models with other independent variables from the dataset (infrastructure, health and primary education, higher education and training, market size, and business sophistication) showed a significantly low level of R-squared and were excluded from the analysis. The fact that the effect of all other variables is already captured in GEI effectively explains our findings.

Table 3. IV 2SLS model for the dependent variable GDP per capita (constant 2010 USD) (between estima-tor)

TSLS, using 490 observations Dependent variable: log of GDP per capita, in constant 2010 USD				
Statisics	**Coefficient**	**Std. error**	**t-ratio**	**p-value**
const	-1.62680	0.331827	-4.903	<0.0001***
l_GEI	3.04050	0.0934421	32.54	<0.0001***
Mean dependent var	9.110937		S.D. dependent var	1.484236
Sum squared resid	289.5884		S.E. of regression	0.770337
R-squared	0.775729		Adjusted R-squared	0.775270
Chi-square (1)	1058.781		p-value	<0.0001***
Instruments	Infrastructure, health and primary education, and market size			
Hausman test				
Null hypothesis: OLS estimates are consistent				
Asymptotic test statistic: Chi-square (1) = 115.164, with p-value = <0.0001***				
Sargan over-identification test				
Null hypothesis: all instruments are valid				
Test statistic: LM = 1.68842 with p-value = P (Chi-square (3)> 1.68842) = 0.429897				
Weak instrument test – First-stage F-statistic (3, 486) = 155.189				

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019. Own calculations in R-studio.

As part of our robustness checks, we tested the addition of control variables for the countries, which demonstrated the highest errors after model fitting (Slovakia, India, and Hong Kong) and the baseline model (Table 3). As a result, the coefficient for GEI decreased to 2.47% (p-value < 0.0001). The direction of the effect stayed the same as in the baseline model but the coefficients for control variables were not statistically significant. These findings confirm the outcomes of the baseline model while adding control variables with statistically insignificant coefficients. As a result, we chose the baseline model as the main one.

Overall, the IV 2SLS model results effectively showed that countries with higher levels of GEI tend to achieve higher levels of GDP per capita. Noteworthy, this finding has been proved for the pooled dataset of countries, including developed and developing countries. Using the pooled datas*et* allows the model to capture the variance between countries, and therefore, the estimated values of the regression coefficient reflect the average effect of GEI improvement on GDP per capita growth. In contrast to previous studies (Hong & Sullivan, 2013; Maradana *et al*., 2017), we showed the average association between GEI and GDP per capita. At the same time, the literature already confirmed the association between entrepreneurship and economic development (Aparicio, 2017; Doran *et al*., 2018; Guerrero *et al.*, 2020). The current study confirmed the previous findings of other authors by using GEI as a proxy measure of entrepreneurship activity. Nevertheless, correlation and association do not mean causality. Therefore, the direction of the influence required further investigation.

Drawing on the results, it is evident that fostering entrepreneurial activities can yield a positive and substantial influence on economic development, as measured by GDP per capita. Moreover, such activities can be a crucial foundation for a country's innovativeness and competitiveness. An alternative interpretation of these outcomes aligns with hypotheses posited by other scholars (Naudé *et al*., 2011; Feki & Mnif, 2016; Farinha *et al*., 2018).

CONCLUSIONS

The study investigated the relationship between entrepreneurship, as measured by the GEI and GDP per capita across 98 countries from 2015 to 2019. We aimed to assess whether entrepreneurship positively and significantly impacts economic development in developed and developing economies.

The analysis revealed that our hypothesis was corroborated. A significant positive relationship exists between entrepreneurship and GDP per capita in developed and developing countries. Specifically, on average, a 1% increase in the global entrepreneurship index (GEI) is associated with a 3.04% rise in GDP per capita, indicating that countries with higher GEI rankings tend to exhibit higher GDP per capita figures.

Furthermore, this study offers several notable features. Firstly, it captures entrepreneurship's influence on economic development across various economies, which could provide insights into developed and developing countries. Secondly, it highlights the importance of key variables such as health and primary education, higher education and training, business sophistication, and market size, which may be critical in supporting entrepreneurial activities and fostering long-term economic development. Lastly, it integrates short-term and long-term perspectives, which might enable policymakers to anticipate the varying effects on GDP per capita and shape their strategies accordingly.

Interestingly, while some variables may negatively impact entrepreneurship and GDP per capita in the short term, our findings suggest they contribute positively to long-term economic development. For policymakers, this study emphasises the importance of fostering entrepreneurship alongside other essential sectors like health and education to stimulate innovation, job creation, and improved quality of life. Policymakers can leverage these insights to shape policies that balance immediate economic needs with long-term development goals.

While this study provides valuable insights into the relationship between GEI and GDP per capita, it is essential to acknowledge the limitations of our research, including a small sample size (98 countries) and a short study duration (2015-2019). Moreover, our study observed an association, rather than causality, between the entrepreneurship environment (using GEI as a proxy) and economic development (expressed as GDP per capita). Further research could broaden the study's scope by including a broader range of nations and employing diverse methodologies. This would allow for a deeper investigation into potential additional factors influencing both the dependent (GDP per capita) and independent (GEI) variables, ultimately providing a more nuanced understanding of the causal relationship between entrepreneurship and economic development.

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Appendix 1: Selected developed and developing countries

Albania	El Salvador	Latvia	Romania
Algeria	Estonia	Lithuania	Russian Federation
Argentina	Ethiopia	Luxembourg	Saudi Arabia
Australia	Finland	Madagascar	Serbia
Austria	France	Malawi	Singapore
Bahrain	Gambia, the	Malaysia	Slovak Republic
Bangladesh	Germany	Mali	Slovenia
Belgium	Ghana	Mauritania	South Africa
Botswana	Greece	Mexico	Spain
Brazil	Guatemala	Montenegro	Sri Lanka
Bulgaria	Honduras	Morocco	Sweden
Burundi	Hong Kong SAR	Mozambique	Switzerland
Cambodia	Hungary	Namibia	Tanzania
Cameroon	Iceland	Netherlands, the	Thailand
Canada	India	Nigeria	Trinidad and Tobago
Chad	Indonesia	Norway	Turkey
Chile	Ireland	Oman	Uganda
China	Israel	Pakistan	Ukraine
Colombia	Italy	Panama	United Arab Emirates
Costa Rica	Japan	Paraguay	United Kingdom
Croatia	Jordan	Peru	United States
Cyprus	Kazakhstan	Philippines	Vietnam
Czech Republic	Kenya	Poland	Zambia
Denmark	Korea, Republic of	Portugal	
Egypt	Kuwait	Qatar	

Source: The Global Competitiveness Report 2017-2018.

Appendix 2: Correlation results for the year 2015-2019

Variables	GDP Per capita	GEI	Infrastructure	Health and Primary Education	High education and trainings	Market Size	Business Sophistication	Innovation
GDP Per capita	1	0.809***	0.068	0.059	0.078	0.035	0.06	0.116
GEI	0.809 ***	1	0.061	0.046	0.073	0.031	0.05	0.123
Infrastructure	0.068	0.061	1	0.978***	0.979***	0.954***	0.975***	0.954***
Health and Primary Education	0.059	0.046	0.978***	1	0.987***	0.949***	0.982***	0.953***
High education and trainings	0.078	0.073	0.979***	0.987***	1	0.948***	0.989***	0.968***
Market Size	0.035	0.031	0.954***	0.949***	0.948***	1	0.962***	0.940***
Business Sophistication	0.06	0.05	0.975***	0.982***	0.989***	0.962***	1	0.962***
Innovation	0.116	0.123	0.954***	0.953***	0.968***	0.940***	0.962***	1

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: GEI Report 2015-2019; GCI Report 2015-2019; World Bank 2015-2019; own elaboration based on calculations in R-studio.

Appendix 3: Multicollinearity statistics

Statistics	GEI	Infrastructure	Health and Primary Education	High education and training	Market Size	Business Sophistication	Innovation
Tolerance	0.896	0.032	0.020	0.011	0.059	0.016	0.052
VIF	1.115	31.737	49.905	94.189	16.963	64.286	19.199

Source: own elaboration based on calculations in R-studio.

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The contribution share of authors is equal and amounted to 25% for each of them.
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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The impact of FinTech literacy on digital entrepreneurial intentions: Exploring crowdfunding, blockchain, and AI through a social cognitive career theory lens

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ABSTRACT

Objective: The objective of the article is to investigate the association between FinTech literacy and the intention to become digital entrepreneurs utilizing the social cognitive career theory (SCCT). Specifically, it sheds light on how three aspects of FinTech literacy (crowdfunding, blockchain, and artificial intelligence) influence individuals' digital entrepreneurial self-efficacy and outcome expectations. Additionally, it examines the separate and sequential mediation roles of digital entrepreneurial self-efficacy and outcome expectations in the connection between literacy in crowdfunding, blockchain, and AI and digital entrepreneurial intention.

Research Design & Methods: The conceptual model was analysed using structural equation modelling with the bootstrapping method based on data from a sample of 978 university students in Vietnam.

Findings: Our results revealed significant direct impacts of FinTech literacy dimensions on individuals' self-efficacy and outcome expectations regarding digital entrepreneurship. Moreover, the mediation analysis uncovered distinct and sequential mediation roles of self-efficacy and outcome expectations in the correlation between the three components of FinTech literacy and the intention to establish digital start-ups, offering new insights into how crowdfunding, blockchain, and AI literacy drive the intention to launch digital ventures.

Implications & Recommendations: This study emphasizes the importance of FinTech literacy for digital entrepreneurship. Academic programs should provide practical FinTech training, and policymakers must support FinTech literacy through policies and resources. Incubators and accelerators can integrate FinTech training to prepare entrepreneurs for the digital economy better.

Contribution & Value Added: In this study, we explore the SCCT framework, offering novel theoretical insights into the psychological drivers of digital entrepreneurship. The study significantly advances the field by highlighting the importance of FinTech literacy and sets a new agenda for future research. These findings expand our theoretical understanding and provide actionable recommendations for educational institutions, policymakers, and the entrepreneurial ecosystem.

Article type:	research article
Keywords:	digital entrepreneurial intention; FinTech literacy; crowdfunding; blockchain; artificial intelligence
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INTRODUCTION

The landscape of entrepreneurial endeavours is experiencing major changes as a result of digital technology development (Hassan *et al*., 2021; Nambisan, 2017; Truong *et al*., 2022; Do *et al.*, 2024). The emergence of digital technology brings about significant changes in entrepreneurial methods and their

resulting impacts, thus underscoring digital entrepreneurship (DE) as a revolutionary approach to addressing societal issues (George *et al*., 2021). Digital entrepreneurship involves starting new businesses using technology (Sitaridis & Kitsios, 2023) and plays a significant role in a country's economic development through job creation, technological advancement, and economic prosperity (Singh & Dwivedi, 2022). Despite the extensive research on traditional entrepreneurship, DE remains underexplored in academic literature (Mir *et al.*, 2022; Vu *et al.*, 2024).

In parallel, the emergence of Financial Technologies (FinTech) has revolutionized the way businesses operate, offering innovative solutions for financial transactions, fundraising, and data analytics (Wang *et al*., 2022). As the digital economy grows, FinTech literacy – the knowledge and skills to effectively use FinTech tools – has become crucial for entrepreneurial success in the digital age (Nguyen *et al*., 2024). Studies highlight the essential role of technical knowledge in helping entrepreneurs adapt to technological shifts and seize emerging opportunities (Festa *et al*., 2022; Sitaridis & Kitsios, 2023). While scholars have scrutinised traditional entrepreneurial skills, the influence of FinTech literacy on the intention to pursue DE has received relatively little attention and warrants further investigation.

To address these gaps, we employed the social cognitive career theory (SCCT) to examine the individual and combined effects of three key components of FinTech literacy, *i.e.*, crowdfunding, blockchain, and artificial intelligence (AI), on the intention to engage in digital start-ups. Specifically, we explored how FinTech literacy enhances digital entrepreneurial self-efficacy (DESE) and outcome expectations (DEOE), two psychological factors that drive entrepreneurial intention (Lent *et al*., 1994). Sequential mediation analysis was central to this study, as it revealed how FinTech literacy impacts digital entrepreneurial intention (DEI) through these mediating factors in a step-by-step process. This analysis provides a more nuanced understanding of how, individually and collectively, crowdfunding, blockchain, and AI influence DEIs.

Our investigation endeavours to bridge the current gaps in digital entrepreneurial intention by addressing three pivotal questions:

RQ1: How does FinTech literacy (crowdfunding, blockchain, and AI literature) influence DESE and DEOE?

RQ2: How do DESE and DEOE mediate the effect of FinTech literacy on DEIs?

RQ3: Do DESE and DEOE co-play serial mediate the effect of FinTech literacy on DEIs?

By integrating SCCT with FinTech literacy, this study provides both theoretical and practical contributions. This study is the first to use the SCCT framework to explore how FinTech literacy affects the intention to engage in DE. By highlighting the distinct and sequential mediation roles of DESE and DEOE in this process, this study provided a deeper understanding of how crowdfunding, blockchain, and artificial intelligence translate into DEIs. The findings also help policymakers promote FinTech education and foster supportive ecosystems to cultivate the next generation of digital entrepreneurs.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Digital Entrepreneurship

Digital entrepreneurship (DE) involves using digital technologies and online platforms to create and expand new business ventures, products, or services, which significantly impact entrepreneurial activity (Nguyen *et al*., 2024; Do, 2021). Numerous scholars have suggested definitions for DE. Singh and Dwivedi (2022) suggest that we may describe DE as a business model that emerges as a venture using technology, digital tools, or media. Paul *et al*. (2023) defined DE as a sub-category of entrepreneurship where certain or all elements of traditional business are digitalized. Meanwhile, Sitaridis, and Kitsios (2023) argued that digital involves human-driven efforts to transform business concepts into concrete products or services, while also establishing the essential procedures for success by leveraging digital technology as a key component.

The rise of DE has brought about profound transformations in innovation and business, fuelled by robust and cutting-edge digital technologies, platforms, and infrastructures (Paul *et al*., 2023; Wibowo *et al*., 2023; Do & Le, 2022). The proliferation of digital platforms and associated entrepre-

neurial ecosystems gave rise to a multitude of opportunities, including e-commerce ventures, online marketplaces, and software offerings (Aloulou *et al*., 2023; Nguyen & Nguyen, 2024). Entrepreneurs leverage information and insights to understand customer preferences and actions, which enables them to create forward-thinking strategies.

FinTech Literacy

FinTech refers to the use of advanced technologies aimed at enhancing and streamlining the delivery and utilization of financial services (Puschmann, 2017). Recent literature has widely recognized FinTech as a pivotal catalyst driving entrepreneurship (Festa *et al*., 2022; Nguyen *et al*., 2024). FinTech enables entrepreneurs to streamline operations, manage resources efficiently, and access broader markets through digital channels (Almansour, 2023). The successful use of FinTech depends on a thorough understanding of data-driven algorithms (Tian *et al.*, 2021). Therefore, individuals must possess specific knowledge and skills to leverage FinTech successfully (Almansour, 2023; Nguyen *et al*., 2024). FinTech literacy refers to individuals' understanding, mindset, and competence in using digital tools, software, and applications for accessing, managing, and analysing financial resources, transactions, and data (Nguyen *et al.*, 2024). In the fast-changing digital business environment, this literacy is paramount for entrepreneurs to fully harness their potential and remain competitive.

As scholars indicate, the predominant applications of FinTech, including crowdfunding, blockchain, and AI, exhibit significant potential for modern entrepreneurs (Festa *et al*., 2022; Ulrich *et al*., 2023; Troise *et al*., 2022; Hidayat-ur-Rehman & Hossain, 2024; Sitaridis & Kitsios, 2023). These applications provide broader access to capital (Troise *et al*., 2022), offer new opportunities for financial transactions and asset management (Ulrich *et al*., 2023), and help improve decision-making and customer experiences for entrepreneurs (Kumar *et al*., 2023).

Although DE is a rapidly growing field, research on the specific impact of FinTech literacy on DEI remains scarce (Nguyen *et al*., 2024). For instance, Festa *et al*. (2022) explored FinTech literacy's influence on entrepreneurial intentions but focused on general entrepreneurial behaviour without delving into the unique DE dynamics. Similarly, Tran *et al*. (2024) examined how FinTech literacy shapes entrepreneurial intentions specifically within the FinTech sector, but their scope was limited to FinTech-related ventures rather than the broader context of DE. Nguyen *et al*. (2024) investigated FinTech literacy's role in influencing DEI, but their research did not fully capture the complex ways in which FinTech literacy enhances both technical expertise and psychological factors like self-efficacy and outcome expectations. This gap highlights the need for more research into how FinTech literacy drives the technical competence and confidence required for digital entrepreneurial success.

Social Cognitive Career Theory

Building on Bandura's social cognitive theory (1991) and the concept of self-efficacy, Lent *et al.* (1994) explain how individuals form career interests, set goals, and make choices through two key mechanisms: self-efficacy beliefs, which reflect one's confidence in performing tasks, and outcome expectations, which refer to anticipated results. It also accounts for personal and environmental influences on these processes, making it a robust framework for understanding career-related decisions (Lent & Brown, 2019; Liguori *et al.*, 2017).

Researchers have widely applied SCCT to understand career development across various fields, such as academic (Li *et al*., 2024), computing disciplines (Lent *et al*., 2008), and engineering (Saifuddin *et al.*, 2013). In entrepreneurship research, scholars have rigorously validated SCCT as an effective framework for comprehending entrepreneurial behaviour and intention, given that entrepreneurship is a chosen career path (Liguori *et al.*, 2017; Pham & Le, 2023). However, its application to DE, specifically through the lens of FinTech literacy, remains novel.

We employed the SCCT framework to investigate the impact of FinTech literacy on the intention to pursue digital start-ups (refer to Figure 1). Drawing on SCCT, the study posits that FinTech literacy, which acts as a personal attribute, affects self-efficacy and outcome expectations, subsequently impacting the intention to engage in DE. The SCCT is highly appropriate for this study for several reasons. Firstly, while the theory of planned behaviour (TPB) and the entrepreneurial event model (EEM) are

widely used to predict entrepreneurial intention by focusing on beliefs and motivations, SCCT offers a promising alternative by addressing external influences such as knowledge. The SCCT incorporates critical components of the entrepreneurial intention models and provides a comprehensive theoretical framework for understanding how personal capabilities and perceptions influence career-related decisions and behaviours (Liguori *et al.*, 2017; Anh Do *et al.*, 2023). Furthermore, SCCT emphasizes the interplay between self-efficacy and outcome expectations, making it an ideal framework for examining the role of FinTech literacy in shaping DEIs. Therefore, expanding SCCT to include the impact of knowledge in emerging technologies such as crowdfunding, blockchain, and AI on entrepreneurs' technical abilities and psychological readiness uniquely contributes to the DE field.

Digital Entrepreneurial Self-efficacy, Outcome Expectations and Digital Entrepreneurial Intention

Digital entrepreneurial self-efficacy (DESE) refers to the confidence an individual has in their ability to effectively handle the challenges of being a successful digital entrepreneur (Xin & Ma, 2023). It involves the belief in one's ability to utilize digital tools and technologies, innovate, adjust to the constantly changing digital environment, and achieve success in the field of DE (Vu *et al*., 2024). Meanwhile, digital entrepreneurial outcome expectations (DEOE) refer to individuals' anticipated outcomes of engaging in DE.

According to SCCT, self-efficacy and outcome expectations are two determinants of behavioural intention (Lent *et al*., 1994). Previous research has reported that entrepreneurial self-efficacy is essential for engaging in entrepreneurial activities and is linked to having positive intentions toward entrepreneurship (Munir *et al*., 2024; Pham & Le, 2023). People with strong entrepreneurial self-efficacy are more inclined to invest effort in overcoming complex tasks and exhibit greater adaptability, resulting in an increased likelihood of wanting to start a business (Pham & Le, 2023). Similarly, several research studies have also shown a direct correlation between entrepreneurial intention and outcome expectations (Duong *et al*., 2023; Liguori *et al*., 2019). When individuals hold optimistic expectations about their future entrepreneurial outcomes, such as favourable financial gains, widespread public acknowledgement, and personal autonomy, they are more inclined to pursue starting their businesses (Santos & Liguori, 2020). Therefore, we hypothesised that individuals' DESE and DEOE positively impact their DEIs.

H1: (a) Digital entrepreneurial self-efficacy and (b) digital entrepreneurial outcome expectations positively affect digital entrepreneurial intention.

As suggested by SCCT, individuals' perceived self-efficacy influences their outcome expectations (Lent *et al*., 1994). Those with elevated levels of entrepreneurial self-efficacy tend to hold more positive expectations about the outcomes of their entrepreneurial endeavours due to their confidence in successfully executing the required tasks (Liguori *et al*., 2019; Santos & Liguori, 2020). Conversely, individuals with lower entrepreneurial self-efficacy are more likely to have less optimistic DEOE. Previous research has confirmed the positive correlation between entrepreneurial self-efficacy and outcome expectations (Duong *et al*., 2023; Santos & Liguori, 2020). Hence, we posited a similar correlation between DESE and DEOE.

H2: Digital entrepreneurial self-efficacy positively affects digital entrepreneurial outcome expectations.

The Role of FinTech Literacy

Crowdfunding is an online solicitation aimed at collecting resources from dispersed and unidentified contributors (Yacoub *et al*., 2022). This technology has quickly emerged as a vital financial option for supporting entrepreneurship. Crowdfunding is distinct from conventional financing because it involves a group of inexperienced investors with diverse motivations for contributing, limited financial resources and little formal investment training (Kumar & Agrawal, 2023). Scholars see crowdfunding as a promising platform that can have a significant influence on the launch of digital businesses, especially in developing economies (Phung, 2023). Digital entrepreneurs utilize crowdfunding platforms to boost user engagement and expand their operations (Liu *et al*., 2023). These platforms enable them to connect with potential customers and investors worldwide to obtain a range of resources (Nambisan, 2017). Therefore, crowdfunding plays a crucial role in DE.

We suggest that individuals who know about crowdfunding are likely to improve their DESE and develop positive DEOE. Crowdfunding opens new possibilities for entrepreneurs by giving them access to unconventional funding sources (Kumar & Agrawal, 2023), motivating individuals to become entrepreneurs (Parhankangas & Colbourne, 2023). By understanding the mechanisms and strategies involved in successful crowdfunding campaigns, digital entrepreneurs become more confident in raising the necessary funds (Yu & Fleming, 2022), validating their business ideas, and engaging with a broader audience (Nguyen *et al*., 2024). This knowledge helps them navigate the complexities of crowdfunding platforms and fosters a sense of competence and control over their entrepreneurial ventures. Moreover, being familiar with crowdfunding increases entrepreneurs' expectations of successful outcomes as they become skilled at using these platforms to secure financial resources, gain market validation, and build a community of early supporters (Kumar & Agrawal, 2023). Consequently, crowdfunding literacy directly contributes to higher self-efficacy and optimistic outcome expectations, essential for sustained entrepreneurial motivation and success in the digital landscape.

H3: Crowdfunding literacy positively affects (a) digital entrepreneurial self-efficacy and (b) digital entrepreneurial outcome expectations.

Blockchain is a technology that securely stores and transmits information in a decentralized, transparent manner through interconnected blocks containing verified data (Ulrich *et al*., 2023). In the digital economy, blockchain is pivotal for entrepreneurship as it offers a secure and transparent framework that enhances trust among stakeholders by ensuring that transactions are immutable and verifiable, thereby reducing fraud and errors (Wang *et al.*, 2022). Empirical studies show that blockchain literacy is closely linked to entrepreneurial behaviour. For example, entrepreneurs proficient in blockchain technology are more likely to implement smart contracts, which automate agreements and reduce operational costs (Chen & Bellavitis, 2020). These technologies not only streamline processes but also foster innovation by allowing entrepreneurs to launch initial coin offerings (ICOs) and security token offerings (STOs), providing greater access to capital and democratizing fundraising (Ulrich *et al*., 2023).

We propose that blockchain literacy can increase individuals' DESE and DEOE. Awareness of blockchain technology equips potential entrepreneurs with the knowledge to interact more effectively with this innovative tool and thus allows them to make informed and strategic decisions that support their digital ventures. This heightened understanding enables entrepreneurs to identify and capitalize on emerging opportunities within the digital landscape, fostering a sense of confidence and competence (Elia *et al*., 2020). Furthermore, individuals familiar with blockchain's benefits – such as increased security, transparency, and operational efficiency – tend to set higher expectations for the success of their ventures (Festa *et al*., 2022). Studies show that entrepreneurs with blockchain literacy are better equipped to identify emerging opportunities, make strategic decisions, and enhance trust with customers and partners, ultimately improving their business outcomes (Nguyen *et al*., 2024). Therefore, blockchain literacy can shape an entrepreneur's expectations regarding the outcomes of their digital ventures.

H4: Blockchain literacy positively affects (a) digital entrepreneurial self-efficacy and (b) digital entrepreneurial outcome expectations.

Artificial intelligence can execute intricate tasks that typically require human intelligence and often outperforms human abilities in certain areas (Kumar *et al*., 2023). This study argues that AI literacy shapes both DESE and DEOE. First, AI literacy equips entrepreneurs with the technical knowledge and skills necessary to effectively use AI-driven tools and solutions, which enhances their confidence in managing AI-powered business processes. AI has been proven to support long-term business success by optimizing tasks such as customer interactions, market research, and fraud detection (Nguyen *et al*., 2024), entrepreneurs who understand these capabilities feel more confident in their ability to implement AI within their ventures.

Furthermore, AI literacy positively influences DEOE by providing a clearer understanding of AI's potential benefits. Entrepreneurs with AI expertise can better anticipate AI's advantages, such as enhanced efficiency, innovation, and competitiveness in the market (Chalmers *et al*., 2021). Moreover, AI enables entrepreneurs to analyse vast data and uncover insights that support data-driven decision-making and strategic planning. It enhances human capabilities and creates avenues for progress and

expansion in the competitive technological environment. When individuals have realistic yet ambitious expectations of how AI can transform their business operations and outcomes, they are more likely to set higher goals and expect positive results. This understanding shapes outcome expectations, as entrepreneurs who are proficient in AI can foresee the impact of advanced analytics, automation, and smart product development on their business success (Almansour, 2023; Dabbous & Boustani, 2023).

H5: AI literacy positively affects (a) digital entrepreneurial self-efficacy and (b) digital entrepreneurial outcome expectations.

The Mediate Role of Digital Entrepreneurial Self-efficacy and Outcome Expectations

Within the SCCT framework, self-efficacy and outcome expectations serve as mediators between personal factors and intention (Duong *et al*., 2023; Liguori *et al*., 2019). Therefore, our extension of this model includes the impact of FinTech literacy on the intention to pursue DE, with DESE and DEOE serving as mediators.

H6: Digital entrepreneurial self-efficacy mediates the effect of (a) crowdfunding, (b) blockchain, and (c) AI on digital entrepreneurial intention.

H7: Digital entrepreneurial outcome expectations mediate the effect of (a) crowdfunding, (b) blockchain, and (c) AI on digital entrepreneurial intention.

Moreover, the SCCT model posits that self-efficacy mediates the relationship between personal factors and outcome expectations (Liguori *et al*., 2019). Thus, it is plausible to suggest that DESE and DEOE act as serial mediators in the link between FinTech literacy and DEI.

H8: Digital entrepreneurial self-efficacy and digital entrepreneurial outcome expectations co-play a serial mediating role in the relationship between (a) crowdfunding, (b) blockchain, and (c) AI and digital entrepreneurial intention.

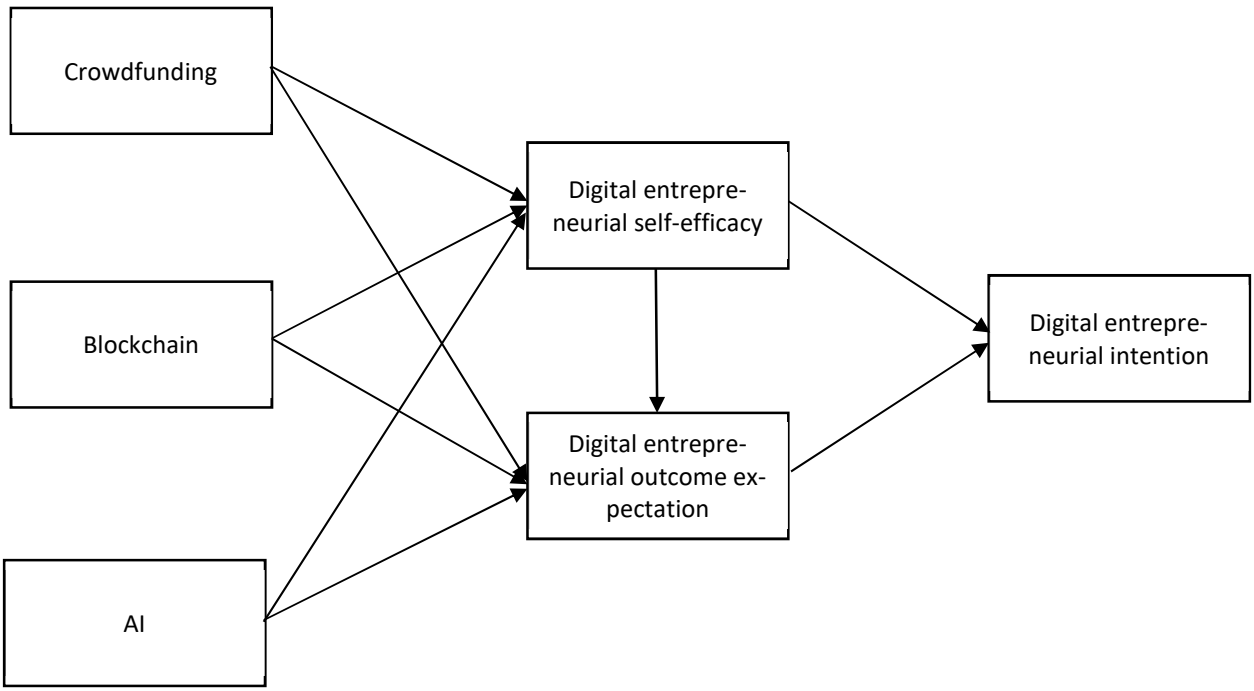

Figure 1. The research model
Source: own elaboration.

RESEARCH METHODOLOGY

Data Collection and Sample

We collected data through a quota convenience sampling method. The need to ensure a balanced representation of respondents across key demographic characteristics, such as study major and gender justified the use of quota convenience sampling. This method aligns with prior studies on entrepreneurial intentions and technology literacy, which often use convenience sampling to address practical constraints when targeting university students (*e.g.*, Nguyen *et al*., 2024; Festa *et al*., 2022). The survey targeted higher education students in Ha Noi, known for its high concentration of universities in Northern Vietnam. We used paper forms to distribute the questionnaire to students offline. We briefed all participants on the research's objectives, and participation in the survey was entirely up to the individual.

Over one month, we distributed a total of 1218 hard copies of questionnaires directly to students. Of the distributed questionnaires, we collected an impressive 1006, resulting in a response rate of 82.6%. Following the collection, we excluded 28 questionnaires, because they contained incomplete data, leaving a final sample of 978 responses for analysis. Within the final sample, male participants constituted 54.5%. Regarding academic majors, 59% specialized in economics and business administration, while 41% were in engineering or other fields. Notably, 73.1% of respondents claimed no enrolment in entrepreneurship courses.

Measures

We measured the constructs in our model using established scales from previous research, chosen for their validity and relevance to the DE context.

We derived the six-item scale measuring DEI from Aloulou *et al*. (2023), which has demonstrated its validity, ensuring its appropriateness for assessing intentions within a digital context. We adopted the three-item scale assessing DESE from Xin and Ma (2023), chosen for its proven reliability in measuring confidence in digital entrepreneurial abilities, which is central to the concept of self-efficacy in the DE landscape. We modified the four-item scale for DEOE from the research of Santos and Liguori (2020), whose work extensively validated this measure in entrepreneurial research, making it highly relevant for capturing expectations regarding entrepreneurial success in digital ventures.

We adopted the ten-item scale for crowdfunding literacy and the five-item scale for blockchain literacy from Festa *et al*. (2022). We selected these scales due to their demonstrated reliability and empirical support in measuring literacy in these specific financial technologies (e.g., Nguyen *et al*., 2024; Tran *et al*., 2024), which are pivotal in the DE domain. Lastly, we adjusted the three-item scale measuring AI literacy from the research of Dabbous and Boustani (2023), chosen for its theoretical grounding and validation in assessing knowledge and competence in AI, which is becoming increasingly critical for modern entrepreneurs.

Data Analysis

We processed and analysed data using SPSS 22 and AMOS 24 software. Initially, we assessed reliability and validity using Cronbach's alpha coefficient. Next, we used confirmatory factor analysis (CFA) to assess the measurement model by examining the convergent and discriminant validity of the measurement scales. Lastly, we utilised structural equation modelling (SEM) to investigate the research hypotheses. More distinctively, to investigate the indirect and serial mediation effects within the research model, we applied an indirect effect plugin with 5 000 bootstrapped samples.

RESULTS AND DISCUSSION

Measure Assessment

As presented in Table 1, the Skewness and Kurtosis values fell within acceptable ranges (from -2 to 2), confirming the normality of the constructs (Pham & Le, 2023). Table 1 also provides the inter-correlation between the six constructs of the research model.

After confirming the variables' normality, we calculated Cronbach's alpha coefficient to assess internal consistency. As reported in Table 2, Cronbach's alpha coefficients for all variables were higher than 0.7. This indicates that the scales were highly reliable and statistically significant (Hair *et al*., 2010).

Table 1. Descriptive characteristics and Pearson correlation

Variables	Mean	S.D	Skewness	Kurtosis	Inter-construct correlations					
					1	2	3	4	5	6
1. DEI	4.9293	1.36992	-0.819	0.179	–					
2. DESE	5.1554	1.35017	-1.094	0.963	0.646**	–				
3. DEOE	5.2582	1.17824	-1.185	1.771	0.529**	0.513**	–			
4. CF	4.4724	1.39071	-0.451	-0.631	0.206**	0.224**	0.291**	–		
5. BC	5.1164	1.20375	-1.053	1.317	0.419**	0.452**	0.574**	0.282**	–	
6. AI	4.6714	1.46516	-0.602	-0.285	0.238**	0.277**	0.369**	0.052	0.479**	–

Notes. N=978, ** significance was at 0.01 level.
Source: own study.

Table 2. The results of convergent validity and reliability assessment

Variables	Code	α	CR	AVE	Factor loading
Digital entrepreneurial intention – DEI	DEI1	**0.946**	**0.946**	**0.745**	0.828
	DEI2				0.870
	DEI3				0.858
	DEI4				0.881
	DEI5				0.854
	DEI6				0.887
Digital entrepreneurial self-efficacy – DESE	DESE1	**0.925**	**0.926**	**0.807**	0.862
	DESE2				0.916
	DESE3				0.916
Digital entrepreneurial outcome expectation – DEOE	DEOE1	**0.836**	**0.858**	**0.609**	0.870
	DEOE2				0.870
	DEOE3				0.812
	DEOE4				0.515
Crowdfunding – CF	CF1	**0.953**	**0.953**	**0.672**	0.732
	CF2				0.777
	CF3				0.791
	CF4				0.862
	CF5				0.876
	CF6				0.867
	CF7				0.839
	CF8				0.850
	CF9				0.831
	CF10				0.760
Blockchain – BC	BC1	**0.913**	**0.916**	**0.686**	0.826
	BC2				0.882
	BC3				0.868
	BC4				0.848
	BC5				0.704
Artificial intelligence – AI	AI1	**0.931**	**0.932**	**0.819**	0.905
	AI2				0.926
	AI3				0.885

Notes. α: Cronbach's alpha.
Source: own study.

We evaluated the convergent and discriminant validity of the measurement scales by performing CFA. The measurement model showed a good fit, as indicated by the following indices CMIN/df = 6.625, CFI =

0.914 > 0.9, SRMR = 0.041 < 0.08, and RMSEA = 0.076 < 0.08 (Hu & Bentler, 1999). Table 2 also presents all variables' average variance extracted (AVE) and composite reliability (CR) reached acceptable levels. All constructs had CR values that went beyond the recommended minimum of 0.6, and the AVE values for all variables were higher than 0.5, indicating satisfactory convergent validity (Hair *et al*., 2010). Furthermore, the factor loadings of all items, which vary from 0.515 to 0.926, demonstrated robust associations between the items and their corresponding constructs.

Given that we used self-report scales to measure the variables in this study, there was a potential for common method variance. To mitigate this concern, we conducted Harman's single-factor test, as suggested by Podsakoff *et al*. (2003), to statistically assess the presence of common method bias. According to the results, the maximum variance explained by a single factor was 35.497%, which was well below the threshold of 50%. Therefore, common method bias was unlikely to be a significant issue in this study.

Model Validation and Hypotheses Testing

The analysis results from the SEM showed that the models achieved a high level of fit, with CMIN/df = 6.581, CFI = 0.914 > 0.9, SRMR = 0.041 < 0.08, and RMSEA = 0.076 < 0.08 (Hu & Bentler, 1999).

As presented in Table 3, the SEM results showed that DEI was positively influenced by DESE (β = 0.575, p <0.001) and DEOE (β = 0.449, p <0.001). Hypotheses H1a and H1b were supported. This finding aligns with the core principles of SCCT, which asserts that self-efficacy and outcome expectations are key determinants of intention (Lent *et al*., 1994). Furthermore, these results are consistent with previous research in the entrepreneurial field, such as Pham and Le (2023), Liguori *et al*. (2017), which emphasise the significant role of self-efficacy and outcome expectations in shaping entrepreneurial intentions. The current research reinforces the notion that individuals' confidence in their digital entrepreneurial abilities and their expectations of favourable outcomes are pivotal in fostering DEI.

Moreover, DESE significantly and positively impacted DEOE (β = 0.223, p <0.001). Thus, hypothesis H2 was supported. This observation is consistent with the SCCT and previous studies in the entrepreneurial context, which have shown that self-efficacy can improve an individual's outcome expectations (Duong *et al*., 2023; Liguori *et al*., 2019; Santos & Liguori, 2020). This relationship highlights the importance of self-confidence in shaping expectations and motivations.

Regarding the direct effects of FinTech literacy, the results showed that individuals' DESE was positively influenced by crowdfunding (β = 0.125, p <0.001), blockchain (β = 0.463, p <0.001), and AI literacy (β = 0.073, p = 0.029), lending support H3a, H4a, and H5a. Similarly, DEOE was also positively affected by crowdfunding (β = 0.058, p = 0.004), blockchain (β = 0.282, p <0.001), and AI literacy (β = 0.067, p <0.001). Thus, we confirmed H3b, H4b, and H5b. These findings lend strong support to the ideas presented in SCCT, which posits that personal inputs, such as specific skills and knowledge, can be pivotal sources of an individual's self-efficacy and outcome expectations (Lent *et al.*, 1994). While prior research has explored the direct impact of FinTech literacy on DEI (*e.g.*, Nguyen *et al*., 2024; Festa *et al*., 2022), these studies have largely overlooked the FinTech literacy influence on intermediate factors such as DESE and DEOE. This study is the first to bridge this gap by examining how FinTech literacy enhances DEI and the underlying psychological mechanisms of self-efficacy and outcome expectations, offering a more nuanced understanding of its role in DE.

Regarding the indirect effects of FinTech literacy, the findings presented in Table 4 demonstrate that FinTech literacy (crowdfunding, blockchain and AI literacy) displays indirect effects on DEI via DESE and DEOE. Specifically, crowdfunding, blockchain, and AI literacy significantly and positively affected individuals' intentions to engage in DE through their DESE ($\beta_{CF\text{-}DESE\text{-}DEI}$ = 0.059, p <0.01; $\beta_{BC\text{-}DESE\text{-}DEI}$ = 0.217, p <0.01; $\beta_{AI\text{-}DESE\text{-}DEI}$ = 0.043, p <0.05). Therefore, H6a, H6b, and H6c were supported. Similarly, crowdfunding, blockchain and AI literacy significantly and positively influenced individuals' DEIs via DEOE ($\beta_{CF\text{-}DEOE\text{-}DEI}$ = 0.022, p <0.01; $\beta_{BC\text{-}DEOE\text{-}DEI}$ = 0.103, p <0.01; $\beta_{AI\text{-}DEOE\text{-}DEI}$ = 0.031, p <0.001). Hence, H7a, H7b, and H7c were supported. These findings indicate that knowledge of crowdfunding, blockchain, and AI boosts individuals' confidence in their digital entrepreneurial skills, leading them to be more inclined to start a digital business. Similarly, this knowledge also helps create positive expectations about the outcomes of their future ventures, further strengthening their intention to start a digital business. These findings are in line with the SCCT that self-

efficacy and outcome expectations can be mediators in the relationships between individual attributes and intentions (Lent *et al*., 1994; Liguori *et al*., 2019)

Table 3. The direct effects results

Hypothesis		Estimate	P-value	Description
H1a	DESE -> DEI	0.575***	0.000	Supported
H1b	DEOE -> DEI	0.449***	0.000	Supported
H2	DESE -> DEOE	0.223***	0.000	Supported
H3a	CF -> DESE	0.125***	0.000	Supported
H3b	CF -> DEOE	0.058**	0.004	Supported
H4a	BC -> DESE	0.463***	0.000	Supported
H4b	BC -> DEOE	0.282***	0.000	Supported
H5a	AI -> DESE	0.073*	0.029	Supported
H5b	AI -> DEOE	0.067***	0.000	Supported

Notes. *** p < 0.001, ** p < 0.01, * p < 0.05.
Source: own study.

Interestingly, the indirect analysis also indicated that crowdfunding, blockchain, and AI literacy had indirect effects on individuals' DEI via a serial mediating mechanism of DESE and DEOE ($\beta_{CF\text{-}DESE\text{-}DEOE\text{-}DEI}$ = 0.038, p <0.01; $\beta_{BC\text{-}DESE\text{-}DEOE\text{-}DEI}$ = 0.140, p <0.001; $\beta_{AI\text{-}DESE\text{-}OE\text{-}DEI}$ = 0.028, p <0.05), lending support H8a, H8b, and H8c. This finding highlights a stepwise process where FinTech literacy first enhances DESE, which in turn positively influences DEOE, ultimately strengthening the intention to pursue DE. This sequential mediation underscores the interconnectedness of knowledge, confidence, and expectations in shaping DEIs. It also illustrates how proficiency in financial technologies can progressively build self-efficacy and foster optimistic outcome expectations, which together drive stronger DEIs.

Table 4. The indirect effects results

Hypothesis		Lower	Upper	Estimate	Description
H6a	CF -> DESE -> DEI	0.028	0.115	0.059**	Supported
H6b	BC -> DESE -> DEI	0.208	0.333	0.217**	Supported
H6c	AI - > DESE -> DEI	0.008	0.080	0.043*	Supported
H7a	CF -> DEOE -> DEI	0.009	0.048	0.022**	Supported
H7b	BC -> DEOE -> DEI	0.092	0.171	0.103**	Supported
H7c	AI - > DEOE -> DEI	0.017	0.047	0.031***	Supported
H8a	CF -> DESE -> DEOE -> DEI	0.006	0.033	0.038**	Supported
H8b	BC -> DESE -> DEOE -> DEI	0.031	0.068	0.140***	Supported
H8c	AI -> DESE -> DEOE -> DEI	0.002	0.015	0.028*	Supported

Notes. *** p < 0.001, ** p < 0.01, * p < 0.05.
Source: own study.

CONCLUSIONS

Building upon the SCCT, we expanded the framework by examining the influence of FinTech literacy – encompassing knowledge of crowdfunding, blockchain, and AI – on DEI. Specifically, we explored how literacy in these financial technologies impacts individuals' confidence in their DESE and DEOE. We also investigated the separate and serial mediating roles of DESE and DEOE in the relationship between FinTech literacy and DEI.

The findings demonstrated that both DESE and DEOE significantly and positively influenced DEI. Furthermore, FinTech literacy, including crowdfunding, blockchain, and AI knowledge, positively affected DESE and DEOE. Notably, blockchain literacy had the strongest impact on both DESE and DEOE. Among the three components, blockchain literacy exerted the strongest influence on both DESE and DEOE, while AI literacy had the weakest effect on DEOE, and crowdfunding literacy had the weakest impact on DESE. Moreover, both DESE and DEOE significantly drove DEI, acting as individual and serial

mediators, as FinTech literacy enhances DESE, which boosts DEOE, ultimately strengthening DEI. These results highlight the interplay of technical knowledge, self-confidence, and outcome expectations in shaping DEI, reinforcing SCCT's core principles.

Theoretical Contributions

The study offers several key contributions to the field of DE. To the best of our knowledge, this is the first study to apply the SCCT framework to examine the influence of FinTech literacy – encompassing knowledge of crowdfunding, blockchain, and AI – on the intention to engage in DE. By extending SCCT to include FinTech literacy, we provided a novel theoretical perspective on how proficiency in emerging financial technologies impacts individuals' confidence (DESE) and expectations of success (DEOE) in the digital entrepreneurial landscape. This extension of SCCT enhances the theory by demonstrating how specific technological literacies act as personal inputs that shape self-efficacy and outcome expectations, offering a more comprehensive understanding of the psychological processes underlying DE.

Furthermore, by examining the distinct and sequential mediation effects of DESE and DEOE, we clarified how FinTech literacy translates into DEI. This nuanced approach adds granularity to SCCT and deepens our understanding of the psychological drivers behind DE. By identifying these mediating pathways, we underscored the importance of psychological factors in fostering DEIs and provided a framework for future research exploring how other personal or contextual factors may influence DE. The findings suggest that enhancing FinTech literacy, specifically in areas like crowdfunding, blockchain, and AI, could constitute a key strategy for building entrepreneurial self-confidence and shaping positive outcome expectations, which are critical for entrepreneurial success.

Practical Implications

The current study emphasizes the crucial role of FinTech literacy in fostering DEI. This finding holds practical implications for various stakeholders.

Firstly, academic administrators and educators can enhance FinTech literacy among aspiring entrepreneurs by designing targeted programs combining practical training and foundational knowledge. These programs could include partnerships with FinTech companies to offer workshops, internships, and hackathons, providing real-world experience in using crowdfunding platforms, blockchain technology, and AI tools for entrepreneurial applications. Furthermore, integrating FinTech literacy into entrepreneurship curricula through project-based learning, such as managing crowdfunding campaigns or exploring blockchain-based business solutions, can build students' confidence, boost their self-efficacy, and foster positive expectations about their ventures. Ultimately, this can increase their likelihood of engaging in DEI.

Furthermore, policymakers can advance FinTech literacy through initiatives such as national strategies that allocate funding to universities and vocational schools for developing FinTech programs and establishing public-private partnerships to ensure training aligns with industry standards. Governments can also incentivize startups to adopt innovative financial technologies by offering tax breaks or subsidies and thus foster a FinTech-savvy entrepreneurial ecosystem. Moreover, dedicated FinTech literacy campaigns can raise awareness and provide resources and training to budding entrepreneurs, particularly in underrepresented regions or demographics, ensuring broader access to knowledge and skills essential for engaging in DE.

Furthermore, organizations supporting entrepreneurs, such as incubators and accelerators, should integrate FinTech literacy into their programs by offering modules on crowdfunding, blockchain applications, and AI-driven entrepreneurship. They can host workshops on launching blockchain businesses and partner with AI startups for mentoring on AI-enabled models. Collaborating with FinTech experts ensures up-to-date training, Moreover, thanks to it, mentors can build DESE and foster optimistic yet realistic DEOE through one-on-one guidance and feedback on FinTech-based projects, boosting entrepreneurs' confidence, and success potential.

Limitations and Future Research Directions

The study offers important insights into the connection between FinTech literacy and the intention to engage in DE. However, there are some limitations to it. Firstly, the cross-sectional design constrains the ability to determine causal relationships, highlighting the need for longitudinal studies that could provide a more in-depth understanding of how FinTech literacy, DESE, and DEOE evolve. Secondly, the study focused on specific aspects of FinTech literacy – crowdfunding, blockchain, and AI – while overlooking other important elements like cryptocurrency and digital payments. Future research could explore these additional areas to offer a broader understanding of FinTech's impact on DEI. Finally, the study's sample of university students may limit generalizability. Future studies could examine more diverse populations, such as seasoned entrepreneurs or individuals in different cultural and economic contexts and investigate how FinTech literacy influences entrepreneurial outcomes over extended periods.

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Sustainable industrial transformation through entrepreneurial ecosystem governance: The case of Polish energy clusters

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ABSTRACT

Objective: The article aims to expand the concept of regional industrial transformation to sustainable industrial transformation (SIT) and explain the role of ecosystemic governance in SIT on conceptual and empirical grounds based on Polish local energy clusters.

Research Design & Methods: We surveyed energy cluster initiatives in Poland, which we supplemented with a secondary data analysis and semi-structured interviews with the clusters' administration. The survey raised a final sample of 43 observations of active energy cluster initiatives in Poland. The analytical technique was qualitative comparative analysis, an approach between qualitative and quantitative data treatment.

Findings: We identified governance characteristics associated with the different levels of sustainable energy industrial transformation (SEIT). We revealed two governance patterns conducive to high-transformative energy clusters and two patterns of low-transformative cluster initiatives.

Implications & Recommendations: We provide empirical evidence of SEIT on an under-researched local level and identify the ecosystemic governance types favourable for and impeding this industrial transformation, with conclusions and recommendations relevant to economic policy and future research.

Contribution & Value Added: This research contributes by expanding the conceptual framework of regional industrial transformation to SIT based on socioeconomic governance, with the adoption of co-evolutionary and entrepreneurial ecosystem approaches. Moreover, it corroborates and advances the concept of SIT on the empirical ground of Polish local energy clusters.

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INTRODUCTION

Environmental and climate challenges demand industrial transformation, that is, the change in industrial structure and related public policies in the multiscalar context of international, national, regional, and local environments (Ashford *et al.*, 2007; Chembessi *et al.,* 2024; Coenen & Truffer, 2012; Schwabe, 2024). We addressed three research and policy gaps in studies of these transformative processes. Firstly, among the referred multiscalar territorial levels of research and policy, the local context remains underexplored due to the predominant search for the sustainability-oriented consensus among the EU, regional, and national authorities and societies (Chembessi *et al.*, 2024; Schwabe, 2024; Szewranski *et al.,* 2019). However, these efforts should be complemented by a build-up of the local sustainability-oriented microstructures of clusters or renewable energy communities (Deutz *et al.*, 2024; Loorbach & Rotmans, 2006; Lowitzsch *et al.*, 2020). At the local level, through direct stakeholder interaction, such as business, local governments, and academia, these social and economic clusters or communities can be advanced

to entrepreneurial ecosystems for industrial transformation toward renewable energy sources (Jasiński *et al.,* 2021; Micek *et al.*, 2021; Mucha-Kuś *et al.*, 2021; Surwillo, 2022). Secondly, industrial transformation to renewable energy should inevitably reconcile economic and social responsibility goals for the safety of communities and environmental well-being (Andersen *et al.*, 2020; Ashford *et al*., 2007; Coenen & Truffer, 2012; Loorbach & Rotmans, 2006). This calls for an advancement of the conceptual lens towards sustainable industrial transformation (SIT) that would integrate economic efficiency with social and environmental responsibility. The achievement of sustainable energy industrial transformation (SEIT) requires adequate socio-economic governance, as sets of institutions (rules, norms, behaviour patterns) that affect the efficiency of a particular system, such as the ecosystem of an energy cluster (Colombelli *et al.*, 2019; Colombo *et al.,* 2019; Lowitzsch *et al*., 2020). Although existing research points to technical and legal governance for the energy transition, socioeconomic governance in this area remains under-researched (Dragan, 2020; Mucha-Kuś *et al*., 2021; Surwillo, 2022; Wiseman, 2023). Thirdly, industrial transformation represents a coevolutionary and context-dependent process that calls for empirical evidence on its pathways and development stages in different territories (Gong & Hassink, 2019, 2020; Smith *et al.*, 2004). This evidence is still scarce, but we should consider it conducive to further comparative generalisations and place-based policies.

Against these three research gaps, we aimed to expand the concept of regional industrial transformation to sustainable industrial transformation and explain the role of ecosystemic governance in SIT on conceptual and empirical grounds based on Polish local energy clusters. Our theoretical framework drew on the coevolutionary approach to regional industrial transformation (Gancarczyk *et al.,* 2024; Gancarczyk *et al*., 2023; Hassink *et al.*, 2019; Oinas *et al*., 2018) and the concept of entrepreneurial ecosystem governance (Colombo *et al*., 2019; Gancarczyk & Konopa, 2021a; Spigel, 2017, 2022).

We surveyed energy cluster initiatives in Poland, which we supplemented with a secondary data analysis and semi-structured interviews with the administration of the energy clusters. The final sample of clusters included 43 observations, representing 60% of active energy cluster initiatives in Poland. The analytical technique we employed was qualitative comparative analysis (QCA). It addresses the specificity of a small number of observations and an extensive set of variables that describe the governance of the entrepreneurial ecosystem. It enabled a configurational approach and the identification of governance characteristics associated with the different levels of SIT advancement. In particular, we identified two governance patterns conducive to high-transformative energy clusters and two patterns of low-transformative cluster initiatives.

Our article provides contributions relevant to research and policy. The first contribution consists of expanding the conceptual framework of regional industrial transformation to SIT based on socioeconomic governance, with the adoption of co-evolutionary and entrepreneurial ecosystem approaches (Asheim, 2019; Colombo *et al*., 2019; Hassink *et al*., 2019; Oinas *et al*., 2018). Secondly, the article corroborates and advances the concept of SIT on the empirical ground of Polish local energy clusters (Chembessi *et al*., 2024; Schwabe, 2024). Thirdly, we provide empirical evidence of SEIT on an under-researched local level and identify the ecosystemic governance types conducive for and impeding this industrial transformation, with conclusions and recommendations relevant to economic policy (Chembessi *et al*., 2024; Coenen & Truffer, 2012; Loorbach & Rotmans, 2006; Schwabe, 2024; Smith *et al*., 2004).

In the following sections, we will provide the conceptual background of energy clusters in Poland and the governance of energy entrepreneurial ecosystems, as well as a research framework to guide empirical analysis. Then, we will report the methodological approach and the findings. We will follow it with a discussion of the results and contributions.

LITERATURE REVIEW AND RESEARCH QUESTIONS DEVELOPMENT

Energy Clusters in Poland: Overview of Policies and Development

European Commission (2021) considers energy clusters crucial for energy security and effective energy transition of EU member states toward a zero-emission economy. The Polish Strategy for Responsible Development (Ministry of Development, 2017) also acknowledges this goal. As a measure to implement the transition to a low-carbon economy, the Just Transition Fund was established under the EU cohesion

policy for 2021-2027 (European Commission, 2020). Furthermore, the resolution of the General Assembly of the United Nations (UN) on 25 September 2015 (UN, 2015) emphasises that clusters are tools for sustainable development policies, such as reducing energy poverty, improving access to clean energy and education, and increasing innovation based on collaboration with research entities (UN, 2016).

Polish legislation defined energy clusters in 2016 with the amendments of the *Act of 20 February 2015 on Renewable Energy Sources*, which determined the substantive, legal, and spatial scope of these initiatives. After the latest amendment to this law, active from 1 January 2024, an energy cluster is defined as a cooperation agreement in the area of a generation, storage, demand balancing, distribution, or sale of electricity or fuels or heat to provide economic, social, or environmental benefits to the parties or to increase the flexibility of the electricity system, whereby the parties in this agreement include at least one territorial government unit or a capital company established by territorial government or a capital company which owns more than 50% of the share capital or stocks or shares of a capital company established by a territorial government. Energy cluster initiatives are often based on public-private partnerships and primarily target individual consumer needs (Mataczyńska & Kucharska, 2020).

Public entities supporting the development of clusters in Poland include the ministries of energy, economy, development, science, and higher education, the Polish Agency for Enterprise Development, and the Industrial Development Agency (Kraska, 2018). Moreover, the Ministry of Energy and the Energy Regulatory Office govern the establishment, operation and licensing of cluster initiatives (KAPE, 2017; Tauron Polska Energia, 2024). Regarding cluster financing, European Union funds dominate, supplemented by national funding, as reflected in national and regional operational programs (Kraska, 2018). Energy clusters can also apply for financing from the Just Transition Fund under the Cohesion Policy 2021-2027. Other sources include the income of the clusters from operations, membership fees, and own funds (KAPE, 2017). Moreover, energy cluster initiatives can benefit from financial relief upon their registration by the Energy Regulatory Office (Energy Regulatory Office, 2024).

The place-based approach to industrial transformation, including the turn of renewable energy, demands policy and research approaches in various transition contexts, such as Central and Eastern European economies (Coenen & Truffer, 2012; Li *et al.*, 2020; Liu, 2020; Luken & Castellanos-Silveria, 2011; Smith *et al.*, 2004). Many of these economies, including Poland, feature energy-intensive industries that have a harmful effect on the environment (Campos-Romero *et al.*, 2024). Their policies oriented toward local energy clusters are at the initial stages in terms of ecosystemic governance structures and industrial technological transitions (Dragan, 2020; Elzen & Wieczorek, 2005; Grigore & Dragan, 2020; Mirowski & Kubica, 2016).

Poland has an energy-intensive industry that uses predominantly traditional sources of electricity and heating systems (Dragan, 2020; Manowska *et al.*, 2017; Mirowski & Kubica, 2016; Mucha-Kuś *et al*., 2021; Sołtysik & Kozakiewicz, 2018). This increases the perception of high transition costs and requires not only legal and technical but also socioeconomic governance, which is the focus of this study (Mucha-Kuś *et al*., 2021; Sołtysik & Kozakiewicz, 2018; Szewranski *et al*., 2019; Uddin & Taplin, 2015). Consequently, energy cluster initiatives and communities are in the nascent stage, with a predominance of community agreements and contracts rather than actively operating ecosystems (Jasiński *et al*., 2021; Surwillo, 2022). Existing research emphasises weak organizational forms of energy clusters and the impediments to their growth, including limitations of the energy infrastructure, unproven business models, instability of the legal system, and limited public trust (Dragan, 2020; Micek *et al*., 2021; Surwillo, 2022; Wawrzyniak *et al.*, 2021). The strategic document of *Polish energy policy until 2040* reported 66 entities in the first half of 2020, compared to the declared 300 units by 2030 (Ministry of Climate and Environment, 2021). Therefore, we can treat the Polish energy ecosystems as early-stage phenomena and use the lens of evolutionary entrepreneurial ecosystem governance to theorise about their characteristics conducive to energy-focused SIT.

Sustainable Industrial Transformation and Energy Cluster Ecosystems at the Local Level

The territorial industrial transformation is a change in the territorial industrial structure (Hassink, 2010; Hassink *et al*., 2019; Isaksen *et al.*, 2019; Martin & Sunley, 2015). This change can be oriented towards industrial path renewal or new path creation or exposed to lock-in when obsolete and environment-

harming standards and products predominate (Asheim, 2019; Grillitsch, 2015; Hassink *et al*., 2019). Considering the sustainability imperative, we conceptually expand the idea of industrial transformation into sustainable industrial transformation (SIT) as a change in the territory's industrial structure that not only meets the economic goals but reconciles economic efficiency with environmental and social goals (Ashford *et al*., 2007; Loorbach & Rotmans, 2006; Smith *et al*., 2004).

In turn, we may treat the sustainable energy industrial transformation as a case of sustainable industrial transformation for balanced and renewable energy sources. Consequently, we may approach SEIT as an industrial change featuring a relatively high share of renewable energy sources compared to traditional sources, whereby relative share refers to the entities considered as reference points, such as local energy cluster initiatives or communities. Moreover, SEIT naturally meets the sustainability challenges by linking economic savings of small prosumers (households, companies, local governments), environmental protection through renewable energy sources, and social benefits of energy security (balanced and distributed energy sources), as well as health protection and life quality.

Due to their nature as specialised industrial agglomerations of interrelated enterprises and business environment organizations, clusters are considered to be the focal settings for territorial industrial transformation (Bohatkiewicz-Czaicka & Gancarczyk, 2024, 2025; Götz, 2021; Howell, 2020; Karlsen *et al.*, 2023; Porter, 2011; Porter, 2001). The actors' proximity centred on regional specialization enables interactions and relational contracts to improve radical innovation (Apa *et al.*, 2021; Howell, 2020). However, technical and organizational knowledge exchanges are a crucial but not sufficient condition for industrial transformation since transformative changes require social consensus and collaboration (Broadstock *et al.*, 2020; Karlsen *et al*., 2023; Timeus & Gascó, 2018). Clusters are also relevant phenomena and concepts in this regard, since they represent governance structures that raise collaborations and gather the key actors around mutual interests and objectives (Götz, 2021; Howell, 2020; Karlsen *et al.*, 2023). Our study focuses on industrial clusters as a policy concept rather than an original theoretical approach and phenomenon of spatial and industrial concentrations (Bohatkiewicz-Czaicka & Gancarczyk, 2024; 2025). As a policy approach, clusters directly correspond with the contemporary idea of entrepreneurial ecosystems, treated as a reconceptualization of industrial agglomerations for policy purposes. This reconceptualization retains the focus on spatial governance formed by key participants of enterprises, local government, and academia within a particular industrial domain, such as energy production and distribution. However, this understanding is released from the necessity of spatial industrial concentration. Clusters and their contemporary policy-driven reconceptualization to entrepreneurial ecosystems are conducive to animating the socioeconomic structures to implement complex projects (Brown & Mason, 2017; Lowitzsch *et al*., 2020; Stam, 2015; Stam & Van de Ven, 2021). Moreover, they ensure a unique grounding to catalyse ideas and reconcile the interests of various stakeholders (Colombo *et al.*, 2019; Gancarczyk & Konopa, 2021b). Furthermore, the cluster and ecosystem approach to industrial transformation in energy supply is relevant due to the place-based and evolutionary nature of SEIT (Gancarczyk *et al*., 2023).

Furthermore, SEIT is necessarily local and requires renewable energy communities and a niche-building approach (Bui, 2021; Cantner *et al.*, 2021; Lowitzsch *et al*., 2020; O'Shea *et al.*, 2021; Schwabe, 2024). This transformation is also local in technical terms due to the capacity of small-scale producers, prosumers, and cooperatives that form this system (Coenen & Truffer, 2012; Elzen & Wieczorek, 2005; Peñate-Valentín *et al*., 2021). As such, it is strongly embedded in the relationships of cross-sectoral and proximate actors (Andersen *et al.*, 2020; Ashford *et al*., 2007; Loorbach & Rotmans, 2006; Smith *et al*., 2004).

However, international, national and, to a lesser extent, regional authorities have been responsible for leading energy industrial transformation, which resulted in a top-down agency of change (Ghobakhloo *et al.*, 2021; Li *et al.*, 2020; Luken & Castellanos Silveria, 2011). There are also bottom-up initiatives promoted as complementary and parallel to these policy actions (Chembessi *et al*., 2024; Deutz *et al*., 2024). The expected outcomes of these actions are the local microstructures of the balanced energy supply and the societal consent for the necessary investment to increase safety, environmental, and economic benefits in the future. The local bottom-up initiatives are nas-

cent in terms of business and economic policy actions, and they are understudied in terms of research agenda (Andersen *et al*., 2020; Chembessi *et al*., 2024; Deutz *et al*., 2024; Ghobakhloo *et al*., 2021; Ghobakhloo *et al*., 2023). These policy and research gaps justify the focus of this paper on the local level of energy industrial transformation.

Entrepreneurial Ecosystem Governance Oriented on the Energy SIT: A Research Framework

Sustainable industrial transformation is necessarily embedded in socioeconomic governance, which is a regulatory, institutional structure, including rules, norms, and behaviour patterns that affect the performance and dynamics of a particular system, such as a cluster or an entrepreneurial ecosystem (Cho *et al.*, 2021; Colombelli *et al.*, 2019; Colombo *et al.*, 2019). Entrepreneurial ecosystems are a contemporary, policy-driven reconceptualization of clusters, representing the sets of outcome-oriented and interrelated actors and factors from the business, social, and public spheres in a given territory (Brown & Mason, 2017; Gancarczyk & Konopa, 2021b; Mason & Brown, 2014; Spigel, 2017, 2022; Stam & Van de Ven, 2021; Wojnicka-Sycz, 2020). Therefore, ecosystemic governance in clusters is a construct oriented on an outcome, such as industrial transformation toward sustainability. Various types of ecosystemic governance are assumed to be defined by interactions or mutual influences with relevant stakeholders, the density of the actors involved, the type of leading tenants, and the explorative or exploitative approach to new business areas or opportunities.

According to the literature on industrial transformation, co-evolutionary processes based on *interactions between key stakeholders*, including industry, government units, and academia drive the transition to a new industrial structure (Cantner *et al*., 2021; Colombo *et al*., 2019; Ter Wal & Boschma, 2011). *Interactions or mutual influences* among key actors, in particular, the intensity of their collaborations, form an important element of the local governance for socioeconomic transformation (Cai *et al.*, 2024; Granovetter, 1985; Putnam, 1992). These collaborations are conducive to a social consensus and to innovative products that initiate new prospective industries (Gong *et al.*, 2022; Gong & Hassink, 2019). To improve exploratory processes and avoid rigid or lock-in specializations, the infusion of external resources, including knowledge, is recommended (Gancarczyk & Gancarczyk, 2018; Hassink, 2010).

One of the conditions for social interactions is density, which denotes the number of entities involved (Amin & Thrift, 1995; Zukauskaite *et al.*, 2017). The density of cluster participants forms a buzz or creative atmosphere that enhances new ideas, which is particularly important for the early stages of cluster or ecosystem evolution (Brown & Mason, 2017; Cantner *et al*., 2021; O'Shea *et al*., 2021; Ter Wal & Boschma, 2011).

Dense and interactive ecosystems do not usually emerge spontaneously but rather develop around central or *lead tenants* (Acs *et al.*, 2017; Brown & Mason, 2017; Mason & Brown, 2014; Thompson *et al.*, 2018). Entrepreneurial ecosystems are centred around private actors, whereas in social entrepreneurial ecosystems, social or governmental actors play a dominant role (Gancarczyk *et al*., 2024; Thompson *et al*., 2000; Thompson *et al.*, 2018). The leading tenants imply the expected purposes and outcomes of the ecosystems. Entrepreneurial ecosystems are predominantly oriented toward productive entrepreneurship that integrates enterprise growth with technological transformation and social and environmental responsibility (Acs *et al*., 2017; Spigel, 2022; Stam & Van de Ven, 2021). Social entrepreneurial ecosystems primarily seek to achieve social and environmental goals through projects with relevant stakeholders (Gancarczyk *et al*., 2024; Gancarczyk & Rodil-Marzábal, 2022; Lai, 2016; Leyshon, 2020; Thompson *et al*., 2000; Thompson *et al*., 2018).

Successful governance of clusters and ecosystems requires the pursuit of both the exploitation of existing capabilities and the entrepreneurial exploration of opportunities in new economic areas (entrepreneurial discovery and expansion). However, the early-stage ecosystem should demonstrate a predominance of exploration to create a niche toward industrial renewal (Foray *et al*., 2015; Gancarczyk *et al*., 2023; Grillitsch, 2015). The overreliance on exploitation can lead to rigid specialization and lock-ins (Hassink, 2010; Martin & Sunley, 2015). Explorative activities include developing innovations, financing research and development, and partnerships with R&D organizations (Cantner *et al*., 2021; Mason & Brown, 2014; Ter Wal & Boschma, 2011). Industrial transformation is enhanced by funding for innovation processes (De Guevara & Maudos, 2009; Gancarczyk & Rodil-Marzábal, 2022; Mason &

Brown, 2014). Innovations such as new products, services, and business processes are direct drivers of industrial transformation, including the turn to renewable energy technologies (Asheim, 2019; Elzen & Wieczorek, 2005). The participation of companies in the financing of R&D favours applied research and innovation development (Mason & Brown, 2014). However, the exploration of new economic areas requires the infusion of technical knowledge from specialised R&D providers, such as technology-based companies, research institutes, and academia (Apa *et al*., 2021; Foray *et al*., 2015).

The above characteristics of ecosystem governance form configurations or patterns associated with different outcomes in terms of SEIT advancement, as highlighted in the research framework (Figure 1). We based the framework on the above theory and empirical evidence from cluster literature. It points to the universal components of cluster governance as antecedents of industrial transitions to sustainability (Brown & Mason, 2017; Mason & Brown, 2014; Stam & Van de Ven, 2021). It guided our empirical investigations in energy cluster pathways to SEIT.

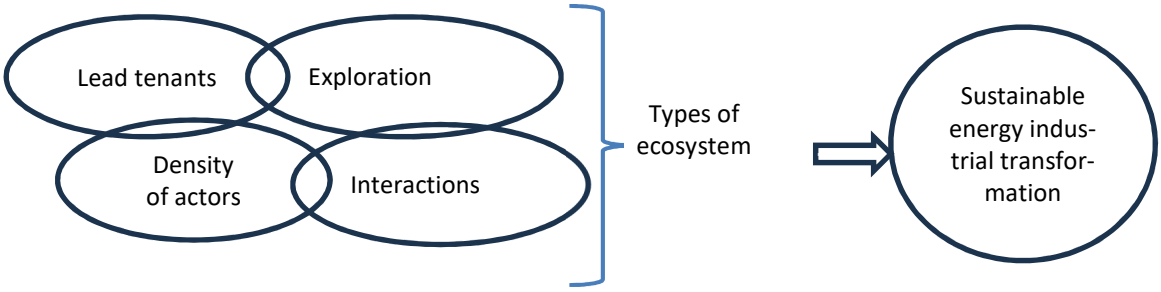

Figure 1. Research framework
Source: own elaboration.

Our research framework assumed that SEIT in cluster initiatives is determined by the types of ecosystem governance. We classified the governance types according to lead tenants, density of cluster participants, interactions of a cluster with key stakeholders, and explorative vs. exploitative approach.

Following the research framework, we posed two questions for our empirical investigations:

RQ1: How does the advance of SEIT differ in various energy cluster ecosystems?

RQ2: What are the types and characteristics of the energy cluster ecosystems that lead to or impede SEIT?

RESEARCH METHODOLOGY

Material and Method

We focused on one country setting, *i.e.,* Poland, to ensure a coherent regulatory and economic framework and a challenging country context for the energy SIT. The main research methods included a survey among energy cluster initiatives in Poland, supplemented by a secondary data analysis and semi-structured interviews with the administration of the energy clusters. We approached two major associations of cluster initiatives, including the Polish Chamber of Energy Clusters (PCEC) and the Cluster Coordinator (CC). Officially, PCEC associates 93 energy cluster initiatives, while The Cluster Coordinator registers 63 entities. We administered the first survey wave among the PCEC members from November to December, 2023. The PCEC's authorities supported it with a cover letter to strengthen the importance and practical implications of the research. We also conducted semi-structured interviews by telephone and online communication with a manager and a staff member to understand the context, the structure of their association, and the validity and responsiveness of the registered members. We preceded the questionnaire distribution with a pilot study and a questionnaire check by PCEC's management, one staff, and three cluster initiatives. The pilot study resulted in some minor formal changes to improve the transparency and accuracy of the questions. We used PCEC email contacts to distribute an online survey questionnaire.

Due to the limited response rate (at the level of 7%), one of the researchers and a PCEC staff contacted all the listed cluster initiatives by phone for a concise interview. The telephone contacts sought to explain the purpose of the investigation, motivate the respondents, and learn about their opinions and attitudes regarding opportunities and barriers in the pursuit of their projects. Another reason for the phone contacts was to check the proportion of initiatives that are actually operating. This query revealed that around 50% (47 cluster initiatives) of the registered entities could be considered inactive (telephone feedback; nonvalid telephone numbers). The final sample achieved 24 responses, representing approximately 52% of 46 cluster initiatives that were found to actively operate, based on phone checks and confirmed experience from PCEC's staff.

We conducted the second research wave between December 2023 and March 2024 and addressed the members of the Cluster Coordinator group with the use of an online questionnaire. We followed a similar procedure, including four telephone orientation interviews with the members of the CC board. The CC board members who were closely involved with the cluster initiatives checked the questionnaire's accuracy and approved this tool without any changes. Next, we administered the survey by email using an online questionnaire. The response rate was only 5% from the official CC register. The follow-up telephone contacts revealed nonvalid or inactive initiatives at the 60% level (38 entities) of the registered population, leaving 25 active entities (40% of the registered cases). Since CC gathers local governments who should respond to official inquiries through an online system of public information, we also used this system. These efforts resulted in 19 completed questionnaires, representing 80% of actively operating cluster initiatives gathered in CC. The CC's manager reported a similar experience with respect to the low cluster responsiveness.

Our final sample embraced 43 complete survey questionnaires, which is 60% of the active clusters in PCEC and CC altogether. We also collected interview material of approximately 30 normalised pages of notes from the semi-structured interviews with the PCEC and CC administration. Furthermore, we reviewed secondary sources, such as websites of the energy clusters associated with the two entities and reports on the development of the energy cluster initiatives in Poland, a material comprising around 1200 normalised pages.

Our research was explorative and used a new, ecosystemic and co-evolutionary perspective on the role of governance in energy-focused SIT (Gong & Hassink, 2019; 2020; Martin & Sunley, 2015; Oinas *et al.*, 2018). Considering the research framework (Figure 1) with a set of theoretical variables and a small number of 43 cases, the qualitative comparative analysis is an appropriate technique to explore our two research questions (Finn, 2022; Ragin, 2009; Ragin, 2019). The QCA method is between qualitative and quantitative approaches and attempts to attain scientific rigour by processing and structuring a large set of antecedents that are treated as causal conditions (factors) (Legewie, 2018; 2013). It enables both the understanding of the complex context with many explanatory factors and a configurational approach, in which the causal combinations (configurations, patterns, solutions) reveal similar, the same, or divergent outcomes (Douglas *et al.*, 2020; Finn, 2022). The QCA addresses the specificity of research objects that are neither stable and developed nor well recognised, representing several alternative solutions rather than one, average combination of explanatory variables leading to expected outcomes (Nicolas Legewie, 2013; Rizova, 2007; Thomas *et al.*, 2014). The QCA technique shows how equifinal patterns lead to the same outcome and, hence, it acknowledges the observed heterogeneity. These characteristics resonate well with the energy cluster population that we study.

However, when applied as the only treatment, QCA can lead to a loss of nuanced but relevant information. We expanded our QCA results and highlighted them by additional methods, including secondary data analysis and semi-structured interviews with key informants. These supplementary sources were important to understand the context of the observations and interpret the causalities in the governance patterns discerned from the survey material.

Variables and Measurement

The survey questionnaire embraced the characteristics of ecosystemic governance and cluster characteristics as control variables. Table 1 presents a theory-driven set of variables reflecting the advance-

ment of SEIT and ecosystem governance characteristics, their meaning and conceptual foundations, as well as the corresponding observed variables and their measurement.

Table 1. Variables describing SEIT advancement and ecosystem governance

Variables and their symbols	Meaning and conceptual foundations of variables	Observed variables	Types of variable; measurement
Energy SIT (SEIT)	Renewable energy-oriented industrial transformation (Chembessi *et al*., 2024; Schwabe, 2024)	Share of renewable energy sources in overall energy production by a cluster	Binary; percentage ranges of renewable energy sources in the total energy production in a cluster; 0%–20% – 0; 21% or more – 1
Lead tenants (LEAD)	Private or public leadership (Broadhurst *et al.*, 2021; Thompson *et al*., 2000)	Cluster led by local government or enterprise s	Binary; enterprise leaders – 1 or local government leaders – 0)
Density (DENS)	Density of cluster participants (Brown & Mason, 2017; Cantner *et al.*, 2021; O'Shea *et al*., 2021; Ter Wal & Boschma, 2011)	Number of key actors forming a cluster – 3 items: (1) overall number of cluster participants, (2) number of enterprises, (3) number of research entities	Ordinal; Likert 1-5 (low number – high number of actors) based on the number of actors reported
Interactions (INTER)	A cluster's collaborations with key external stakeholders (other than participants of a cluster agreement) (Cantner *et al*., 2021; Colombo *et al*., 2019; Gong & Hassink, 2019)	Intensity of collaborations – 4 items: intensity of collaborations with (1) local government, (2) enterprises, (3) R&D entities (universities, research institutes, specialised R&D enterprises) and (4) international sources of technological and organizational knowledge	Ordinal; Likert 1-5 (low – high intensity of collaboration with each stakeholder group)
Exploration (EXR)	Exploration of new technological opportunities vs. exploitation of the existing knowledge base (Foray *et al*., 2015; Grillitsch, 2015)	Pursuit of explorative activities – 3 items: (1) innovation pursuit, as the participation of a cluster in innovation activities, (2) partnerships in innovation activities with R&D entities (universities, research institutes, academic enterprises, specialised R&D enterprises), (3) investment of cluster enterprises in environmental technologies	Binary; item 1: involvement in innovation activities – 1, lack of involvement in innovation activities – 0, item 2: partnership in innovation with any of the R&D entities – 1, lack of partnership in innovation with R&D entities – 0, item 3: cluster enterprises invest in environmental technologies – 1, cluster enterprises do not invest in environmental technologies – 0

Source: own study.

The control variables describing the characteristics of the clusters included areas of activity, geographic scope, number of inhabitants, cluster age, and installed energy power (Table 4). Moreover, we asked respondents to indicate the major resource constraints they face, evaluate legislatures on energy clusters, and provide open-response recommendations to improve the economic and legal environment for energy clusters.

Table 2 indicates the characteristics of the outcome and the conditions used in QCA. The aggregate latent variables of DENS, EXPR, and INTER demonstrated adequate levels of Cronbach's alfa, a feasible reliability test for the small N available. Chi-square and Spearman's correlations proved that SEIT and its conditions are not independent, and the positive correlations were either moderately strong (LEAD, DENS, EXPR) or strong (INTER).

The QCA method bases on combinatory logic that requires that all research variables be standardised into binary values: either 1 as present (confirmed in the research) or 0 as absent (rejected in the research). Since our variables were theoretically driven constructs, including both binary and complex latent conditions expressed with the sets of observed variables on binary and ordinal scales, we used a fuzzy-set analysis (Ragin, 2009; Rihoux & Ragin, 2009). This approach requires qualifying

a particular nonbinary factor as fully present (completely in), fully absent (completely out) or in-between (a cross-over point). We assigned adequate thresholds to the latent conditions (Appendix 1). We used a theory-driven and observation-based calibration of crossover points rather than the quantitative structuration of the sample, such as percentiles. Our approach is justified by the data that do not comply with any standard distributions and small N with a minor fraction fulfilling the criteria of presence (membership) for the outcome and conditions. As reflected in the frequencies (Table 3), we may explain these characteristics by the nascent stage of the energy cluster initiatives, which forces a reduction of the thresholds of presence, absence, and in-between, and hence recognises even incremental efforts to improve the outcome and conditions. To enhance the comparability of our small N data expressed on different scales, we standardised these data.

Table 2. Characteristics of the outcome and its conditions

Symbol	Item type	Scale	No. of items	Mean	Median	SD	Cronbach alfa**	Chi-square; Spearman rank R***
SEIT	Outcome	0;1 binary	1	0.21	0	0.41	N/A	N/A
LEAD	Condition	0;1 binary	1	0.56	1	0.50	N/A	p=0.03; 0.34**
DENS	Condition	1-5 Likert	3	1.40*	1*	0.79*	0.83	p=0.02; 0.39**
INTER	Condition	1-5 Likert	4	1.86*	1.66*	0.86*	0.85	p=0.00; 0.62**
EXPR	Condition	0;1	3	0.40*	0.33*	0.39*	077.	p=0.03; 0.45**

Note: * – descriptive statistics for the mean values of variables, ** – p<0.05; Chi square and Spearman correlations between SEIT and conditions.
Source: own study.

Moreover, QCA requires that the data be calibrated to assign them with values corresponding to the states on the scale from 0 to 1 (Ragin, 2019). We adopted a dedicated software for QCA, the FZQCA4.1 version, for calibrating, structuring, and processing data. The QCA rules allow that the data falling exactly at the cross-over point are not discarded but retained in the sample by adding a value of 0.001. We applied this procedure.

RESULTS AND DISCUSSION

Research Sample Characteristics

Table 3 presents the characteristics of the research sample of energy clusters, including the percentage of renewable energy sources versus other properties as control variables.

The research sample of 43 energy clusters included 13 entities covering one county, whereby the county is the largest unit of Poland's local administration, 14 entities including 4-5 communes, and 16 entities operating in 3-4 communes. Eleven clusters operate on the territories with a population of more than 100 000; eight organizations cover less than 20 000 inhabitants, and 24 initiatives represent a population between 20 000 and 100 000. Their activities focus predominantly on electricity production, distribution, and trade (37 clusters), energy storage and balancing (14 clusters), and steam heat production and distribution (7 clusters). Only four cluster initiatives have power installed exceeding 50 MW, while 10 organizations operated between 5 and 50 MW and 29 subjects were below 5 MW. The history of operations was no longer than eight years; 21 clusters were established between 2016 and 2018, and 22 clusters originated in the years 2021-2023. Renewable energy sources represented 0-20% in 34 clusters, and only 9 clusters reported renewable energy of 21% or more.

Table 3. Characteristics of the research sample: Polish energy clusters (N=43)

Characteristic	N	%	Characteristics	N	%
Size – geographical scope			**Year of establishment**		
Medium (1 county)	13	30.23	2016-2018	21	48.84
Small (4-5 communes)	14	32.56	2021-2023	22	51.16
Very small (1-3 communes)	16	37.21			
Scope – activity areas*			**Renewable energy sources**		
Electricity production, distribution, and trade	37	86.05	0%-20%	34	79.07
Energy storage and balancing	14	32.56	21%-60%	2	4.65
Steam heat production and distribution	7	16.28	61%-100%	7	16.28
Others	7	16.28	**Population covered**		
Power installed			<20 000	8	18.60
<5 MW**	29	67.44	20 000-50 000	12	27.91
5-50 MW	10	23.26	50 000-100 000	12	27.91
>50 MW	4	9.30	>100 000	11	28.58

Note. * – frequencies from multiple-response questions; ** – MW (megawatt).
Source: own study.

The Advancement of SEIT in Various Energy Cluster Ecosystems

Following the QCA technique, we sought the configurations of factors that are necessary and/or sufficient for SEIT to occur (Legewie, 2013; Ragin, 2019). The sufficiency of solutions or factors means that they produce the outcome but are not the only antecedents leading to it (Ragin, 2009). The necessity of a condition or a factor implies that they are indispensable to generate the outcome. The necessary condition is the only antecedent of the outcome. The necessary factor is a widely shared antecedent of the outcome, or it appears in all the solutions relevant to the outcome (Ragin, 2023). In this research, factors or conditions are central tenants (LEAD), density of actors (DENS), exploration activities (EXPR), and a cluster's interactions with key stakeholders (INTER) (Tables 1 and 2).

Before we identified the necessary or sufficient solutions, we determined the necessary conditions. Table 4 reports this analysis, including both the set-theoretic factors versus the presence of SEIT and their counterfactuals approached through negation, meaning the absence of factors and SEIT (a lack of or low levels of the factors and SEIT).

Table 4. Analysis of the necessary conditions for the presence or absence of SEIT

Conditions	SEIT (presence)		~SEIT (absence)	
	Consistency	Coverage	Consistency	Coverage
LEAD	0.91	0.39	0.51	0.70
~LEAD	0.57	0.68	0.56	0.95
DENS	0.57	0.68	0.15	-0.56
~DENS	0.63	0.68	0.92	0.87
INTER	0.65	0.54	0.24	0.64
~INTER	0.56	0.19	0.82	0.88
EXPR	0.77	0.39	0.44	0.72
~EXPR	0.44	0.20	0.62	0.90

Note: ~ – negation mark.
Source: own study.

Analysis of necessary conditions (Table 4) reports the consistency and coverage values, whereby consistency reflects the extent to which a factor covers an outcome (similarly to the correlation coefficient in classical regression), and coverage indicates the extent to which a condition conforms to an outcome (Legewie, 2018; 2013). A condition can be considered necessary if its consistency and coverage exceed 0.9 and 0.5, accordingly (Legewie, 2013). Our findings did not indicate necessary conditions for SEIT since a highly consistent factor of central tenants (LEAD) did not meet the coverage criterion. However, we find support for the lack of actor density (~DENS) as a necessary condition for the absence of SEIT.

To identify the patterns conducive to SEIT, in the next step of the analytical procedure, we constructed a so-called truth table that presents the results that show all the possible configurations of factors (Ragin, 2019). We may treat these configurations or solutions as patterns of the governance of the ecosystem of energy clusters related to SEIT (Appendix 2). We determined two relevant and equifinal configurations leading to SEIT in Appendix 2 based on cut-offs' frequency and consistency.

Our empirical material provided more evidence of a low or absent energy clusters' sustainable transformation (34 cases) than evidence supporting it (9 cases), which also justifies an investigation of the counterfactual, *i.e.* the relationships between the set conditions and the absence of SEIT (Appendix 3). We identified four relevant and equifinal configurations that hinder SEIT and bolded them in Appendix 3, while data covered nine configurations (Ragin, 2019; Rihoux & Ragin, 2009).

Identifying the Final Patterns of Energy Cluster Ecosystem Governance Leading to SEIT and Impeding SEIT

Next, we minimised the procedure to identify the final sufficient governance patterns for SEIT. The minimization procedure consisted of combining solutions that differed in only one condition and removing this condition did not change the required outcome (Ragin, 2009). Table 5 presents the final governance patterns according to their share in all observations that achieved SEIT (unique coverage) and consistency with the SEIT outcome.

Table 5. Final patterns of the ecosystemic governance for the presence of SEIT and for the absence of SEIT

Condition	Patterns of ecosystem governance			
	SEIT (presence)		SEIT (absence)	
	Transformative social entrepreneurial ecosystem: local government-led, not dense, but interrelated, and explorative ecosystem	**Transformative entrepreneurial ecosystem**: dense, interrelated, explorative, and enterprise-led ecosystem	**Embryonic social entrepreneurial ecosystem**: local-government-led, not dense and not interrelated ecosystem	**Embryonic entrepreneurial ecosystem**: not explorative and not dense enterprise-led ecosystem
LEAD	○	●	○	●
DENS	○	●	○	○
INTER	●	●	○	
EXPR	●	●		○
Consistency	0.94	0.71	0.98	0.89
Raw coverage	0.25	0.44	0.54	0.21
Solution consistency	0.71		0.95	
Solution coverage	0.49		0.69	

Note: ● – core causal condition (present); ○ – core causal condition (absent); ● – contributing causal condition (present); ○ – contributing causal condition (absent); blank space – not relevant condition.
Source: own study.

Two patterns revealed a transformative capability to produce SEIT. We also identified two patterns to be impeding or unsuccessful in this regard. We treated these causalities as alternative governance patterns conducive to sustainable energy industrial transformation (transformative ecosystem governance) or less developed and causing a lack of or a low level of SEIT (embryonic ecosystem governance) (Brown & Mason, 2017; Mason & Brown, 2014; Thompson *et al*., 2018). Since the patterns differed in the type of central tenants, being either local governments or enterprises, we also differentiated them as social entrepreneurial or entrepreneurial ecosystems. Consequently, the results pointed to the favourable governance of a transformative social entrepreneurial ecosystem and a transformative entrepreneurial ecosystem, and at the unfavourable govern-

ance of an embryonic social entrepreneurial ecosystem and an embryonic entrepreneurial ecosystem (Brown & Mason, 2017; Stam & Van de Ven, 2021; Thompson *et al*., 2018).

We may capture the transformative social entrepreneurial ecosystem as a local government-led, not dense, but interrelated and explorative governance pattern successful in SEIT. It represents a favourable governance defined by two core causal conditions of local government leadership (LEAD absent) and strong collaborations with key stakeholders (INTER present) (Thompson *et al.*, 2018). Two contributing causal factors are a low number of cluster participants (DENS absent) and an exploratory approach to industrial transformation (EXPR present). Meanwhile, the transformative entrepreneurial ecosystem is also a successful governance for SEIT that we may describe as a dense, interrelated, explorative, and enterprise-led ecosystem. It is defined by two core causal conditions of a high number of cluster participants (DENS present) and strong collaborations with key stakeholders (INTER present). Two contributing causal factors are enterprise leadership (LEAD present) and the exploratory approach to industrial transformation (EXPR present).

The embryonic social entrepreneurial ecosystem is a local government-led, not dense, and not interrelated ecosystem. It represents unfavourable governance which is not defined by any core conditions, but only three contributing conditions of local government leadership (LEAD absent), low number of cluster participants (DENS absent), and lack of collaborations and interactions (INTER absent) (Gancarczyk *et al*., 2024; Thompson *et al*., 2018). Exploration remains a nonrelevant condition in this pattern. The embryonic entrepreneurial ecosystem constitutes an alternative unsuccessful governance for SEIT, a not explorative and not dense enterprise-led ecosystem. It is defined by one core causal condition of nonexploratory approach to industrial transformation (EXPR absent) and two contributing conditions of enterprise leadership (LEAD present) and a low number of cluster participants (DENS absent), while interactions with stakeholders (INTER) represent a nonrelevant factor in this instance (Cho *et al*., 2021; Ter Wal & Boschma, 2011).

Table 8 also indicates the unique levels of consistency and coverage for the identified solutions, which individually met the consistency threshold of 0.70. The overall solution consistency and coverage for the favourable and unfavourable patterns also conform to the standards. The strength of the relationship between the favourable solutions (solution consistency) exceeded 0.70 (0.71), and these solutions represented 49% of the energy cluster cases raising SEIT (at least 25% is recommended) (Legewie, 2013; Ragin, 2019). The relationship between unfavourable solutions was even stronger (0.95) and they formed 69% of the energy cluster cases that did not produce SEIT.

Discussion

Identified governance patterns represent causalities, that is, combinations of causal conditions that should be explained as interrelated, mutually influencing, and complex antecedents rather than individual SEIT determinants (Finn, 2022; Ragin, 2019). We will discuss these antecedents based on the survey data, but to deepen this analysis, we will also use the secondary data analysis and semi-structured interviews indicated in the method section. The inference of causalities governing the four ecosystems can be as follows.

The transformative social entrepreneurial ecosystem features extensive collaborations with such stakeholders as enterprises, local governments, R&D providers universities, research institutes, specialised R&D enterprises), and international sources of technological and organizational knowledge (Wawrzyniak *et al.*, 2021; Andersen *et al*., 2020; Ashford *et al*., 2007; Loorbach & Rotmans, 2006; Smith *et al*., 2004). This highly interactive approach is crucial to a low density of cluster participants and compensates for the low number of entities forming the cluster (Cantner *et al*., 2021; Colombo *et al*., 2019; Ter Wal & Boschma, 2011). It can also enhance the explorative approach present in this ecosystem. The latter contributes to SEIT through participation in innovation activities, partnerships with R&D entities (universities, research institutes, academic companies, specialised R&D enterprises), and investment by enterprises in environmental technologies. Existing case-based reports emphasis the mutual benefits of collaboration between an energy cluster and R&D entities (Micek *et al.*, 2021; Wawrzyniak *et al*., 2021). The benefits for the cluster include the influx of high-quality technical and management standards, as well as educational and dissemination assistance. The advantages for the

R&D entity are access to the cluster's infrastructure that enables research activities (Micek *et al.*, 2021, p. 45). In addition to these hard and direct effects on SEIT, energy clusters appreciate the creation of a network to reconcile the interests of diversified stakeholders and collaborate for future innovative energy technologies (Micek *et al.*, 2021, p. 64).

As an alternative governance pattern favourable for SEIT, the transformative entrepreneurial ecosystem relies both on the density of its participants and on extensive collaborations with a wide range of key stakeholders nationally (Gancarczyk *et al*., 2024; Thompson *et al*., 2000) and with international sources of technological and organizational knowledge (Gancarczyk *et al*., 2023; Gong & Hassink, 2019; Hassink, 2010). This dense and interactive governance is supported by enterprise leadership and an explorative approach to industrial transformation (Broadhurst *et al*., 2021; Gancarczyk *et al*., 2024; Thompson *et al*., 2000). We may treat the explorative approach as a direct enabler of the transition to renewable technologies (Foray *et al*., 2015). However, it does not act in isolation but is reinforced by the leadership of companies that channel an R&D investment to practical outcomes (Brown & Mason, 2017; Mason & Brown, 2014; Spigel, 2017). Moreover, a creative buzz from the density of participants and interactions with key stakeholders also enables exploration (O'Shea *et al.*, 2021) that can provide access to complementary resources. As our interviewees underlined:

> The large scale of simultaneous projects makes the cluster a partner for all major global suppliers of RES [renewable energy sources] technology. Without an energy cluster, no single investor stands a chance. Therefore, we are blazing a trail (an interviewee cluster manager).

> 'The cluster should become the leading organization that brings together entities for the joint production and distribution of electricity, acting as a model not only for the region but also for the whole country. Innovative and efficient solutions in energy distribution should encourage local governments and investors to become more involved in RES, so that the cluster cannot only meet local needs, but, over time, also generate increasing profits from exporting energy outside the county (an interviewee cluster manager).

The embryonic social entrepreneurial ecosystem represents an unfavourable governance that fails to produce SEIT. This is a less developed ecosystem both in terms of few participants and lack of collaboration (Bessagnet *et al*., 2021; Brown & Mason, 2017; Cho *et al*., 2021). We can assume that, if led by local governments, energy clusters miss SEIT due to low participation and isolation from the key stakeholders who might have served as sources of knowledge and other intangible and tangible assets (Gancarczyk *et al.*, 2024; Lai, 2016; Leyshon, 2020; Thompson *et al*., 2000; Thompson *et al*., 2018). A 'lack of development and coordination activities' (a local government respondent) represents an important barrier to the necessary resources, primarily access to financial capital, land, and facilities. Legislatures often fail to provide incentives for integrating clusters with the existing energy system and building the crucial interrelations between producers, prosumers, distributors, and consumers, as exemplified by 'the legal conditions of establishing energy cooperatives by towns and cities' (a local government respondent) (Dragan, 2020; Kuciel & Proszek, 2001; Mataczyńska & Kucharska, 2020). One of the necessary partners, from strategic and operational angles is energy distributors. However, as the local government respondents highlighted in the survey material:

> 'Currently, we observe the reluctance of incumbent energy operators to cooperate with energy clusters, although the clusters are essential for the proper functioning of the system. … Lower distribution fees [required by energy operators] for renewable energy infrastructures developed by energy clusters' [would improve the efficiency of energy clusters].

According to our findings, these crucial drawbacks overshadow the exploration of new technological opportunities and remove it from consideration as a driver of SEIT in local government-led energy ecosystems.

The embryonic entrepreneurial ecosystem constitutes alternative unsuccessful governance for SEIT. Unlike the local government-led governance, this enterprise-centred ecosystem fails to produce SEIT primarily due to a nonexploratory approach. When led by companies, energy clusters do not reach SEIT if

they are not involved in innovation, investment in environmental technologies, or R&D partnerships (Foray *et al*., 2015; Gancarczyk *et al*., 2023; Grillitsch, 2015). Regardless of the level of interaction and collaborations (a nonrelevant factor in this governance pattern), a lack of explorative approach is detrimental to clusters with enterprise leadership (Acs *et al*., 2017; Spigel, 2022; Stam & Van de Ven, 2021). The survey respondents emphasised not only financial and tangible capital shortages (*e.g*., facilities) but also deficiencies in technological and human resources as the main impediments to the growth of these ecosystems. Moreover, they underlined considerable problems with financing that rest on membership fees and EU funds whose infusion is being either postponed or held up, as reported below.

> 'Despite the proposals of legal amendments from PCEC, these changes are either delayed or unsatisfactory.'
> 'There is no financial support to implement the projects; the support declared for the pre-investment and investment phases was not provided. Consequently, we are in the phase of participant agreement and awaiting pre-investment support for strategy development.'
> 'We lack regulation that would remove the obligation of public procurement for the sale and distribution of energy within the cluster (in particular, between local governments and companies). The freedom of energy exchange and the release of fees for energy exchange within a cluster [among cluster participants] are crucial. New amendments to the laws on public procurement and energy are needed, as the recent amendments did not meet the expectations of the cluster communities.'

Modest participation, a contributing factor in this ecosystem pattern, also weakens the potential for a sustainable industrial transition.

> 'There are legal impediments that prevent the optimal structure of the cluster participants that would gather local governments, municipal companies, R&D entities, and private companies (*i.e.*, legal barriers to establish partnerships or associations of local governments and companies). … We need better collaboration with the local government to build structures and dialogue within the cluster' (a respondent from an enterprise-led cluster).

CONCLUSIONS

This research achieved its objective on theoretical and empirical grounds by expanding the concept of regional industrial transformation with sustainability outcomes and explaining the role of ecosystem governance in SIT, based on Polish local energy clusters. The implementation of this purpose enabled responses to research questions that guided the empirical study.

Regarding RQ1, we analysed and described the advancement of sustainable energy industrial transformation in various energy cluster ecosystems while quantifying SEIT as a share of renewable energy sources in the overall energy supply of a cluster. Adopting the QCA technique, we classified the governance of energy clusters into eight entrepreneurial ecosystems related to SEIT, finding only two types that produced the expected outcomes out of the eight patterns covered by the empirical material. Within the sample study of 43 units, only nine energy clusters produced the threshold outcome, while the majority of the units revealed only low or no SEIT. This finding indicated a low advancement in sustainable energy transformation among Polish clusters and qualified this SEIT as an early-stage evolution. In response to RQ2, we discerned the types and characteristics of the energy cluster governance that led to SEIT and impeded it. Above, we described and discussed the two types of entrepreneurial ecosystem governance sufficient for SEIT and the two types sufficient to prevent SEIT.

This article provided research and policy-relevant contributions. First, we expanded the conceptual framework of regional industrial transformation to a sustainable industrial transformation based on socioeconomic governance with the adoption of coevolutionary and ecosystemic approaches (Asheim, 2019; Colombo *et al.*, 2019; Hassink *et al*., 2019; Oinas *et al*., 2018). The concept of SIT bases on the expected outcomes or goals of industrial transformation that should aim at reconciling social and environmental goals. To empirically highlight SIT, we focused on its particular case, namely the energy SIT.

Seeking an explanation of the antecedents of SEIT, we adopted the theoretical perspectives of co-evolution and entrepreneurial ecosystems (Gong & Hassink, 2019; Martin & Sunley, 2015). Furthermore, the conceptual framework guiding our empirical investigations (Figure 1) was based on the theory and empirical evidence from cluster and ecosystem literature, and this general framework proved relevant in explaining the antecedents of sustainable energy industrial transformation. This contributes to a wider generalization of the cluster ecosystem components as derived from the existing evidence and corroborated in the spatial and industrial context of our study. Our empirical results support the theoretical underpinnings of coevolutionary perspective to industrial transformation, such as interactions of key stakeholders and explorative approach (Gancarczyk *et al*., 2024, 2023). Moreover, they suggest the relevance of the antecedents of successful clusters, such as density and the leadership role (Amin & Thrift, 1995; Broadhurst *et al*., 2021; Zukauskaite *et al*., 2017). However, considering the small N and the method we applied, the results are analytical generalization rather than statistical generalization (Silverman, 2015; Yin, 2018). This analytical generalization does not confirm or reject individual variables, but it translates their configurations into causalities or ecosystem governance patterns that produce SEIT or impede SEIT (CC Ragin, 2019).

Second, the article advances the concept of SIT and corroborates it on the empirical ground of Polish local energy clusters, with a focus on a particular case of SEIT (Chembessi *et al*., 2024; Schwabe, 2024). In this empirical setting, SEIT is at the nascent stages. Therefore, our results add to the research on an early-stage industrial transformation (Bessagnet *et al*., 2021; Brown & Mason, 2017; Chembessi *et al*., 2024; Cho *et al*., 2021). We advance this research by pointing to driving and impeding causalities or governance patterns. Unlike the majority of existing research that uses a case study method or tests isolated determinants to come up with one average pattern, we propose a configurational perspective of QCA and discern alternative solutions both for the success and failure in SEIT. This research approach addresses the complexity, variety, and emerging patterns of the initial stage of industrial transformation (Brown & Mason, 2017; Schwabe, 2024). Based on this lens, we can treat the energy communities organised into clusters as niche-builders who can proliferate their behaviours through imitation and diffusion to a wider socioeconomic system. The referred mechanism strengthens the importance of the investigations focused on industrial niches as relevant to research and practice (Schwabe, 2024).

Thirdly, we provided evidence of SEIT on an under-researched local level, with conclusions and recommendations relevant to economic policy regarding energy communities (Chembessi *et al*., 2024; Coenen & Truffer, 2012; Loorbach & Rotmans, 2006; Schwabe, 2024; Smith *et al*., 2004). Since the antecedents of SEIT were discerned at the initial development stage as emerging patterns, a recommendation is to further improve the conditions forming the successful governance in SEIT and avoid failed governance patterns (Spigel, 2022). We identified the transformative and embryonic ecosystems as either local government-led or enterprise-led. Therefore, our findings also raised practical recommendations for these two types of central tenants initiating and organizing local energy clusters (Broadhurst *et al.*, 2021). The lead tenants can identify themselves with adequate patterns and understand the current position. Furthermore, leading entities can target a successful governance pattern that best suits their specificity to enhance industrial change. The referred benchmarking, simulations and adjustments of cluster leaders vis-à-vis the governance patterns can enhance the upgrading of ecosystem governance, acknowledging their unique characteristics (Gong & Hassink, 2020). Our findings are also informative for the upper levels of policy since the local level is always dependent on the multiscalar context. This research evidence calls for regulation that enhances the integration of local energy communities with the country's energy system (Dragan, 2020; Kuciel & Proszek, 2001; Surwillo, 2022). We can achieve this by improving access to finance, supportive public procurement, and freeing internal energy exchanges of the cluster from excessive charges. By referring to the upper levels of public choices, we also contribute to a wider context of industrial policy, in particular, to the concept of New Industrial Policy that recognises a bottom-up and place-based perspective on designing the public intervention in support of industrial transitions (Gancarczyk & Ujwary-Gil, n.d.)

Our article is not free from limitations, which we will justify, explain the way of addressing them, and use as a basis for future research directions. The small N research sample and analytical rather

than statistical generalizations are disadvantages resulting from the nature of the phenomenon studied. We addressed these limitations with a tailored QCA technique, which is specifically recommended for this type of empirical material. The value of QCA was to produce analytical generalization in the form of causalities (patterns of ecosystem governance). This analytical generalization can further be used to develop research hypotheses tested on large samples for statistical generalization.

Another drawback refers to the limited evidence of successful SEIT against the absence of SEIT in our sample and a threshold (*i.e.,* 0.70) rather than strong (*e.g.,* 0.85) consistency of the empirical evidence supporting successful ecosystems. Recently, Ragin (2008, 2019, 2023) emphasised the researcher's judgment based on theory and empirical knowledge and proposed 0.70 (Ragin, 2023) as a cutting point for solution inconsistency. We followed this recommendation as justified by an emerging and poorly defined phenomenon studied. Moreover, we derived a final sample from the entire population of energy clusters. A predominant approach in QCA is a small N purposeful sampling that focuses on the best-performing clusters, thus leading to better consistency. Our sampling embraced a considerable share of active cluster initiatives, giving a broader and more accurate picture than selective sampling. Furthermore, this evidence is valuable for highlighting the governance of SEIT in its initial phase. As energy communities grow in number and their structures advance, future studies can build on this research to verify its findings on larger datasets.

Ultimately, our study is limited to one country setting. We justified this setting as a challenging and emerging context for SEIT and discussed it against a relevant socioeconomic and regulatory background. A particular territorial context is also relevant to designing and implementing place-based policies as demanded by the New Industrial Policy Paradigm. However, future studies should provide a comparative view of countries with varied advances in the energy transition to better understand the governance that is conducive to it. Here, we can recommend future studies comparing the experience among mature and nascent contexts of the energy transitions.

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Appendix 1: Calibration thresholds and frequencies for the nonbinary conditions

Item symbol and scale	Item values and frequencies	Fully present	In-between (cross-over point)	Fully absent
DENS (1-5 Likert)	1.00- 34 1.50 – 1 2.00 – 4 3.50 – 1 4.00 – 1 5.00 – 1	4.00	2.00	1.50
INTER (1-5 Likert)	1.00 – 11 1.17-2.33 – 2 2.50-4.17 – 11	4.00	2.33	1.00
EXPR (0;1)	0.00 – 15 0.33 – 15 0.66 – 3 1.00 – 10	1.00	0.33	0.00

Source: own study.

Appendix 2: Truth Table with all possible configurations and sets of cases demonstrating the same solution relative to the outcome of SEIT

Solution	LEAD	DENS	INTER	EXPR	N	Raw cons.	PRI cons.	SYM cons.	SEIT (outcome)
1	0	0	0	0	12	0.16	0.02	0.02	0
2	1	0	0	1	9	0.42	0.26	0.26	0
3	**1**	**1**	**1**	**1**	**6**	**0.71**	**0.56**	**0.56**	**1**
4	0	0	0	1	6	0.44	0.09	0.09	0
5	1	1	0	1	3	0.69	0.48	0.48	0
6	1	0	1	1	5	0.55	0.39	0.39	0
7	1	0	0	0	2	0.44	0.19	0.19	0
8	1	0	1	0	1	0.59	0.21	0.21	0
9	**0**	**0**	**1**	**1**	**1**	**0.94**	**0.72**	**0.72**	**1**
10	1	1	0	0	0				
11	1	1	1	0	0				
12	0	1	0	0	0				
13	0	0	1	0	0				
14	0	1	1	0	0				
15	0	1	0	1	0				
16	0	1	1	1	0				

Note: Frequency cut-off – 1; raw consistency cut-off – 0.70; PRI consistency cut-off – 0.5; N – number of energy clusters representing a given solution.
Source: own study.

Appendix 3: Truth Table with all possible configurations and the sets of cases demonstrating the same solution relative to the absence of SEIT

Configur.	LEAD	DENS	INTER	EXPR	N	Raw cons.	PRI cons.	SYM cons.	~SEIT (outcome)
1	**0**	**0**	**0**	**0**	**12**	**0.98**	**0.98**	**0.98**	**1**
2	1	0	0	1	9	0.80	0.74	0.74	0
3	**0**	**0**	**0**	**1**	**6**	**0.95**	**0.91**	**0.91**	**1**
4	1	1	1	1	6	0.63	0.44	0.44	0
5	1	1	0	1	3	0.72	0.52	0.52	0
6	1	0	1	1	3	0.75	0.64	0.64	0
7	**1**	**0**	**0**	**0**	**2**	**0.87**	**0.81**	**0.81**	**1**
8	**1**	**0**	**1**	**0**	**1**	**0.89**	**0.79**	**0.79**	**1**
9	0	0	1	1	1	0.84	0.28	0.28	0
10	0	1	0	0	0				
11	1	1	0	0	0				
12	0	0	1	0	0				
13	0	1	1	0	0				
14	1	1	1	0	0				
15	0	1	0	1	0				
16	0	1	1	1	0				

Note: Frequency cut-off – 1; raw consistency cut-off – 0.86; PRI consistency cut-off – 0.5; N – number of energy clusters representing a given solution.
Source: own study.

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The contribution share of authors is equal and amounted to ⅓ for each of them. Marta Gancarczyk – conceptualization, method, data gathering and processing, writing; Damian Tomczyk – conceptualization, method, data gathering and processing, writing; Jacek Gancarczyk – conceptualization, method, data processing, writing.

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Conflict of Interest

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How do agile and internationally experienced companies respond to sanctions?

Beata Stępień, Szymon Truskolaski

ABSTRACT

Objective: In this article, we show how agility and international experience influence the adjustment strategies that firms adopt when exposed to sanctions. We also assess how these strategies affect firms' financial performance.

Research Design & Methods: Quantitative; international e-survey, computer-assisted web interview (CAWI) method, structural equation modelling (SEM), linear regression, clustering; 610 middle-sized companies studied from Poland, US and Germany, data gathered in 2023.

Findings: The more agile and internationally experienced the firms, the more proactive measures they use to adapt to sanctions. Proactive adaptation strategies positively impact financial performance. Agility and international experience are mutually reinforcing.

Implications & Recommendations: When exposed to the sanctions regime, proactive adaptation strategies increase the likelihood of firms' survival. Meanwhile, agility and international experience reinforce proactivity. Therefore, firms should strengthen both these characteristics as they increase the likelihood of resilience in the face of a crisis.

Contribution & Value Added: The article extends understanding of firms' strategic behaviour in the face of a sudden external change/crisis, such as the imposition of sanctions. It shows how intrinsic factors, in this case, agility and international experience, influence the adaptation choice. The results show that agile and internationally experienced companies adopt proactive strategies towards sanctions, which has positive financial consequences. Agility and international expansion serve here as an effective and resilient way of survival during external shocks, such as war.

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INTRODUCTION

On 23 February 2022, Russia launched another armed invasion of Ukraine. This time the attack was not limited to the Crimea and Donbass regions but covered the entire country. The Western world immediately responded to this act of bestiality by imposing individual, political, and economic sanctions on Russia and its ally (Belarus). In contrast to the 2014 restrictions, the sanctions imposed in 2022 were much broader in scope. Unlike many of the previous sanctions, they received wide support from the citizens of the Western world. The clear evidence of companies voluntarily expanding sanctions and leaving Russia and Belarus was equally unusual.

Traditional costing suggests that, faced with sanctions, a company should cease sanctioned activities and continue all others. In this simplistic view, there is no room for either over-compliance

or sanctions' violation. However, business reality is more complex than models. Companies are not perfect optimisers, especially in the face of sudden change or external shock. Studies of corporate behaviour in the face of financial, biological, social or political crises show that companies use the full range of adaptation strategies, from freezing operations, cutting costs, and changing product and service offerings, to seeking new markets and supply chain partners (Gittins *et al.,* 2022; Kraus *et al.,* 2020; Eggers, 2020). Similarly, when faced with sanctions, companies adapt to new circumstances by placing their strategies across the spectrum of possible options: circumventing or violating sanctions (Gaur *et al.*, 2023; Meyer *et al*., 2023; Andreas, 2005; Early, 2015), adjusting or voluntarily limiting business activities with the target country to a greater extent than sanctions mandate (Breen, 2021; Batmanghelidj & Moret, 2022; Early & Preble, 2020).

To date, there has been little body of academic data examining how firms from sanctioning countries respond to these restrictions (for exceptions, see Stępień *et al*., 2024; Meyer *et al.*, 2023; Besedeš *et al*., 2021; Weber & Stępień, 2020; Giumelli & Onderco, 2021; Weber & Stępień, 2020). Sanctions-related issues have recently attracted more attention from international business (IB) scholars in the aftermath of the armed conflict in Ukraine, but there is still little research that shows which factors of firms' capabilities (including agility or their level of internationalisation) influenced a particular type of response to sanctions and what effects these responses had (see, *e.g.,* Stępień & Truskolaski, 2024; Besedeš *et al.*, 2021; Stępień & Weber, 2019).

For firms to survive in a turbulent environment, they should understand which factors within firms determine the choice of specific adaptation strategies that generate financial gains or losses. This article explores firms' intrinsic characteristics that determine their behaviour in the face of sanctions, focusing on particular capabilities of firms: their agility and international experience. However, the findings of this research are applicable not only to firms' responses to the sanctions regime but also to their behaviour in the face of various crises and disruptions.

We aimed to explore the relationships between the agility level, the firms' international experience, and the way they respond to sanctions. We posed the following research questions:

RQ1: What is the relationship between agility, international experience, and financial performance?

RQ2: How do agility and international experience affect the choice of adaptation strategies to the imposition of sanctions?

RQ3: How does the financial performance of sanctioned companies depend on the choice of specific adjustment strategies?

The research material was data from an international quantitative survey on current EU and US sanctions against Russia. In April 2023, international research agencies conducted the survey using the CAWI method with an electronic questionnaire. The sample consisted of 610 medium-sized enterprises operating in agriculture, manufacturing, wholesale and retail trade and transport and storage. The survey encompassed the United States (200 companies), Germany (210 companies), and Poland (210 companies). War and sanctions affected all respondents.

The remainder of the article is structured as follows. The theoretical section will describe the nature of sanctions and the possible responses of firms to their imposition. Next, it will discuss how agility and international experience can influence the choice of adaptive strategies and how these in turn determine the financial performance of firms. The next part will present the conceptual model. In the methodology section, we will describe the research sample and the statistical analysis methods used. In the results section, we will analyze the relationships between the variables and comment on the results obtained. In the conclusions section, we will indicate research's academic and practical value and outline the area of possible future research to enhance the understanding of firms' behaviour towards sanctions and in the face of external shock.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Economic sanctions change the environmental game rules (Bapat & Kwon, 2015; Morgan & Bapat, 2003; Weber & Stępień, 2020). The main factor that differentiates firms' approaches to sanctions is the calculation of the costs and benefits associated with the continuation of, or a change in, the existing strategy. However, the calculation of alternative adaptation options is itself made through the prism of companies' attitudes to risk.

Sanctions increase the political risk of investments and activities in the area covered by them (see, *e.g.*, Sottilotta, 2016; Biglaiser & Lektzian, 2011; Lektzian & Biglaiser, 2013, 2014; Mirkina, 2018). We analysed the political risk through the lens of perceived uncertainty. Uncertainty relates both to the nature and extent of the sanction's impact on company performance (due to the general economic downturn) and to the duration and development of the sanctions dispute, which affects all current and future business relationships of companies with the sanctioned country (Lektzian & Biglaiser, 2013). Consequently, firms operating under sanctions regimes must pay a premium for the risk of economic interaction (Noland, 2008). The need to demonstrate compliance with sanctions within the supply chain means that this premium also applies to those indirectly affected by restrictions. Some companies prefer to voluntarily restrict their operations to avoid investing in the complex due diligence required to ensure that their Russian partners are not affiliated with sanctioned entities (Johnston, 2015).

From a business perspective, sanctions increase the risk of operating in sanctioned territory and generate adaptation costs. However, they also provide an incentive to seek new opportunities. For example, after the annexation of Crimea to Russia in 2014, the Government Regulation of the Russian Federation No. 708 of 2015 was published, providing several economic benefits for new foreign investors. This was not only economically beneficial but also allowed foreign companies to circumvent Russian counter-sanctions on the import ban of EU and US goods in the food sector. Thus, the economic opportunities that the imposition of sanctions created may, therefore, far outweigh the political risks for foreign investors.

The scenario that companies expect to unfold in the sanctioned country also influences their strategic choice of how to respond to sanctions. If companies believe that there is a high probability that sanctions will be maintained or tightened, their response to adapting to sanctions and withdrawing operations from such a country seems reasonable. In contrast, the prospect of an imminent end to the conflict and the lifting of sanctions may lead companies to passively, albeit temporarily, circumvent or ignore sanctions without, for example, making changes to their supply chains.

The optics of the cost-benefit calculus also change depending on the 'scale of blowback' from sanctions. Companies can estimate the costs of a strategic response to sanctions in at least two ways. The first is the current and future costs of complying with sanctions, and the second is the severity of the costs of circumventing or violating sanctions (Morgan & Bapat, 2003; Weber & Stępień, 2020). When restrictions directly threaten the firm's existence and a rapid change of market (sales, suppliers, etc.) is impossible, circumventing or violating sanctions seems to be the only option to ensure survival. The potential costs of breaking the law seem less severe than going out of business. Conversely, complying with sanctions may seem reasonable and less costly to the company than deliberately circumventing or violating them, if the level of inconvenience and loss of benefits associated with the imposition of sanctions appears low.

Typology of Strategic Responses to Sanctions

Firms take appropriate adaptation measures depending on how they assess the consequences of sanctions for their survival and continued operations. Existing work highlights different responses. Firms try to limit their operations in the sanctioned territory, seek new business partners to replace business relationships disrupted by sanctions, or try to find alternative ways to continue existing business relationships by circumventing the violation of sanctions (Barry & Kleinberg, 2015; Early, 2015; Lektzian & Biglaiser, 2013; Meyer & Thein, 2014; Crozet *et al*., 2021). Thus, firms' responses to economic sanctions range on a spectrum from undercompliance through compliance with sanctions, to voluntary overcompliance.

Meyer and Thein (2014) examined firms' strategic responses in sanctioned Myanmar and diagnosed three main behaviour types: business as usual/no change, low-profile strategies/reduction of activities and withdrawal.' The dominant type of strategy was to reduce involvement but not to cease activities there (so-called 'low-profile' strategies). This type of response falls into the category of following the letter of the restriction and includes mainly passive types of operations aimed at reducing costs or business activities in sanctioned countries.

Oliver (1991) analyses the general coping strategies of firms with institutional change and categorises them as acceptance, compromise, avoidance, defiance, and manipulation but does not further investigate what types of actions these firms take to implement such strategies. Building on Oliver's (1991) categorisation, Weber and Stępień (2020) divide the basic strategy of undercompliance to sanctions into circumvention (*i.e.,* increasing investment in Russia and locating production there) and avoidance (*e.g.,* violating regulations by exporting to Russia via third countries). They identify a range of both proactive and passive strategic responses that firms use to cope with the sanctions imposed. Proactive adaptation can be described as the result of 'thinking out of the box' and includes, for example, finding new markets, moving operations to non-sanctioned countries, or increasing investment in a sanctioned market or moving more operations to sanctioned markets. Therefore, proactive responses can serve as examples of the whole spectrum of compliance, under-compliance or over-compliance behaviour.

Strategic Agility and Sanctions Response

Companies build competitive advantage through the resources they own and/or control. The value of these resources, and therefore their potential to create advantage, increases with their market perception as valuable, rare and difficult to imitate and substitute. Resources are both assets and capabilities (including a firm's management skills, organisational processes and procedures, and information and knowledge) that are useful in identifying and responding to market opportunities or threats (*e.g.,* Sanchez & Mahoney, 1996; Christensen & Overdorf, 2000; Wade & Hulland, 2004). In a turbulent economic environment, to survive and grow, firms develop so-called dynamic resources, now recognised as a long-term source of competitive advantage, whereby a firm can realise its potential faster, more effectively and more efficiently compared to the response of other firms to environmental change (Shams *et al*., 2021, Ulrich & Yeung, 2019).

Following Conforto *et al*. (2016), we define agility as the ability of the firm to quickly and effectively change/transform its strategy/behaviour in response to external triggers (such as crisis or imposition of sanctions) to achieve better performance. Agility is a dynamic competence, developed internally through managerial skills and appropriate management, which appears to make the company more resilient to external shocks and allows it to adapt more quickly to changes in its environment (Barthe-Delanoë *et al*., 2018; Harrold, 2009; McCann *et al*., 2009).

Studying small and medium-sized enterprises in Poland, Kowalik and Pleśniak (2022) show that agile competencies, such as market sensing and entrepreneurial marketing orientation make firms more innovative. Gonzalo *et al*. (2023), who study managers' approach to corporate strategy during COVID-19, show that managers' agile competencies, reflected in their level of creativity, leadership style and communication style, influence out-of-the-box thinking and thus promote proactive actions.

In the study of the relationship between firms' dynamic competencies and their level of innovation (which we treat as a manifestation of proactive behaviour), Ingram and Kraśnicka (2023) not only show an explicit positive relationship between these variables, but also look at the reverse link. By examining the impact of a turbulent environment on the growth of dynamic competence, they show that such a relationship exists, although it is not strong. Therefore, we may assume that it is the internal characteristics of firms that determine their agility level and how they respond to outside changes, and that the turbulent environment only reinforces these competencies.

Sanctions are changes that make the environment more turbulent. Therefore, firms with agile capabilities should respond to such changes faster and more effectively than their counterparts without internal flexible adaptability (Doz & Kosonen, 2010). Based on the above considerations, we hypothesised:

H1: When faced with sanctions, agile companies adopt more proactive than reactive measures to survive and perform in the new environment.

International Experience and Sanctioning Reactions

In this article, we define international experience as a complex construct that relates to the number of international markets occupied, the length of time that firms have operated internationally, and the extent and nature of activities undertaken abroad. The literature on international business, international entrepreneurship, and resource theory of the firm all point to links between the scale, length and scope of international operations and the nature of the strategies of such entities.

For example, entrepreneurial literature and resource theory research (with a special focus on the knowledge-based stream) emphasise that the international scale of a firm's operations leads to the accumulation of knowledge and experience that enables it to respond appropriately to conditions in different host markets. In turn, such competencies enable a proactive approach to strategy formation in the face of sudden change (see, for example, Oliver, 1991; Piercy *et al*., 1998; Hillman & Wan, 2005; Khanna & Palepu, 2010; Aguilera-Caracuel *et al.,* 2012; Głodowska *et al.,* 2019). Analysing case studies of internationalised firms from a sanctioned country, Aliasghar and Rose (2023) showed that the level of cooperation and strength of ties within an international supply chain explicitly increases the likelihood of survival of such firms. In their research on sanctions against Russia imposed after the first attack on Crimea and Donbas, Stępień and Weber (2019) proved that firms with more international experience were more resilient to the negative impact of sanctions because they were able to use a variety of adjustment strategies. Based on this research, we hypothesised:

H2: When faced with sanctions, companies with more international experience adopt more proactive than reactive measures to survive and perform in the new environment.

Financial Performance as the Result of Adjustment Strategies

To the best of our knowledge, there are no published studies investigating the relationship between financial performance and specific adaptation strategies of companies in the face of sanctions. However, as highlighted above, sanctions are a sudden change in the environment, independent of business players. External crises induce similar adaptive changes, so here we use research on the response of small and medium-sized enterprises to the recent global crisis, the COVID-19 pandemic, to capture the relationship between the nature of adaptive responses and firms' financial performance.

Unsurprisingly, previous research on the survival strategies of firms (including SMEs) during external crises, including the COVID-19 pandemic, revealed that they used both reactive and proactive strategies (Gittins *et al*., 2022; Kraus *et al.*, 2020). In a study of the strategies of small firms in the B2C services sector most affected by the pandemic, Stępień and Światowiec-Szczepańska (2022) show that firms that took a proactive approach to the restrictions weathered the crisis much better, both in terms of financial performance and competitive positioning, than those that adapted passively to the restrictions by reducing costs. When studying export activity of companies during the COVID-19 pandemic, Daszkiewicz *et al*. (2023) found that the level of international activity, degree of innovation and market diversification had a significant and positive impact on exports. The results also indicated the use of mixed adaptation strategies by surveyed companies, with many of these activities being proactive. Eggers' (2020) meta-analysis of 68 studies on the behaviour of small and medium-sized enterprises in different types of crisis showed that the more effective survival strategies are proactive, with a strong emphasis on market and entrepreneurial orientation.

Therefore, we assumed the following:

H3: Despite sanctions-related changes, proactive adjustment strategies enable positive financial performance.

H4: Passive adjustment strategies in the face of sanctions lead to negative financial performance.

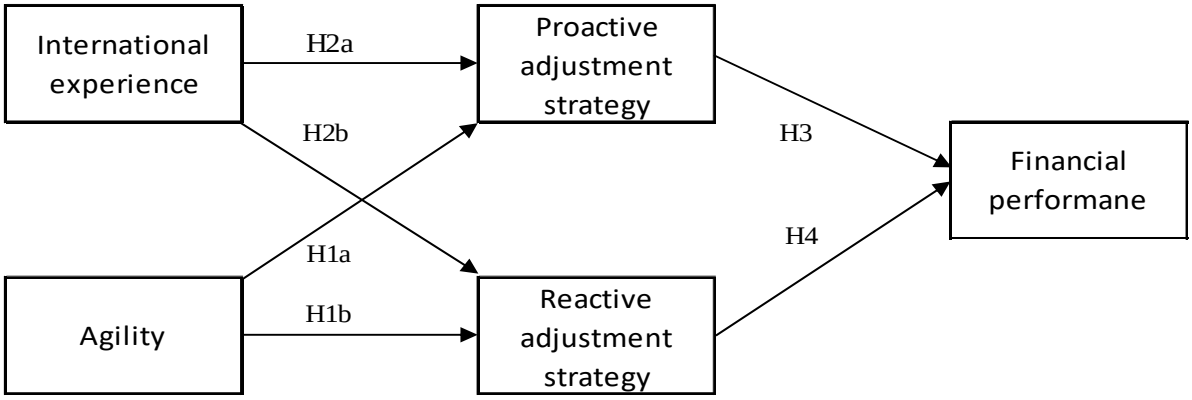

Figure 1. Conceptual framework: Impact of agility and international experience on strategies and performance of sanctioned' companies
Source: own elaboration.

RESEARCH METHODOLOGY

The sample

The quantitative empirical research was international in scope and focused on companies directly or indirectly affected by the sanctions imposed on Russia in 2022 in connection with its invasion of Ukraine. The subject of the analysis was medium-sized companies operating in Russia before the outbreak of the war. We chose medium-sized companies purposefully. Firstly, most research on the behaviour of firms in the face of sanctions focuses on large firms, while small and medium-sized firms remain on the periphery of academic interest, even though this group serves as the backbone of any economy. Secondly, multinational firms are better equipped to anticipate – and possibly even shape – sanctions policy, while medium-sized firms have less capacity and resources to monitor sanctions or anticipate regulatory changes.

The study investigated companies with between 50 and 250 employees. The sample consisted of 610 responses, and the participating companies came from three countries, *i.e.* the US, Germany, and Poland, with 200, 210, and 200 companies, respectively. In each of these countries, we examined the following sectors: wholesale/retail (37.7%), manufacturing (29.7%), transport/storage (18.9%), and agriculture (13%). Table 1 shows summary statistics for the sample.

Table 1. Companies' sample characteristics

No.	**Criteria**	**USA**	**%**	**Germany**	**%**	**Poland**	**%**	**Total**	**%**
1.	*Country*	200	32.80%	210	34.40%	200	32.80%	610	100%
2.	*Industry*								
	Agriculture	16	8%	40	19%	23	11.50%	79	13%
	Manufacturing	59	29.50%	58	27.60%	64	32%	181	29.70%
	Wholesale/Retail Trade	97	48.50%	60	28.60%	73	35.60%	230	37.70%
	Transportation/Storage	28	14.00%	52	24.80%	35	17.50%	115	18.90%
Other		0	0%	0	0%	5	2.50%	5	0.80%
3.	*Size (Number of Employees)*								
	50-99	57	28.50%	113	53.80%	115	57.50%	285	46.70%
	100-249	143	71.50%	97	46.20%	85	42.50%	325	53.30%
4.	*Main client*								
	B2B Sector	45	17.20%	65	25%	152	58%	262	43%
	B2C Sector	23	23.47%	61	62%	14	14%	98	16%
	B2B & B2C	132	52.80%	84	33.60%	34	13.60%	250	40.98%

Source: own study.

To represent the most likely cases of the impact of sanctions on strategic responses, we deliberately chose the industries in which the surveyed companies operate. These industries were directly affected by sanctions, at least in terms of transportation or the ban on cooperation with public entities in Russia and Belarus. Moreover, the value chains in these industries were also internationally dispersed, resulting in a multidimensional and multi-directional impact of sanctions on their operations.

We have limited our sample to the three sanctions' senders countries in which the companies were based, *i.e.*, Germany, Poland, and the United States. Germany is the economic leader of Europe and is politically and economically engaged with Russia as an important partner supplying Germany with gas and fuel and where Germany has made significant investments (Karnitschnig & Nöstlinger, 2022). Since the beginning of Russia's war of aggression against Ukraine, public support for sanctions has remained consistently high.

As a neighbour of both Ukraine and Russia, Poland has been severely affected by the invasion. Before the conflict, more than two million Ukrainians worked in Poland, and after the war, more than five million Ukrainian refugees arrived in Poland, most of whom remain in Poland to this day (Strzelecki *et al.*, 2022). Poland is known for its dependence on Russian gas supplies (Szeptycki, 2021) and its historical oscillation between friendship and hostility towards Russia (Ozbay & Bulent, 2008).

The United States is the world's most active sender of sanctions, characterised by the most effective enforcement of sanctions laws, both at home and abroad. As in Germany, the vast majority of the public supports existing – and even tougher – sanctions against Putin's regime, while economic relations with Russia (and Ukraine) are weaker compared to German and Polish economic relations.

The survey utilised CAWI in the form of an electronic questionnaire translated from English into Polish and German. The SAGO Group surveyed American and German companies, and INDICATOR Agency surveyed Polish companies between March and April 2023.

Variable Construction

Research on sanctions with firm actions as the axis of interest is still scarce (see Bapat *et al.,* 2020). In this study, we employed structural equation modelling (SEM) to examine the relationships among several latent constructs, *i.e.,* strategic agility, international experience, proactive adjustment strategies, reactive adjustment strategies, and financial performance. Below, we define each construct, describe how it was operationalized, and explain the measurement items used in our survey instrument.

1. Strategic agility (SA)

Definition: Strategic agility refers to a firm's dynamic capabilities that enable it to rapidly and effectively respond to environmental volatility through quick decision-making and innovative actions.

Measurement: We measured strategic agility using five items adapted from established scales on dynamic capabilities and organizational agility. Respondents indicated their agreement with each statement on a five-point Likert scale ranging from 1 ('strongly disagree') to 5 ('strongly agree').

***Measurement items*:**
SA1. The most important decisions regarding the company's strategy are made very quickly.
SA1. We continuously analyse risks and develop appropriate response scenarios.
SA3. We are constantly looking for new opportunities in the marketplace.
SA4. As a business, we adapt quickly to market changes
SA5. We develop skills and resources that enable us to respond very quickly to market risks and opportunities.

2. Proactive adjustment strategies (PA)

Definition: Firms' strategies that aim to adapt to environmental changes by seeking new opportunities and innovatively altering their operations.

Measurement: We measured proactive adjustment strategies using four items that capture various proactive responses to sanctions. Respondents indicated the extent to which their company engaged in each activity on a five-point Likert scale ranging from 1 ('Not at all') to 5 ('To a very great extent').

Measurement items:
PA1. Relocating operations to non-conflict countries.
PA2. Exporting to/from Russia or Belarus via new third countries.
PA3. Creating new export/import markets outside Russia/Belarus.
PA4. Creation of new supply chain/subcontracting links outside Russia/Belarus.

3. Reactive adjustment strategies (RA)

Definition: Actions that firms take in response to environmental changes that involve reducing or ceasing certain activities, often as a way to minimize losses or comply with new regulations.

Measurement: We measured reactive adjustment strategies using five items reflecting passive or defensive responses to sanctions. Respondents indicated the extent to which their company engaged in each activity on a five-point Likert scale ranging from 1 ('Not at all') to 5 ('To a very great extent').

Measurement items:
RA1. Termination or complete closure of production/distribution/purchasing/sales activities in Russia/Belarus.
RA2. Sale of infrastructure in Russia/Belarus.
RA3. Withdrawal or freezing of investments in Russia/Belarus.
RA4. Reducing labour costs or employment in Russia/Belarus.
RA5. Reducing labour costs or employment in the country or other non-conflict areas.

4. Financial performance (FP)

Definition: Financial performance captures the impact of the war and sanctions on the financial outcomes of the surveyed companies.

Measurement: We assessed financial performance using three indicators. Respondents rated the impact of the sanctions and war on each financial metric using a five-point Likert scale ranging from 1 ('Significant decrease') to 5 ('Significant increase').

Measurement items:
FP1. total sales;
FP2. total net income;
FP3. total profitability levels.

5. International experience (IE)

Definition: International experience is a multifaceted construct reflecting a firm's accumulated knowledge, activities, and capabilities in global markets, indicating its ability to operate and compete internationally.

Measurement: Unlike the other constructs, we measured international experience using three categorical variables that capture different dimensions of internationalization:

Number of foreign markets (IE1): Assessed by asking respondents to indicate the number of foreign markets in which their company operates:
1 ('One market')
2 ('Two to four markets')
3 ('Five to ten markets')
4 ('Eleven to twenty markets')
5 ('More than twenty markets')

Types of international involvement (IE2): Measured by identifying the nature of the company's international activities:
1 ('Mostly local/domestic')
2 ('Exporter/importer')
3 ('Long-term production/service cooperation')
4 ('Own factories abroad')

5 ('Own distribution networks abroad')

Years of international experience (IE3): Determined by the length of time the company has been active internationally:
1 ('None; domestic operations')
2 ('Less than one year')
3 ('More than one year, less than three years')
4 ('More than three years, up to ten years')
5 ('More than ten years')

Due to the categorical nature of these variables and the absence of Likert-scale responses, we employed a clustering approach to integrate these dimensions into a single latent construct representing international experience. This method allowed us to capture the multifaceted nature of internationalization on an ordinal scale suitable for inclusion in the SEM.

We conducted a hierarchical cluster analysis using Ward's method and Euclidean distances to group firms based on their responses to IE1, IE2, and IE3. The clustering process resulted in five distinct clusters:

1. Nascent internationals: Firms in this cluster are in the early stages of international expansion. With the lowest scores for the number of foreign markets (qi), types of international experience (qh), and years of international experience (qj), these firms are likely to be engaged in their home markets or have just started to venture into international markets. Their international activities are limited in scope and diversity.
2. Emerging exporters. This cluster represents firms that are somewhat more experienced than those in cluster 1. They have started to establish a presence in foreign markets, possibly through basic export/import activities. Their experience is growing, but they still have a limited range of international activities and a relatively short history of involvement.
3. Intermediate internationals. Firms in cluster 3 have a moderate level of experience in international operations. It 'is represented in the majority by long-term exporters. Companies in this cluster have been active in several foreign markets for some time and may have developed a few long-term international relationships or smaller overseas operations. Their international presence is consolidating, but they are not yet deeply integrated into global markets.
4. Advanced internationals. These companies are quite experienced and have a significant international presence. They have a wider range of international activities and have been operating in foreign markets for a longer period. Their international operations are diverse, and they are likely to have developed significant expertise in navigating the complexities of international business.
5. Global operators:. As the most experienced group, companies in Cluster 5 are deeply integrated into the international marketplace. They operate in a large number of foreign markets, have extensive types of international operations – including ownership of overseas facilities and distribution networks – and have accumulated many years of international experience. These companies are true veterans of global business, with rich and diverse international expertise.

Each firm was assigned to a cluster, which we then coded numerically (1 to 5) to represent the level of international experience, with higher values indicating greater internationalization.

We chose the clustering approach to handle the non-ordinal data and to create an ordinal variable representing international experience. This method captures the complexity and multifaceted nature of internationalization, allowing us to include it as a latent construct in the SEM analysis. Clustering provides a nuanced categorization that reflects the heterogeneity of firms' international activities, which would not be captured by a single metric.

We assumed that nascent internationals have the least international experience while global operators have the most international experience of the whole sample.

Figure 2 provides a visual representation of the clustering analysis conducted to categorise firms based on their international experience. The clusters ranged from 'global pioneers' with extensive and diverse international involvement to 'established exporters' indicating a strong but potentially more focused international presence. The silhouette plots within each cluster illustrate the distribution of

firms along three key dimensions: the number of foreign markets in which they operate (qi), the diversity of their international operations (qh) and the length of their international experience (qj). The relative size of each cluster was indicated by the percentage and actual number of firms it contains, providing insight into the commonality of each international experience profile within our dataset.

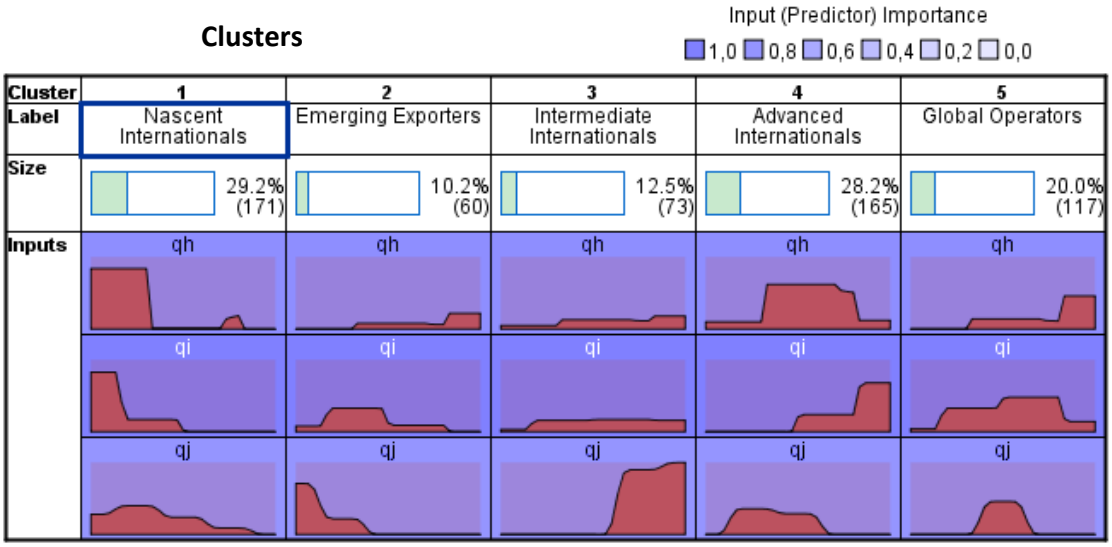

Figure 2. The level of international experience: The categorisation of sample companies

Note: Inputs show the distribution of responses across clusters, Y axis in each cell corresponds to Likert scale
qi – number of foreign markets in which the company operates, 1 – one, 2 – two to four,
3 – five to ten, 4 – eleven to twenty, 5 – more than 20 foreign markets.
qj – years of international experience, 1 – none; domestic operations; 2 – one year; 3 – more than one year, less than 3 years; 4 – more than 3 years to 10 years; 5 – more than 10 years of international experience
qh – types of international experience, 1 – mostly local/ domestic; 2 – exporter/importer; 3 – long-term production/service cooperation; 4 – own factories abroad; 5 – own distribution networks abroad.
Source: own elaboration.

The inclusion of clusters in structural equation modelling (SEM) analysis in our research serves a methodological strategic purpose. Traditional SEM approaches tend to focus on variables that lend themselves to linear scaling, such as those measured on a Likert scale. However, certain key questions about the international experience were not ordinal in nature, making standard SEM techniques inadequate for capturing the nuanced complexity of the data. To address this challenge, we employed a clustering technique that allowed us to transform the rich, categorical data from the non-ordinal survey questions into a continuous scale that reflected a spectrum of international experience from nascent to seasoned operations.

Clustering allowed us to synthesise the multi-dimensional data derived from the survey questions on the number of foreign markets in which companies operate, the diversity of their international operations and the duration of their international activities into a single ordinal metric. This transformation was essential for two reasons. Firstly, it allowed us to maintain the integrity and granularity of the original data while adapting it for use within the SEM framework. Secondly, it provided a coherent structure that facilitated the interpretation of the latent constructs within our model. The resulting ordinal scale, ranging from 1 to 5, reflects a cumulative index of international experience, with higher scores indicating greater depth and breadth of international engagement.

The introduction of this cluster ordinal variable into the SEM model greatly enhanced its analytical capabilities. It provided a means to quantify and examine the impact of firms' level of internationalisation on other strategic variables within the model. It also allowed for a more sophisticated understanding of how different levels of international experience influence business strategies and outcomes. By bridging the gap between categorical survey data and SEM, the clusters not only preserved the nuanced information contained in the survey responses but also enhanced the robust-

ness and interpretability of the SEM analysis. This innovative approach underlines the SEM's adaptability to non-traditional data types and highlights the importance of flexible modelling techniques in exploring complex research questions.

We tested the following research hypotheses derived from the literature:

H1: When faced with sanctions, agile companies adopt more proactive than reactive measures to survive and perform in the new environment (H1= H1a>H1b).

H2: When faced with sanctions, companies with more international experience* adopt more proactive than reactive measures to survive and perform in the new environment (H2= H2a>H2b).

H3: Despite sanctions-related changes, proactive adjustment strategies enable positive financial performance.

H4: Passive adjustment strategies in the face of sanctions lead to negative financial performance.

Structural Equation Modelling: Measurement Validation

We used structural equation modelling (SEM) to establish and test causal relationships between several latent factors – agility, international experience, reactive, and proactive strategic responses to sanctions, and the financial outcomes of the respective actions. The data were analysed as follows. Firstly, we checked the logical and statistical consistency of the constructs used in the conceptual models by means of confirmatory factor analysis (CFA). We then calculated multivariate correlation analysis between the constructs. Next, we used SEM in STATA to test the conceptual framework. This followed a two-step approach (Anderson & Gerbing, 1988), first examining the measurement model and then evaluating the structural model used to test the hypothesised relationships. We validated this model for the full sample (610 cases).

Table 2. Construct validity and reliability test

Variables and Items	Number of items	AVE	Composite Reliability	Cronbach's Alpha	Kaiser-Meyer-Olkin
Agility (SA)	3	0.51	0.75	0.78	0.70
Financial performance (FP)	3	0.79	0.92	0.93	0.76
Proactive adjustment strategies (PAS)	4	0.64	0.88	0.88	0.83
Reactive adjustment strategies (RAS)	4	0.76	0.93	0.93	0.85

Notes: We based measurement for constructs on a five-point scale where 1 = 'Completely disagree' and 5 = 'Com-pletely agree' or 1 = 'Never' and 5 = 'Very often,' depending on the question posed in the survey.
Source: own study.

We tested the discriminant validity of the constructs shown in Table 2 using Fornell and Larcker's (1981) method of comparing the average variance extracted (AVE) to the squared correlation between constructs. The AVE for agility, proactive adjustment strategy, reactive adjustment strategies, and financial performance were 0.51, 0.79, 0.64, and 0.76, respectively.

We tested the constructs' reliability using Cronbach's alpha, and the composite reliability method. All constructs surpassed the recommended threshold of 0.7, showing strong internal consistency. Scoring 0.7 and above for all constructs, all these measures, together with the Kaiser-Meyer-Olkin (KMO) indicated that the constructs demonstrate robust psychometric properties and the measurement model displayed good data fit.

Given that international experience was measured using a clustering approach, traditional reliability measures were not applicable. However, we evaluated the clustering solution for its adequacy using silhouette analysis, ensuring meaningful groupings with clear distinctions between clusters.

Structural Equation Modelling: Model Evaluation

Next, we estimated the structural model to investigate the relationships between proposed latent variables. We assessed the goodness of fit of SEM model with Chi-square, the likelihood ratio, root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index indices. Table 3 presents the results of model fit and performance.

Our model showed a significant likelihood ratio with a chi-square of 231.264 ($p < 0.001$) compared to a saturated model and a baseline chi-square of 6759.878 ($p < 0.001$). These results indicate that our model significantly improves the fit compared to a model of independence.

Table 3. Model fit and performance statistics

Fit statistics	Description	model
Likelihood ratio		
chi2_ms	model vs. saturated	231.264
chi2_bs	baseline vs. saturated	6759.878
Population error		
RMSEA	Root mean square error of approximation	0.055
pclose	Probability RMSEA <= 0.05	0.147
Information criteria		
AIC	Akaike's information criterion	22817.007
BIC	Bayesian information criterion	23035.673
Baseline comparison		
CFI	Comparative fit index	0.978
TLI	Tucker-Lewis Index	0.972
Size of residuals		
SRMR	Standardized root mean square residual	0.067
CD	Coefficient of determination	0.899

Source: own study.

We then turned to the root mean square error of approximation (RMSEA) as an estimate of the population error, which was 0.055, indicating a very good fit (the RMSEA ranges from 0 to 1, with lower values generally indicating a better model fit).

Comparative indices such as the CFI and TLI were 0.978 and 0.972, respectively. Both indices range from 0 to 1, with values closer to 1 indicating a better fit. Values above 0.90 are considered to indicate an acceptable fit, suggesting that our model provided a reasonable fit to the data.

Finally, SRMR, an absolute measure of fit, was 0.067 below the commonly used cut-off of 0.08, indicating a good fit of the model residuals. Meanwhile, CD of 0.899 indicated a high degree of variance explained in our model.

RESULTS AND DISCUSSION

Figure 3 shows the relationships between agility, international experience, proactive and reactive adaptation strategies, and financial performance. The results presented in the model confirmed all the hypotheses put forward in the article.

Table 4. Structural model results

Hypothesized path	Standardized coefficient (β)	Standard error (SE)	t-value	p-value	Supported
H1a: Strategic agility → Proactive adjustment	0.67	0.05	13.40	<0.001	Yes
H1b: Strategic agility → Reactive adjustment	0.55	0.06	9.17	<0.001	Yes
H2a: International experience → Proactive adjustment	0.61	0.04	15.25	<0.001	Yes
H2b: International experience → Reactive adjustment	0.54	0.05	10.80	<0.001	Yes
H3: Proactive adjustment → Financial performance	0.36	0.03	12.00	<0.001	Yes
H4: Reactive adjustment → Financial performance	-0.25	0.15	-1.65	<0.1	Yes

Source: own study.

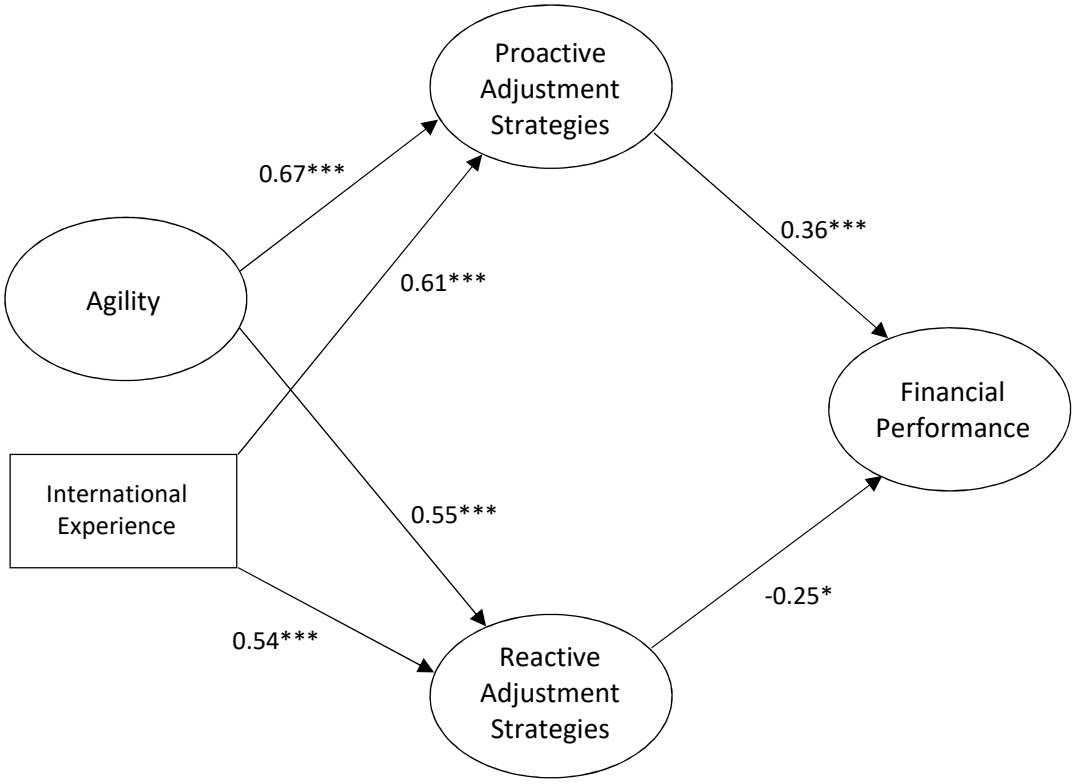

Figure 3. The SEM model results: Impact of agility and international experience on strategies and performance of sanctioned' companies
Source: own elaboration.

H1a and H1b: Strategic Agility positively influences both proactive and reactive adjustment strategies.

The path coefficient from strategic agility to proactive adjustment strategies was β=0.67, which is significant at p<0.001. This indicated a strong positive relationship, suggesting that firms with higher strategic agility were more likely to adopt proactive strategies in response to sanctions. The path coefficient from strategic agility to reactive adjustment strategies was β=0.55, significant at p<0.001. While this relationship is also positive, it is weaker compared to the influence of proactive strategies. This suggests that agile firms are somewhat inclined to adopt reactive strategies, but their preference leans more toward proactive measures.

H2a and H2b: International experience positively influences both proactive and reactive adjustment strategies.

The path coefficient from international experience to proactive adjustment was β=0.61, significant at p<0.001. This strong positive relationship indicated that firms with greater international experience are more inclined to engage in proactive adjustments when facing sanctions. The path coefficient from International Experience to Reactive Adjustment Strategies was β=0.54, significant at p<0.001. Similar to agility, the influence on reactive strategies was positive but less pronounced, suggesting that internationally experienced firms were more proactive.

H3: Proactive adjustment strategies positively impact financial performance.

The path coefficient from proactive adjustment strategies to financial performance was β=0.36, significant at p<0.001. This strong positive relationship implies that firms adopting proactive strategies in response to sanctions experience better financial outcomes.

H4: Reactive adjustment strategies negatively impact financial performance.

The path coefficient from reactive adjustment strategies to financial performance was β=-0.25, significant at p<0.1. This negative relationship indicated that firms relying on reactive strategies

tend to experience poorer financial performance, but the low significance of this result makes the conclusions drawn from it tentative, suggesting that further research is needed to confirm the strength and consistency of this effect.

Discussion

Agility is an attribute of companies that makes them more likely to act proactively rather than passively in the face of the threat of sanctions against a country with which all the companies studied had direct or indirect trade relations at the start of the war. This relationship highlights the importance of agility in adapting to and learning from international markets. Our findings corroborate studies that show how the entrepreneurial capabilities of small and medium-sized enterprises enable them to operate proactively internationally (Oviatt & McDougall, 2005; Coviello, 2006; Gancarczyk & Gancarczyk, 2018). However, the presence of agile resources does not preclude the use of passive adaptation measures, and it may limit them in favour of non-standard moves. In the face of such limitations, most actors adopted mixed adaptation strategies using both passive and active adjustment, as shown in a previous study by Weber and Stępień (2020) on European firms during the period of Russia's first invasion of Crimea. Moreover, regardless of the level of compliance with sanctions (*e.g.*, overcompliance or undercompliance), the companies studied by these authors used a mixed set of adaptations.

International experience works in a similar way to agility. Firms that have been operating for a long time in multiple country markets and with a broad range of foreign activities (such as, *e.g.,* production or distribution networks abroad) have a wider range of experience gained in different economic, institutional or cultural environments, and can therefore use this experience proactively in the face of sudden changes, such as the imposition of the sanctions. As Johanson and Vahlne (2015) indicate in the revised Uppsala model, the ability to grow internationally is, among other things, a function of their experience and network relationships, which are not instantaneous but take time and trust between partners in an international supply chain.

As we hypothesised, reactive strategies lead to negative financial results. On the other hand, proactive adaptation leads to positive financial results, despite undoubtedly adverse changes in the environment, such as the sanctions introduction. The results suggest that companies with strong international experience and agile capabilities can think outside the box and find solutions that generate revenue in the long run, even in the face of adverse change. However, we believe – although this will be the subject of further research – that even very agile and internationalised companies take proactive adjustment measures after the so-called first shock, *i.e.*, sometime after the introduction of sanctions. Immediate responses by firms tend to be more reactive in nature, which is why we have a mixed set of actions in our study. We base our assumption on the results of the qualitative studies by Stępień and Światowiec-Szczepańska (2022) and Gittins *et al.* (2022), which describe such a development of adaptation to pandemic COVID-19 sanctions. In the first phase, reactions to the crisis were mainly passive and only in the next phase did companies with a certain potential for agility, innovation and experience reacted proactively.

Both strategic agility and international experience are crucial for firms to adapt effectively to disruptive events like sanctions. While agility focuses on the firm's internal capabilities to respond quickly, international experience provides external knowledge and networks. Firms that possess both are better positioned to implement proactive strategies that enhance financial performance.

CONCLUSIONS

The introduction of sanctions disrupts the existing rules of the business game and forces a change in existing business relationships. In our article, we have shown that the companies which are more likely to survive and prosper when sanctions are imposed are those with agile skills and extensive international experience. Companies with such internal characteristics are able to turn an adverse environment into success. They do this through a combination of proactive and reactive measures, but only the proactive measures produce positive financial results. Our research also shows that agility and

international experience are mutually reinforcing: agility drives companies to develop their business internationally, and international experience shapes agile resources.

Strategic agility is a driver of proactive responses. Firms with higher levels of strategic agility are more capable of swiftly identifying and capitalizing on new opportunities arising from sudden environmental changes such as sanctions. The stronger influence on proactive strategies suggests that agility equips firms to not only respond but also to anticipate and shape their environments. The weaker yet significant influence on reactive strategies may reflect that agile firms still implement necessary defensive measures but prioritize proactive initiatives.

International experience enhances proactive adaptation. Firms with extensive international experience possess valuable knowledge and networks that enable them to navigate complex international landscapes effectively. The strong positive relationship with proactive strategies indicates that such firms leverage their experience to explore alternative markets, adjust supply chains, and innovate their business models. The positive relationship with reactive strategies, though weaker, suggests that international experience also aids in implementing necessary cost-cutting or compliance measures.

Proactive adjustment strategies have a substantial positive effect on financial performance, emphasizing the financial benefits of innovatively adapting to sanctions. Reactive adjustment strategies negatively affect financial performance, indicating that solely defensive measures may not suffice and could harm profitability. These findings align with prior research on crisis management and organizational resilience, where proactive approaches lead to better outcomes (Eggers, 2020; Stępień & Światowiec-Szczepańska, 2022).

The objective of the above-described research and analysis was to extend an understanding of firms' strategic behaviour in response to sudden external changes or crises, such as sanctions. The aim was to demonstrate how intrinsic factors influence sanctions' adjustment strategies. This article also makes a contribution to the limited economic and business literature on companies' behaviour towards sanctions by analysing the impact of sanctions on financial performance. Finally, unlike most studies in this area that primarily focus on large firms, this article examines mid-sized firms. Further research on the behaviour of firms vis-à-vis sanctions can focus on the strategies of small actors and show the rationale and process of adaptation changes in firms affected by such restrictions.

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Conflict of Interest

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Sustainability as a strategic response to the liability of foreignness: Empowering multilatinas for sustainable development

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ABSTRACT

Objective: This study explores the role of sustainability as a strategic mechanism for multilatinas to overcome the liability of foreignness (LOF) and drive sustainable development in host countries. It also highlights the intersection of sustainability, business ethics, and internationalisation, focusing on their collective impact on sustainable development and identifying business ethics as a promising area for future research.

Research Design & Methods: This article uses a single-case methodology to incorporate triangulation from diverse sources. We collected primary qualitative data from five Latin American countries, complemented by secondary data extracted from company reports and third-party communications.

Findings: Our study contributes to the LOF and sustainability literature by demonstrating how an effective sustainability strategy empowers EMNEs to mitigate the inherent disadvantages of operating in foreign markets.

Implications & Recommendations: By leveraging sustainability, these companies bolster their commitment to sustainable development in host countries, thus transcending traditional liabilities associated with their emerging market status.

Contribution & Value Added: The findings from this single case study provide valuable insights into the intricate relationship between sustainability, internationalisation, and sustainable development within the complex landscape of emerging markets. This research contributes significantly to the scholarly debate surrounding these topics.

Article type: research article

Keywords: sustainability strategy; liability of foreignness; multilatinas; emerging markets; sustainable development; internationalisation

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INTRODUCTION

Do companies embrace environmental and social sustainability because they are financially profitable, or do they become financially profitable because they embrace environmental and social sustainability?

Based on previous studies, we can confidently say that a company's financial performance also depends on non-financial factors like environmental, social, and governance (ESG) dimensions, impacting its international operations (Gomez-Trujillo & Gonzalez-Perez, 2020). Consequently, corporate social responsibility (CSR), corporate sustainability, and the management of non-financial risks (ESG) influence firms' financial performance. As a result, business leaders need to adopt a management approach that positively impacts the 'triple bottom line' (Doś & Pattarin, 2024; Pisani *et al.*, 2017).

At the same time, corporate sustainability seeks opportunities for future growth while considering limitations and liabilities, placing it at the core of corporate strategy (Gomez-Trujillo & Gonzalez-Perez, 2022). While sustainability as a corporate strategy has previously been studied, the specific intersection

of sustainability and liability of foreignness (LOF) remains underexplored, particularly in the context of emerging market multinational enterprises (EMNEs) from Latin America, or 'multilatinas.'

Latin America presents unique challenges and opportunities for multinational enterprises (MNEs). The region has diverse institutional frameworks, socio-economic inequalities, political instability, and environmental vulnerabilities (Monte-Cueto *et al*., 2024).

The novelty of this study lies in examining how firms from this region leverage sustainability strategies to overcome the challenges posed by LOF, contributing to both international business literature and sustainability discourse. Given Latin America's unique institutional and regulatory dynamics, this article contributes an original perspective by exploring how multilatinas manage LOF through sustainability strategies, thereby advancing their host countries' sustainable development goals (SDGs). Moreover, it highlights the intersection of sustainability, business ethics, and internationalisation, focusing on their collective impact on sustainable development and identifying business ethics as a promising area for future research.

Thus, we focused on a detailed analysis of the strategic path of a Colombian multinational business group, Interconexion Eléctrica S.A. (ISA), a Colombian multinational enterprise operating across energy, telecommunications, and infrastructure sectors in Latin America that has achieved world sustainability leadership recognized by global indices like the Dow Jones Sustainability Index and the FTSE4Good, (Arenales, 2022; Arias Jimenez, 2022). Moreover, ISA exemplifies how emerging market multinationals (EMNEs) use sustainability strategies to overcome the liability of foreignness (LOF).

Specifically, we examine how sustainability strategies help address these firms' operational challenges in diverse host country contexts, where distinct regulatory, social, and environmental conditions can affect their competitiveness. The research question guiding the analysis was: "How does an EMNE overcome the liability of foreignness while contributing to the sustainable development of multiple host countries?".

This manuscript is structured as follows. The next section will provide the literature review, followed by the case study methodology. Subsequently, we will present the results of the selected corporate case study, Interconexión Eléctrica SA-ISA, along with a descriptive analysis of the company's strategies and sustainability leadership. The subsequent discussion will explain the process of overcoming liabilities of foreignness during internationalisation and the contributions of EMNEs to sustainable development. Finally, we will formulate conclusions, limitations, and future research recommendations.

LITERATURE REVIEW

Internationalisation of EMNEs

International business studies initially relied on classical internationalisation theories from developed countries and industrial organization approaches. The new complexity of the global economy requires new theoretical insights or an extension of them (Cuervo-Cazurra & Ramamurti, 2014; Luo & Tung, 2007; Mathews, 2006; Ramamurti, 2009).

In this regard, Cuervo-Cazurra and Genc (2008) state that these companies face some disadvantages compared to developed country MNEs, arguing that they are less competitive due to their country's institutional voids. However, this condition can change if both MNEs operate in countries with these challenging conditions (Correa de Cunha *et al.*, 2022). In the same line, Luo and Tung (2007) expose the springboard perspective. Furthermore, EMNEs see internationalisation as a springboard for resource acquisition and a way to reduce the institutional difficulties in their home countries. Furthermore, Mathews (2006) proposes that companies from peripheral areas internationalise driven by resource linkage, leverage, and learning.

Recent research from Asia and Africa highlights similar dynamics in the internationalisation of EMNEs (*e.g.,* Ramamurti, 2009; Luo & Tung, 2018; Narula, 2019). These studies provide valuable comparative insights, showing how firms from emerging markets adapt to institutional voids and develop sustainability strategies as competitive advantages.

EMNEs and Their Liabilities of Foreignness

Although there is evidence of the benefits of internationalisation, it can also generate a competitive disadvantage for emerging market companies. Hymer (1976) introduced the concept of the 'cost of doing business abroad' that multinationals experience when operating internationally. Later, Zaheer (1995) further developed this concept using institutional theoretical lenses and put forward the 'liability of foreignness ' (LOFs) term, arguing that they represent additional tacit and social costs that firms face when entering a particular country.

These liabilities decline as firms get more embedded in local networks (Zaheer & Mosakowski, 1997).

Moreover, stakeholder theory examines how sustainability strategies influence relationships with external actors, such as communities and governments. Stakeholder theory highlights the importance of balancing diverse stakeholder interests to build legitimacy and foster long-term success (Freeman, 1984). Similarly, institutional theory highlights how government policies, cultural norms, and regulatory environments shape corporate strategies and behaviours (North, 1990). For multinational corporations, navigating diverse institutional contexts often requires adapting sustainability practices to align with local expectations and regulations. Prior research shows that firms operating in emerging markets, such as Latin America, leverage sustainability to address institutional voids and build legitimacy among stakeholders (Cuervo-Cazurra & Genc, 2008; Kolk & Curran, 2017).

EMNEs and Sustainability to Overcome LOF and Generate Sustainable Development

Sustainability initiatives by multinational companies draw the attention of scholars seeking to explain the drivers and motives for their implementation. For instance, in their systematic literature review, Gomez-Trujillo and Gonzalez-Perez (2020) identified internationalisation as a driver for pursuing sustainability initiatives. Sustainability can also serve as a tool to enhance stakeholders' acceptance and corporate reputation at an international level (Gomez-Trujillo *et al.*, 2023; Mushafiq *et al.*, 2024). Moreover, reputation and internationalisation can influence strategic decisions, international marketing, and international trade (Velez-Ocampo & Gonzalez-Perez, 2019). Given the above, the relationship between business and development has been studied with a particular emphasis on the role of multinational enterprises (MNEs) as sustainability drivers and, specifically, on their role in the sustainable development goals (SDGs) proposed by the United Nations (Berning, 2019; Kolk *et al.*, 2017; Van Zanten & Van Tulder, 2018; Ziemba *et al.*, 2024). This is particularly relevant because there is evidence of potential negative impacts of MNE investment in developing countries due to the negative productivity spillover effect between MNEs and local firms, as well as the reduction of employment generation and integration of informal actors due to a higher automatization and higher labour standards in global value chains (Brandl *et al.*, 2022; Gerschewski, 2013; Narula, 2019).

RESEARCH METHODOLOGY

This study employs a single in-depth qualitative case study methodology (Ghauri, 2004; Stake, 1994). Case studies are particularly suitable when researchers have limited control over events, focus on real-life phenomena, and have limited existing knowledge of the context (Doz, 2011; Yin, 2018). In-depth single case studies provide a comprehensive understanding of the interplay between a phenomenon and its context (Dubois & Gadde, 2002). Furthermore, case studies are particularly well-suited for exploring new research areas where existing theories may be insufficient (Eisenhardt, 1989; Verbeke, 2022).

Case Study Selection

To address our research question, we assessed the available population of companies (Cooper, 1984).

We selected the single-case study design to allow for an in-depth exploration of ISA's sustainability strategies and their role in overcoming liabilities of foreignness. We chose ISA due to its recognition as a global leader in sustainability, extensive presence in Latin America, and alignment with the research objectives. This approach provides detailed insights into complex phenomena that a comparative study

might not fully capture. It is particularly suitable for examining underexplored topics like sustainability and the liability of foreignness in emerging markets.

Data Collection

We employed triangulation using multiple data sources to ensure validation, mitigate bias, and achieve data saturation (Creswell, 2003; Denzin, 2012; Fusch *et al.*, 2018; Velez-Ocampo & Gonzalez-Perez, 2022).

We collected primary data through 31 in-depth interviews conducted in person or mediated by MS Teams in the local language (Spanish and Portuguese) between April and July 2021 with individuals holding positions such as past president, vice president of strategy, subsidiary managers, directors, analysts, and specialists in five Latin American countries. Moreover, one of the authors is part of the organisation. Thu, we took the ethnographic approach into account. Following recommendations by authors such as Einsenhardt (1989) and Vissak (2010), we added new participants until we reached theoretical saturation, as additional interviews provided little or no new information. We addressed ethical concerns by conducting interviews based on confidentiality, neutrality, flexibility, and early feedback (Myers & Newman, 2007; Solarino & Aguinis, 2020). Please refer to Table 1 for information on the interviews by Headquarters (21) and subsidiaries (10).

Table 1. Interviews conducted by headquarters and subsidiaries

Country	Headquarters	Subsidiaries				Total number of interviews
	Colombia	Peru	Brazil	Chile	Bolivia	
Senior executives	9	2	2	4	1	18
Mid-level managers / specialists	12	0	1	0	0	13
Length (hours)	23.53	1.97	3.83	4.38	1	34.71

Source: own study.

We based the criteria for selecting participants based on their knowledge and experience of the company's internationalisation and involvement in sustainability issues. This mix of roles between senior executives, mid-level managers, and specialists allowed for interviews with elite and non-elite informants, challenging the researcher's assumptions and reducing elite bias (Solarino & Aguinis, 2020; Myers & Newman, 2007). Moreover, we participated in 14 corporate meetings with various stakeholder groups, which allowed us to observe the relationship capabilities and handling of local needs in different countries.

Secondary sources included archival data covering the entire history of ISA since 1967, both before and after primary data collection. Written reports, such as sustainability reports since 2005 and 86 media news items, were handy for pre-interview and post-interview analyses (Ghauri, 2004). Please refer to Table 2 for a summary of the complementary sources used.

Table 2. Complementary data sources used in the study

Data source	Description	Total reviewed	Total used
Corporate reports	Annual and sustainability reports	17	4
Media news	News articles about ISA's activities	86	13
	Total Documents	**103**	**17**

Source: own study.

We used direct observations and secondary to provide context, validate findings, and triangulate or cross-check information (Miles *et al.*, 2014). Using multiple sources enhances the findings' credibility, replication, and trustworthiness (Eisenhardt & Graebner, 2007).

Data Analysis

The data analysis consisted of several steps. Following the recommendations of Miles and Huberman (1984), we intertwined data collection and analysis from the initial observation and interviews.

Step 1: Construction of a case description and explanation for first-order analysis. We developed an initial thematic structure based on the literature review, interviews, and secondary data (Miles & Huberman, 1984).

Step 2: Data classification. In this stage, we manually coded the data to relate it to the research question, resulting in 236 codes and 22 categories. At this stage, we identified gaps in the data (De Massis & Kotlar, 2014).

Step 3: Iteration process. During this step, we refined codes and categories by comparing them with existing literature and empirical evidence (Eisenhardt, 1989).

Step 4: Second-order analysis. We identified relationships among first-order codes and categories (Aguinis & Solarino, 2019). Figures aid in interpreting concepts and relationships in qualitative data and effectively summarize the main research findings (De Massis & Kotlar, 2014).

RESULTS AND DISCUSSION

This section describes the case and narratively presents the findings explaining the evolution of the company and its strategic cycles, its internationalisation process, and the implementation of a sustainability strategy to overcome its liabilities and contribute to sustainable development.

Our Case: ISA Group

ISA is a Colombian multilatina founded in 1967. It is a mixed-ownership company (60.23% state-owned enterprise, 51.41% by the Colombian national government, 8.8% by the subnational government of Medellin), and 39.77% by private investors (ISA, 2022).

By December 2022, it had 4713 direct employees, from which 22% of its top management team were women. ISA's net income reached COP 14.4 billion that year, and the ROE closed at 11.9% (ISA, 2022).

Moreover, ISA has 51 companies and subsidiaries, with multi-business operations in (i) electric energy transportation, (ii) roads and motorways, (iii) information technology and telecommunications, (iv) management of real-time systems, and (v) investment. Furthermore, it operates directly in seven Latin American countries (Colombia, Peru, Bolivia, Chile, Brazil, Argentina, and Panama).

In 2023, DJSI selected ISA as one of the world's top 10 energy utility companies in sustainability. In addition to being a member of the DJSI, the commitment to the sustainability of this multinational company is directly connected to global initiatives such as the 17 Sustainable Development Goals (SDGs), the United Nations Global Compact and its ten principles, and the Global Reporting Initiative (GRI).

Standard and Poor (S&P) classified ISA as one of the most sustainable companies in the world. Furthermore, the company received the bronze medal in the Sustainability Yearbook 2022, an initiative that aims to distinguish those companies within their industries that have each demonstrated strengths in corporate sustainability worldwide. Moreover, due to its corporate investment and best corporate sustainability practices, it was included in the FTSE4Good, an index designed to measure the performance of companies demonstrating specific ESG practices.

In August 2021, the company sold 51.4% of its total shares to Ecopetrol for USD 3.6 billion. The closing of this acquisition marks a milestone in developing the Ecopetrol Group's energy transition strategy, which seeks to maximize the life and value of the hydrocarbon portfolio while progressing decarbonization and diversification into low-emission businesses (Semana, 2021).

ISA's Internationalisation

The internationalisation process of ISA started in 1992 and evolved in the following years. Nevertheless, this process was boosted in 2000. Table 3 describes ISA's internationalisation process.

As observed, growth intention drove ISA's internationalisation. This wish included new opportunities abroad. It was also a motive to buy better or get better deals that led the company to search for international resources.

The drivers of this process included escape, learning, upgrade, locational, and firm-specific advantages, as previously analysed by Cuervo-Cazurra *et al.* (2015). Accordingly, this reveals the influence

of home country conditions on internationalisation decisions and responds to the call to challenge traditional internationalisation theories focused on host-country characteristics, especially in Latin American contexts (Cuervo-Cazurra *et al.*, 2018).

Table 3. ISA Group Internationalisation

1992	The first international interconnection between Colombia and Venezuela.
1998	Interconnection between Colombia and Ecuador.
2000	Entry to international markets. Concession in Peru.
2001	* Creation of ISA Peru. * Arcos submarine cable: ISA connects Colombia's telecommunication system to those of the United States, Venezuela, Mexico, and 12 countries of Central America and the Caribbean.
2002	Red de Energía del Perú (REP) is born.
2003	* International Electricity Transactions between Colombia and Ecuador. * ISA enters Bolivia's energy market. ISA Bolivia is born.
2005	* ISA joined the Global Compact * Fiber-optic Connection between Colombia and Venezuela. * Partial acquisition in Central America.
2006	* ISA entered the Brazilian market by purchasing 50.1% of CTEEP. * ISA partially acquired the Consorcio TransMantaro (CTM) in Peru.
2007	Incorporated the PDI Company in Peru.
2009	Started Operations in Panama. Interconexión Eléctrica Colombia Panamá S.A. (ICP).
2010	ISA entered the road concessions business in Chile. Acquisition of 60% of the shares of the Spanish company held in Cintra Chile Ltda.
2012	ISA enters Chile's Energy Market.
2017	Partial acquisition of TAESA and IENNE in Brazil.
2018	* Acquisition of the remaining 50% of IESUL in Brazil. ISA owns 100% of ISA CTEEP in Brazil. * Permissions by the Guna Yala indigenous community in Panama to interconnect Colombia with Panama. * Conexión Jaguar® had its first biodiversity and climate change mitigation project in Peru.
2019	Contract subscription of a full (100%) acquisition of the road concession on the Colombian Caribbean coast.
2020	* Creation of Interconexiones Viales in alliance with the building company Construcciones El Cóndor to provide road infrastructure in Peru and Colombia. * Creation of the program 'Conexión Puma' in Chile as a simile of the program Conexión Jaguar in other Latin American countries.
2021	* ISA INTERCHILE launches the program 'Connections for Development.' * Acquisition of 100% shares of Piratininga-Bandeirantes Transmissora de Energia (PBTE) in Brazil through CTEEP. * Ecopetrol acquired 51.4% of ISA's shares.
2022	* ISA received recognition for the placement of a green bond from its subsidiary ISA INTERCHILE. * The S&P Global Sustainability Yearbook 2022 rates ISA as one of the most sustainable companies in the world.
2023	* ISA CTEEP preferred shares (TRPL4) into the new Stock Market Index portfolio from São Paulo (Ibovespa). * ISA INTERVIAL CHILE entered the interurban road business. * ISA REP won the largest tender for energy projects in the last years.

Source: own study.

Surprisingly, while analysing the drivers of this internationalisation process, sustainability appeared as one of them.

On the other hand, we found evidence of firm-specific advantages (FSAs) before the internationalisation process. These FSAs related to knowledge, technology, managerial capabilities, and coordination skills (Wei & Nguyen, 2020).

In this way, internationalisation drivers become crucial, driving companies to expand internationally, as they are vulnerable in host countries and face different liabilities. This is the starting point for the subsequent search for mechanisms to overcome those liabilities. Hence, we proposed:

***Proposition* 1:** Corporate sustainability emerges as a catalyst for the international expansion of EMNEs and as an effective strategy to mitigate the challenges posed by the liability of foreignness.

Contribution to the Sustainable Development Goals (SDGs)

The company's commitment to sustainable development reflects in its premise that organizations that are not sustainable are not viable, as manifested by a sustainability manager of a subsidiary. This adds to the limited literature on the private sector's role in achieving the SDGs and Agenda 2030 (Witte & Dilyard, 2017).

As previously exposed, ISA has a clear strategy for creating value and considering different stakeholders. Moreover, its strategy is seen as a flag when entering overseas markets. This flag legitimizes their operations, thus helping them overcome liabilities abroad and contributing to the sustainable development of host countries. Consequently, we proposed:

***Proposition* 2:** By incorporating the sustainability flag into their corporate strategy, EMNEs can increase their contribution to sustainable development in host countries and generate public value among their stakeholders.

The propositions build on the idea that sustainability is both a competitive differentiator and a legitimacy-building mechanism (Mathews, 2006; Kolk & Curran, 2017). This dual role is particularly critical in regions with institutional voids, as highlighted by Cuervo-Cazurra *et al.* (2018). By leveraging sustainability, EMNEs overcome liabilities of foreignness and contribute to host-country development and increased legitimacy (Figure 1).

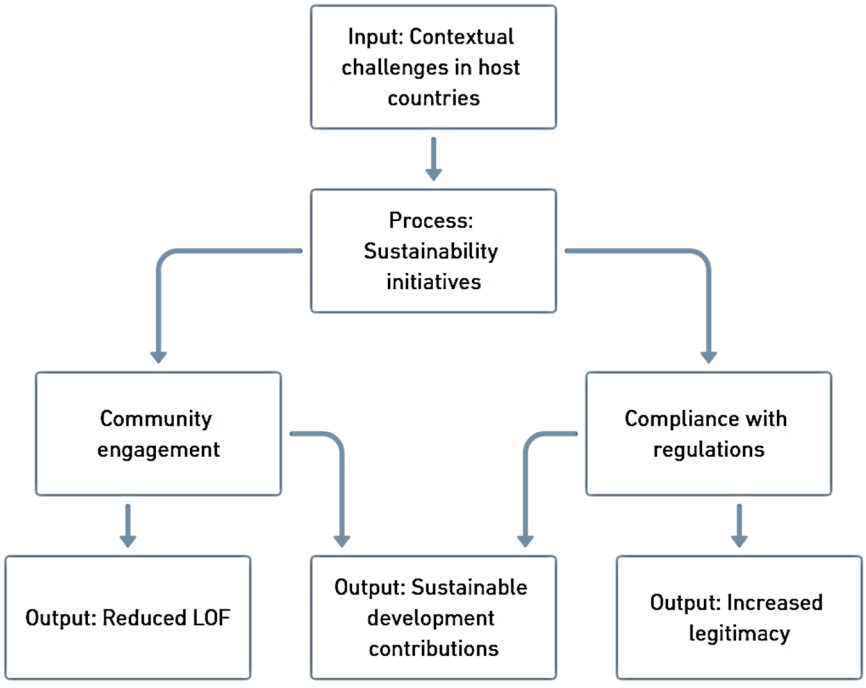

Figure 1. Integration of sustainability into the internationalisation strategy of ISA
Source: own elaboration.

Discussion

We aimed to contribute to the understanding of EMNEs' internationalisation and implementing a sustainability strategy to overcome their liabilities of foreignness and contribute to sustainable development.

The findings suggest that sustainability strategies help firms overcome liabilities of foreignness and align closely with business ethics principles. This alignment is crucial in emerging markets, where ethical challenges are prevalent, and addressing these concerns can enhance firms' legitimacy and stakeholder trust. Hence, this article advances knowledge in corporate sustainability, international business, and business ethics within an integrative framework derived from a case study in an emerging market context.

This study's findings align with stakeholder theory by demonstrating that ISA's sustainability strategies enhance legitimacy through proactive community engagement and alignment with local expectations. Furthermore, institutional theory helps explain how ISA adapts its strategies to address the institutional voids prevalent in Latin America, leveraging sustainability to navigate diverse regulatory environments.

Moreover, the study reinforces Zaheer's (1995) argument on the liability of foreignness (LOF), highlighting that firms face distinct unfamiliarity and relational hazards in emerging markets. However, unlike Zaheer's focus on developed market MNEs, our study shows that EMNEs employ sustainability as a dual mechanism for legitimacy and competitive differentiation, extending the framework to contexts with institutional voids. Furthermore, while Luo and Tung's (2007) springboard perspective emphasizes resource acquisition, our findings suggest that EMNEs leverage sustainability as a resource and a cultural bridge to align with host-country expectations, addressing relational hazards more effectively.

The company's emphasis on sustainability reflects Mathews' (2006) notion of resource linkage and leverage, highlighting how EMNEs exploit unique advantages to overcome LOF. Moreover, the findings expand on Cuervo-Cazurra and Ramamurti's (2014) assertion that EMNEs adapt their strategies to contextual voids, demonstrating sustainability's role as a dynamic enabler in this adaptation.

Although the five countries examined, *i.e.,* Colombia, Peru, Brazil, Chile, and Bolivia, exhibit diverse regulatory environments and institutional capacities, sustainability appears as a mechanism to gain legitimacy among stakeholders and to overcome LOF (Luo *et al.*, 2002). This is a new dimension for the analysis of LOF, as scholars have extensively studied it in the context of developed countries (Kolk & Curran, 2017).

At the same time, the sustainability flag, the genuine interest in societal issues, the corporate strategy, and its commitment to global initiatives such as The Global Compact, GRI, and SDGs, and its relationship with stakeholders make way for the contribution to sustainable development and the generation of public value as a way to return something to society (Wood, 1991). While studies by Kolk and Curran (2017) suggest that sustainability strategies are often reactive in emerging markets, our findings illustrate a proactive stance by EMNEs like ISA, demonstrating their role as initiators of public value and sustainable development in host countries. This positions sustainability as a forward-looking strategy, contrasting with traditional narratives of compliance-driven approaches. Figure 2 shows this dynamic.

Moreover, the findings revealed the critical influence of cultural norms and institutional frameworks on the design and execution of sustainability strategies, which demonstrates that the ability to tailor sustainability practices to specific cultural and institutional contexts not only enhances legitimacy but also strengthens operational effectiveness, as it is also seen in other EMNEs such as Cemex in Mexico and Natura in Brazil.

Furthermore, ISA offers an exemplary dedication to reaching its goals while dealing with the specific liabilities that MNEs from emerging economies face when internationalising their operations. Luo and Tung (2018) highlight that MNEs from emerging economies often use their international growth to compensate for their liabilities and exploit competitive advantages in a long-range strategy. Furthermore, this case provides insights into how an MNE from a challenging emerging country integrates sustainability, innovation, and stakeholder relationships into its business strategy. Although there are sustainable companies that internationalise later in life, showing that sustainability does not always follow internationalisation, we may see the sustainability flag as a mechanism to reduce liabilities and contribute to societal development.

While the case study highlights ISA's internal strategies, it is essential to consider the broader external context. The success of sustainability strategies is not solely determined by internal dynamics but also by interactions with external stakeholders, including impacted communities, regulatory bodies, and non-governmental organisations. For instance, ISA employs three key mechanisms to mitigate LOF effectively: compliance with international standards, proactive engagement with local stakeholders, and an ability to align sustainability initiatives with local priorities.

While this study highlights sustainability as a critical strategy for mitigating liabilities of foreignness (LOF) and driving internationalisation, research should consider alternative explanations. For instance, some may argue that ISA's success stems primarily from its unique firm-specific advantages, such as its technical expertise and strong financial backing, rather than its sustainability strategies. However, the findings suggest that these advantages are complemented by sustainability initiatives, which enhance legitimacy and facilitate stakeholder trust, particularly in challenging institutional environments.

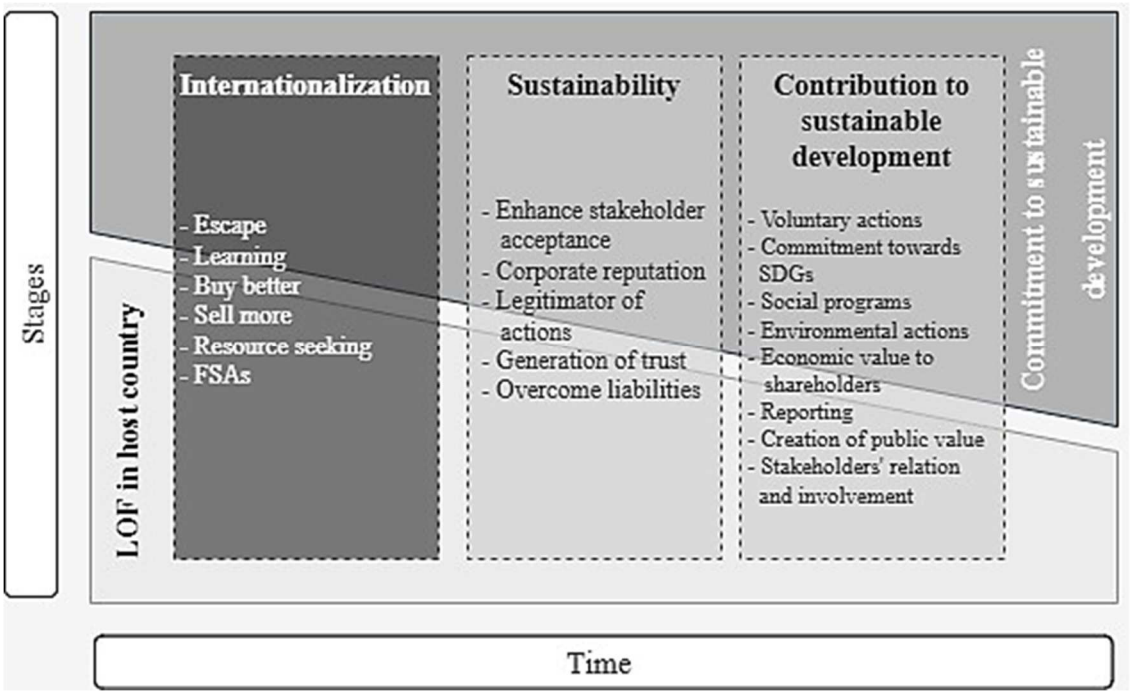

Figure 2. Process of overcoming the LOFs and the contribution to the sustainable development of EMNES
Source: own elaboration.

CONCLUSIONS

This study highlighted how ISA, a highly regulated service firm in an emerging market, effectively leverages sustainability strategies to mitigate liabilities of foreignness and contribute to sustainable development. While the findings are specific to the context of Latin American multilatinas operating in regulated industries, they reveal important patterns applicable to similar firms navigating institutional voids in other regions.

In this way, the context of the Latin American region becomes a critical aspect that differentiates IB from traditional business (Welch *et al.*, 2011), as this region can bring new insights regarding the internationalisation process of companies from emerging market and their differences from companies from developed countries (Aguilera *et al.*, 2017).

Nevertheless, this study has some limitations. Firstly, we presented findings in light of highly regulated service firms from an emerging market. Therefore, there are opportunities to extend and test our propositions in different industries and regions. Future research could examine how these strategies perform in sectors with varied regulatory pressures or emerging markets outside Latin America. Moreover, while this study relies on a qualitative, single-case approach, incorporating quantitative methods would allow further validation and broader generalisability of the findings.

Furthermore, while the five countries examined in this article are in Latin America, they do not share identical institutional conditions. Each faces unique political, social, and economic tensions, which may result in varying levels of incentives for sustainability and differing local advantages for firms. This diversity highlights the need for caution in generalising the findings across contexts with distinct institutional frameworks.

Future research could investigate how variations in institutional frameworks impact the sustainability strategies of multilatinas, mainly through comparative studies of firms operating in distinct national contexts. Moreover, future research could examine the role of external factors, such as community engagement and stakeholder collaboration, in the effectiveness of sustainability-driven internationalisation strategies, especially in regions characterized by institutional and cultural diversity. By addressing alternative explanations and acknowledging the contextual specificity of this case study, this research underscores the multifaceted nature of sustainability strategies in overcoming LOF.

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The growth effects of Bulgaria and Romania's EU accession: A synthetic control method examination

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ABSTRACT

Objective: The article aims to evaluate the growth effects of the 2007 Eastern enlargement of the European Union (EU) for the New Member States (NMS).

Research Design & Methods: To study the growth effects of the 2007 Eastern enlargement we apply the synthetic control method (SCM). The synthetic control method (SCM) is a statistical method that contains two groups: the treatment group that included Bulgaria and Romania and the control group that included Armenia, China, Egypt, India, Iran, Israel, Kazakhstan, Kyrgyzstan, Moldova, Morocco, Mexico, Montenegro, Malaysia, Russia, Serbia, Thailand, Tajikistan, and Turkey. These groups served to evaluate the effects of a treatment related to the EU accession.

Findings: We found that the 2007 EU enlargement had substantial uninterrupted positive effects on the economic growth of Bulgaria and Romania. However, these effects have become noticeable only since 2014, seven years after the EU accession. Therefore, we should not expect that the EU accession immediately contribute to increased growth rates of the NMS.

Implications & Recommendations: We demonstrate that the real GDP per capita of Bulgaria and Romania increased on average by 188 and 644 USD per year relative to their synthetic counterparts between 2007-2019, respectively. The actual yearly real GDP per capita growth rate for the same period in Bulgaria and Romania was 1.6% and 4.6% larger than the growth rate of these countries, respectively, if they did not become EU members in 2007. Therefore, our results support the positive growth effects of the EU accession.

Contribution & Value Added: We focused on the effects of the second enlargement of the EU to the East that took place in 2007 and so far has not received substantial attention in the literature. Our results document the significant positive effects of the EU accession on the rates of growth in Bulgaria and Romania. Therefore, this article, at least to our knowledge, is the first article that focuses on estimating the growth effects of the 2007 EU enlargement.

Article type: research article
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INTRODUCTION

Scholars have been interested in the effects of European integration since the foundation of the EU and received increased attention after the subsequent waves of its enlargement. The collapse of communism and the successful transition of the Central and East European (CEE) economies were followed by the EU enlargement to the East in three consecutive waves in 2004, 2007, and 2013. The first Eastern enlargement of the EU occurred on May 1, 2004, and ten economies became new members. This enlargement included eight CEE countries and two Mediterranean countries: Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. The 2004

enlargement was the largest one-time enlargement in the EU history. The second Eastern enlargement took place in 2007 and included two CEE countries, *i.e.* Bulgaria and Romania. Finally, the third enlargement that occurred in 2013 encompassed only Croatia.

While the first wave of the Eastern enlargement has received quite a large dose of attention in the literature, the subsequent waves received much less attention. The main goal of this article is to evaluate the growth effects of the 2007 Eastern enlargement of the EU for the NMS. The accomplishment of this goal requires comparing the actual growth of the NMS following their EU accession with their counterfactual growth, the growth that would take place if these countries had not become EU members. However, the only observable data is the growth rates of the NMS after they became EU members. Therefore, the counterfactual data is unobservable which hinders the comparison of the actual and counterfactual growth rates. We tackle this issue using the synthetic control method (SCM) that has recently gained popularity in evaluating the economic effects of various policy changes.

The feasibility of the SCM requires similar pre-treatment characteristics across treated and untreated units. In our case, the untreated units (*i.e.* the control group), or the donor pool, should consist of countries that share similar economic and institutional features with Bulgaria and Romania, the NMS, before the 2007 EU enlargement took place. The natural candidates for the donor pool were the countries that emerged as the result of the breakup of the Soviet Union and former Yugoslavia but still were not admitted to the EU. These countries have similar characteristics to the NMS as for many years, their economies operated under central planning and gradually switched to the market economy only after the collapse of communism in the late 1980s and the early 1990s.

We designed a natural experiment by constructing the treatment group that included Romania and Bulgaria, and the donor pool that embraced the countries that did not join the EU but shared similar pre-EU accession characteristics to the treatment group. We then applied the SCM framework to evaluate the impact of the treatment, the EU membership, on the outcome, and the real GDP per capita growth. By using the SCM, we could estimate the dynamic effects of the EU accession having controlled for the time-varying heterogeneity at the country level. These are the main advantages of the SCM over traditional empirical research methods, *i.e.* the panel data analysis (PDA) or the differences-in-differences(Diff-in-Diff) that are limited to measuring only the average effect of the treatment and controlling for the time-invariant individual-level heterogeneity.

Our findings showed that the EU accession added 188 and 644 USD per year to the real GDP per capita of Bulgaria and Romania between 2007 and 2019, respectively. This translates into a yearly 1.6% and 4.6% larger GDP growth rate for Bulgaria and Romania, respectively, as an outcome of the EU accession. Another interesting point is that the positive and uninterrupted growth effect of the 2007 EU accession on the economies of Bulgaria and Romania started following 2014, seven years after becoming EU members. Since the free movement of labour for the workers of these countries in the EU was restricted until 2014, the degree of integration is consequential to economic growth. This finding also implies that a long post-treatment period is necessary to evaluate the growth effects of European integration due to the gradual adjustment of the NMS to the new institutional framework.

This article is organized in the following way. In the next section, we will review the empirical literature on the growth effects of European integration with a special focus on the use of the SCM. The subsequent section will outline the research methodology and discuss the dataset and estimation results. The last section will provide conclusions, discuss the limitations of the employed research methodology, and outline directions for future studies.

LITERATURE REVIEW

There are several approaches in the economic literature to study the effects of European integration on the rate of per capita GDP growth. On the one hand, traditional neoclassical growth theories assuming constant returns to scale, perfect competition and homogeneity of factors and products predict that economic integration stimulates income convergence (see Barro and Sala-i-Martin, 2004). On the other hand, according to new growth and economic geography theories that relaxed the restrictive

assumptions of neoclassical economics (Romer, 1986; Lucas, 1988; Krugman, 1991; Aghion *et al*., 1998; Fujita *et al*., 1999) quite the opposite may happen.

The empirical evidence on the growth effects of economic integration also remains unsettled. In one of the earliest contributions, Landau (1995) reported no effects of the EU accession on growth in the group of OECD economies during the 1950-1990 period. This finding was supported by Vanhoudt (1999) who found no positive effects of European integration on the growth of the member states compared to non-EU members. At about the same time, Henrekson *et al*. (1997) reported statistically significant growth effects of the EU membership based on cross-sectional regressions. Subsequently, in his panel study of OECD economies, Torstensson (1999) detected a positive growth effect of European integration resulting from transfers of capital and 'know-how.'

Badinger (2005) reported no significant long-run growth effects of economic integration but at least he found transitory growth effects. Böwer and Turrini (2010) ran panel regressions from 1960 to 2008 and concluded that the period of EU accession was distinguished by, having controlled for a wide range of economic factors, significantly higher growth rates of GDP per capita. Finally, Cuaresma *et al*. (2013) estimated that the EU accession had a positive effect on economic growth in the long run and inferred that it was more beneficial for poorer countries.

Our article finds itself in the literature that applies the SCM as a useful alternative to the popular PDA and Diff-in-Diff approaches. An important drawback of the previously used research methodologies is to find the right benchmark for comparison. Eichengreen and Boltho (2008) tried to construct a world where integration did not take place and concluded that incomes would be lower in Europe without integration. Hence, they argued that one needs to have a counterfactual to estimate the ex-post effects of economic integration. However, their approach does not specify how to construct the counterfactual world which is the key element in counterfactual experiments. The SCM methodology can convincingly address this issue.

This methodology was first employed by Abadie and Gardeazabal (2003) to study the impact of terrorism in the Basque country. They constructed the synthetic equivalent of the Basque country as the comparison group using the combination of similar Spanish regions and compared the rate of growth in the actual Basque country with the growth rate that would have occurred in the counterfactual country free of terrorism. They found that as a result of terrorism GDP per capita in the real Basque country was 10% lower compared to the counterfactual Basque country.

In another study that applied SCM, Abadie *et al*. (2010) investigated the effects of a tobacco-control program legislated in California in 1988. They created synthetic California by using a weighted average of the US states and estimated the cigarette sales in California that would have occurred in the absence of this legislation. In their subsequent study, Abadie *et al*. (2015) used the fall of the Berlin Wall as a natural experiment to evaluate the effects of the 1990 German unification on the rate of growth in West Germany employing the SCM. The synthetic West Germany was constructed as a weighted average of Austria, Japan, Netherlands, Switzerland, and the United States. They reported the negative effects of the unification on growth in West Germany during the 1992-2003 period. Billmeier and Nannicini (2013) evaluated the impact of economic liberalization episodes in the world on real GDP per capita using the SCM. They found either positive or nonnegative impacts of economic liberalization on the trajectory of real income per capita. In a more recent article, Campos *et al*. (2022) measured the impact of the 1994 referendum in Norway on its productivity and concluded that Norway incurred a significant loss of productivity by not joining the EU. In another application of the SCM, Kantorowicz and Spruk (2021) determined the impact of the level of institutional reforms on the economic growth of the transition countries.

The SCM methodology also serves to investigate the effects of the EU enlargements including the 2004 Eastern enlargement. Campos *et al*. (2019) generally remained inconclusive regarding the effects of European integration on the rate of growth in the CEE countries when the EU accession date was set to 2004. They reported the positive effects only when the EU accession date was set to 1998. However, this left four years of pre-intervention data to construct synthetic control. This seems short in comparison with the prior studies that employed the SCM such as Abadie *et al*. (2003) and Abadie *et al*. (2015). Moreover, their sample ended in 2008 which left only five years of post-treatment data to

evaluate the effects of EU accession. In contrast, Cieślik and Turgut (2021) estimated that the 2004 EU accession had immediate and positive effects on the rates of economic growth of the NMS in the first few years following the EU enlargement. The effects of the EU accession became more visible since 2007 when the NMS joined the Schengen zone.

In contrast to the aforementioned studies, we focused on the effects of the second enlargement of the EU to the East that took place in 2007. The closest to our article in this vein is Hagemejer *et al*. (2021) in which the authors studied the 2007 EU enlargement using the SCM. We extended their analysis in the following ways. Firstly, we excluded Ukraine from the control group since Ukraine was subject to a huge negative idiosyncratic shock in 2014 which can cause downward bias in the predictions of synthetic units. Secondly, we contemplated SCM in a way to prevent one country from dominating the synthetic units. For example, in Table A2 on p.140 in Hagemejer *et al*. (2021), the weight of Belarus is 0.9 in synthetic Romania which makes the synthetic unit highly sensitive to the developments in the Belarusian economy. Thirdly, we provided a placebo test and sensitivity analyses to verify the robustness of our results and a comparison of predictors between treated and synthetic units to ensure the resemblance of the latter to the former.

RESEARCH METHODOLOGY

Methodology

The SCM is an empirical research method that estimates the effect of treatment through the comparison of the real outcome and its counterfactual during the post-treatment period. Assume that $Y_{1,j}^t$ is the actual value and $Y_{0,j}^t$ is the counterfactual value of the outcome variable of the treated unit j, in our case the real GDP per capita of Bulgaria or Romania, and T_0 is the intervention or treatment time, accession to the EU is the treatment and 2007 is the time in our case. Then, the effect of the treatment can be expressed as:

$$\tau_j^t = Y_{1,j}^t - Y_{0,j}^t; \forall\, t \geq T_0 \tag{1}$$

The main challenge here was to obtain the post-2007 real GDP per capita values of Bulgaria or Romania if they did not join the EU in 2007 since these values were not observed. The SCM accomplishes this by creating a synthetic unit, a counterfactual scenario, that is the weighted average of the units from a control group that best resemble the pre-treatment characteristics of the treated unit. Consider that data for $J+1$ countries are observed between $t = 1, \dots, T$, and among them, $j = 1$ is the treated country and $j = 2, \dots, J+1$ are the countries in the control group. Assume that vector W contains the weights of the countries in the control group denoted by w_j. The literature recommends choosing the weights by minimizing the difference between the characteristics of the treated unit and the synthetic control before the treatment takes place (see Abadie and Gardeazabal, 2003; Abadie *et al*., 2010 for further details). Then, the synthetic unit of the treated country j would be equal to:

$$Y_{0,j}^t = \sum_{j=2}^{J+1} w_j Y_{jt} \tag{2}$$

The multiplication of weights by the outcome variable of the countries in the control group produced synthetic Bulgaria or Romania and the difference of the post-treatment real GDP per capita between the actual and the synthetic Bulgaria or Romania gives the effect of the EU membership on growth estimated by the SCM:

$$\tau_j^t = Y_{1,j}^t - Y_{0,j}^t = Y_{1,j}^t - \sum_{j=2}^{J+1} w_j Y_{jt}; \forall\, t \geq T_0 \tag{3}$$

In summary, the SCM estimates the effects of treatment through the comparison of the real outcome and its counterfactual during the post-treatment period. The synthetic control estimator is applicable when the fit between actual and treated units is good, in other words, the units in the donor pool and treatment groups share similar pre-treatment characteristics. Another crucial point in the application of the SCM is that the units in the control group should not be affected by the treatment and subject to huge idiosyncratic shocks during the post-treatment period (Abadie *et al*., 2015).

Data and Sample

The treatment group for the SCM consisted of Bulgaria and Romania following their accession to the EU in 2007. We included the following countries in the donor pool: Armenia, China, Egypt, India, Iran, Israel, Kazakhstan, Kyrgyzstan, Moldova, Morocco, Mexico, Montenegro, Malaysia, Russia, Serbia, Thailand, Tajikistan, and Turkey. We did not include Croatia and Ukraine in the donor pool because Croatia became an EU member in 2013, and Ukraine was subject to a huge negative idiosyncratic shock in 2014 and the following years due to revolutions and civil unrest set out in 2014 and the subsequent war with Russia.

We identified the countries in the donor pool based on two features: i) they did not become EU members in the study period, and ii) their GDP per capita predictors were similar to the values of the treatment group before the EU accession. In addition to not being a member of the EU, we required the countries in the control group to have characteristics similar to the treated countries to avoid overfitting. Moreover, the selection of countries was also dictated by the data availability, in particular human capital. This is why we were not able to select some key countries such as Belarus and Georgia into the donor pool. We run sensitivity analysis by dropping human capital from predictors and adding countries to the donor pool that are dropped due to insufficient human capital data.

We employed country-level balanced panel data for the period 1994-2019 extracted from the most recent version of Penn World Table version 10.0 accessible at: https://www.rug.nl/ggdc/productivity/pwt/. The data included the outcome variable, Y_{it}, that was the PPP adjusted real GDP per capita in country j at time t. The pre-EU accession characteristics were proxied by the standard economic growth predictors including the human capital, labour share in GDP, the investment and the government consumption over GDP, openness to international trade, and the price level and are in line with the empirical growth literature (Levine & Renelt, 1992; Barro, 2012).

The accession of Bulgaria and Romania to the EU took place in 2007 giving us 13 years of pre-treatment and 12 years of post-treatment data, both are long enough samples to fit data and evaluate the effects of the treatment. Even though the data goes back to an earlier period, we started the sample from 1994 to avoid structural breaks as the majority of the countries in our treatment and control group started their transitions to the market economy at the beginning of the 1990s.

RESULTS AND DISCUSSION

Baseline Results

We determined the weights of each country in the control group by minimizing the difference of outcome variables and growth predictors between the actual and synthetic Bulgaria and Romania. Table 1 reports the weights of each country used in the synthetic versions of these countries. The weighted average of Israel, Malaysia, Russia, and Tajikistan constructs the synthetic Bulgaria since all other countries in the donor pool obtained weights close to zero. Synthetic Romania uses the weighted average of the same countries of synthetic Bulgaria plus Armenia and Egypt.

Table 1. Synthetic weights for Bulgaria and Romania

Treated country	Donor pool country	Synthetic control weight
Bulgaria	Israel	0.0493
	Malaysia	0.2187
	Russia	0.3807
	Tajikistan	0.3512
Romania	Armenia	0.0574
	Egypt	0.1412
	Israel	0.0383
	Malaysia	0.0370
	Russia	0.5056
	Tajikistan	0.2134

Source: own study.

We compare the actual values of the average pre-EU accession real GDP per capita and its predictors for Bulgaria and Romania with their synthetic counterparts, respectively, to evaluate the fit of the SCM. The empirical results in Table 2 show that the fitted values obtained from the SCM are generally very close to the actual pre-treatment values of the predictors for Bulgaria and Romania. The average fitted values of real GDP per capita, human capital, labour share in GDP and government consumption share in GDP were almost the same as the average actual historical values. The fit was relatively poor in the trade openness variable since, on average, imports exceeded exports both in Bulgaria and Romania between 1994-2006 whereas SCM produced opposite results. Overall, the fit of the SCM was acceptable.

Table 2. Pre-treatment characteristics

Indicators	Bulgaria		Romania	
	Actual	Synthetic	Actual	Synthetic
Real GDP per capita	9994.3	9967.0	9186.5	9186.5
Predictors				
Human capital	2.90	3.01	2.93	2.93
Labour share in GDP	0.46	0.46	0.50	0.50
Investment rate	0.12	0.18	0.15	0.15
Government consumption rate	0.30	0.27	0.26	0.26
Trade openness	-0.06	0.05	-0.04	0.04
Price Level	0.22	0.26	0.25	0.25

Notes: The real GDP per capita and the GDP predictors for Bulgaria and Romania under the actual column are the historical values for the period between 1994 and 2006 whereas the same variables under the synthetic column are constructed using the synthetic control weights.
Source: own study.

As already mentioned, the applicability of the SCM crucially depends on the pre-treatment fit of the outcome variable between treated and synthetic groups. Figure 1 shows this fit by displaying the path of the GDP per capita of Bulgaria and Romania and their synthetic counterparts between 1994-2019, respectively. For both countries, the synthetic values closely track the GDP per capita of the actual historical values during the pre-EU accession period. The pieces of evidence provided in Figure 1 and Table 2, the good fit of the outcome variable and the similar pre-EU characteristics, support the use of the SCM to estimate the effect of the accession to the EU on growth in Bulgaria and Romania.

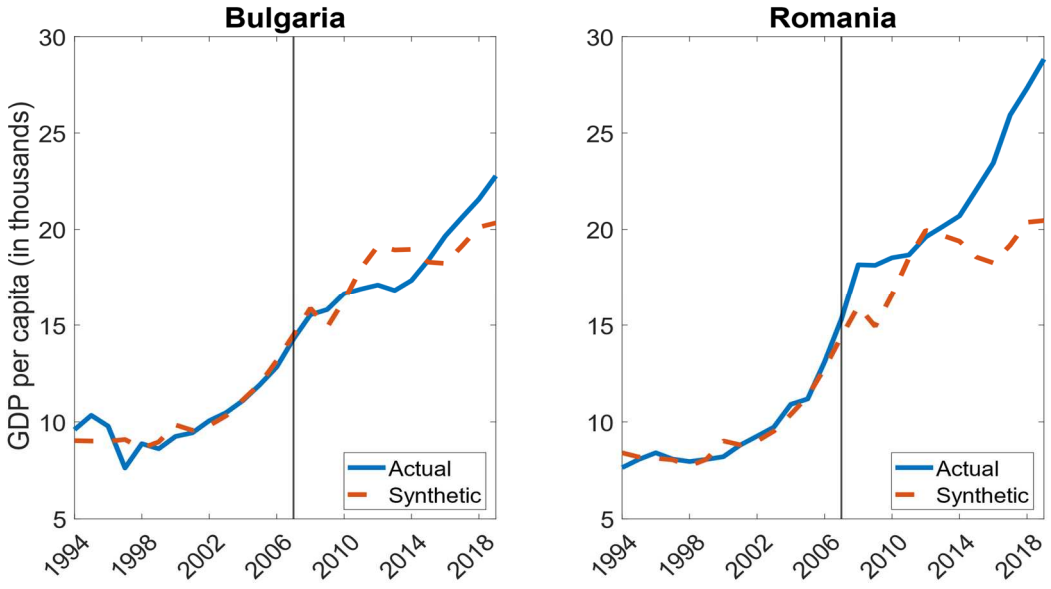

Figure 1. Trends in GDP per capita: Actual versus synthetic

Notes: The blue solid line shows the actual historical value of real GDP per capita chained PPP in 2017 USD and the red dashed line shows the fitted value of the same variable constructed using the synthetic control weights.
Source: own elaboration.

Figure 2 shows the difference between the actual real GDP per capita and its synthetic counterpart for Bulgaria and Romania. This difference is our estimate of the effect of the EU accession on the real GDP per capita of Bulgaria and Romania. We found that accession to the EU did not have a significant impact on the growth of Bulgaria and Romania up to 2014, even though the initial impact was slightly positive in the first few years. The uninterrupted effect of the EU accession becomes more visible after the end of the Eurozone crisis, in particular for Romania. From 2015 to 2019, the GDP per capita difference between the real and synthetic Romania increased sharply whereas the increase was more gradual for Bulgaria. Overall, using the SCM, we found a positive impact of the EU membership on growth in Bulgaria and Romania.

The estimations show that the actual PPP adjusted real GDP per capita was 22 774 USD for Bulgaria and 28 889 USD for Romania in 2019, whereas it was 20 334 USD and 20 456 USD for their synthetic versions, respectively, in the same year. This implies that PPP adjusted real GDP per capita of Bulgaria and Romania grew by about 188 and 644 USD more per year relative to the synthetic counterparts over the entire 2007-2019 period, respectively, on average. In relative terms, the average growth rate of the real GDP per capita in the real Bulgaria and Romania was 4.95% and 7.36%, respectively, whereas it was 3.36% and 3.49% in their synthetic counterparts. In the last period of the sample, the year 2019, we found per capita GDP in real Bulgaria and Romania to be about 12% and 40% higher than in the synthetic versions, respectively.

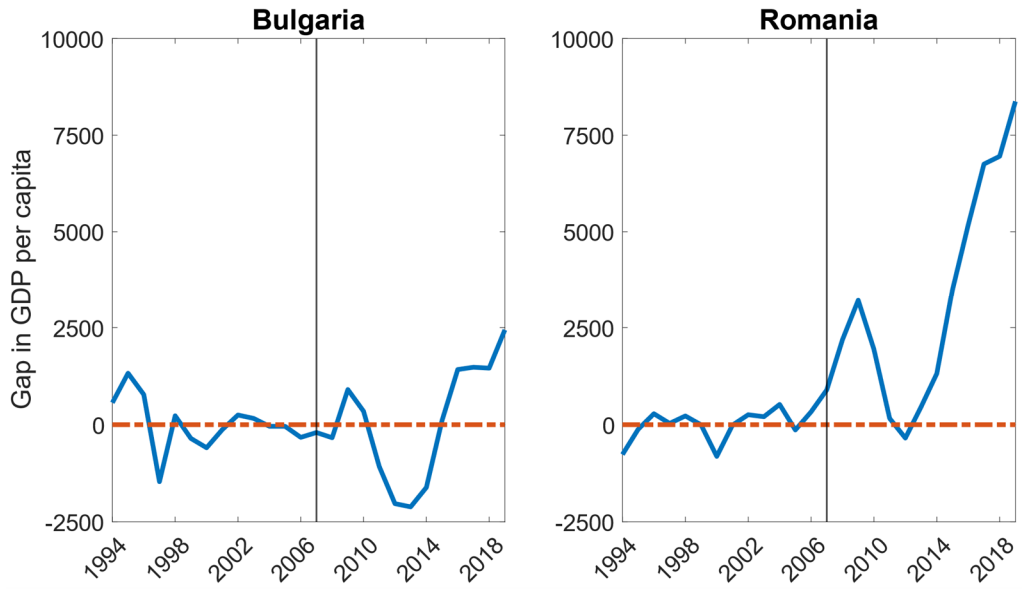

Figure 2. GDP per capita difference between actual and synthetic
Source: own elaboration.

Placebo Test

We conducted 'in-time' placebo study to verify the robustness of our previous results. We assigned the EU accession date to the year 2000, 7 years before the actual EU accession, and re-estimate the model. We chose this date because Bulgaria and Romania applied for EU membership in the mid-1990s and started implementing reforms in 2000. This would also help assess whether there were any anticipation effects of the EU accession. Then, we compared the results of the placebo enlargement with the 2007 enlargement. If the treatment effect under a hypothetical EU enlargement date was similar to the one in Figure 1, then the positive growth effect of EU enlargement in our baseline analysis lost its credibility. This is because the growth effects should be only observed following the EU membership that occurred in 2007.

Figure 3 shows the results of the 'in-time placebo' test. The path of the GDP per capita for Bulgaria and its synthetic counterpart was almost identical between the years 2000 and 2007, the post-EU accession period. We made similar observations regarding Romania. However, actual GDP per capita exceeds synthetic one after 2005 but at a very modest level. These findings are important because, in contrast to

the actual EU accession, the 2000 placebo enlargement has no significant effect on growth in both treated countries. Hence, based on this result, we can argue that the positive effects of the EU accession on the rate of growth in Bulgaria and Romania were not coincidence-driven.

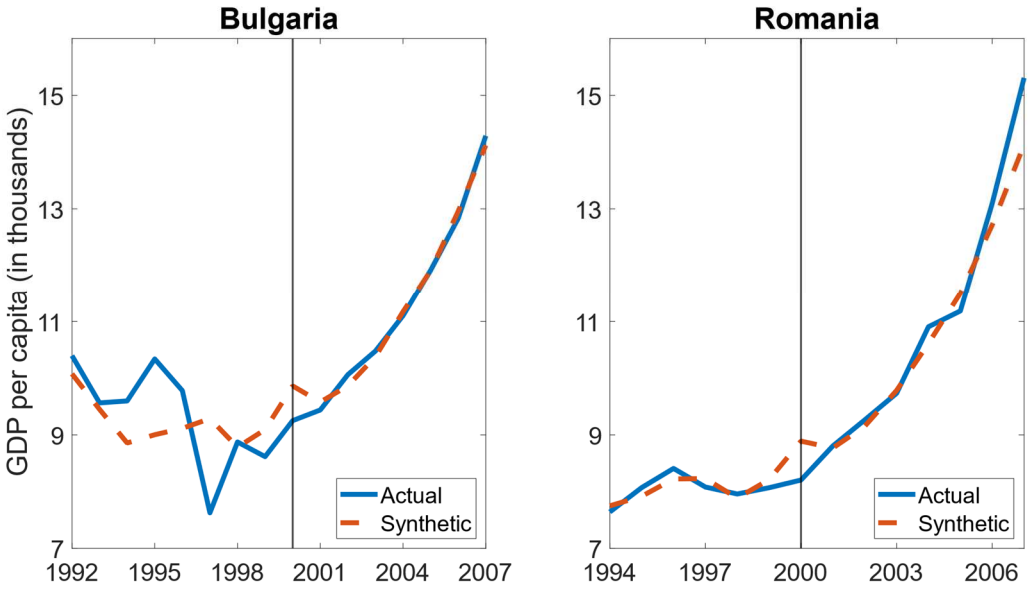

Figure 3. In-time placebo: Actual versus synthetic
Source: own elaboration.

Sensitivity Analyses

In addition to the placebo test, we conducted two sensitivity analyses to further verify the baseline results' solidity. In the first sensitivity analysis, we removed human capital from the growth predictors given in Table 2 so that we could include the countries in the donor pool that were dropped in the baseline model due to a lack of human capital data. The donor pool includes the following countries: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Moldova, North Macedonia, Russia, Serbia, and Turkey. This allowed us to assess whether our baseline results suffer from overfitting. As mentioned by Abadie *et al*. (2015), to avoid interpolation biases and overfitting, it is important to select the countries in the donor pool that share characteristics similar to the treated countries. Since communist history and geography are important characteristics, we constrain the countries in the donor pool that share these features.

Table 3 reports the synthetic weights obtained from the first sensitivity analysis. Belarus now constitutes a very large part of the synthetic Bulgaria with a weight of 0.89 after entering into the donor pool. Such a large weight causes the synthetic Bulgaria to be very responsive to the developments in Belarus which may also cast doubts on the representativeness of the synthetic Bulgaria. The weights in synthetic Romania were distributed more reasonably. Again, Belarus plays a key role in the synthetic unit of Romania. However, the economies of Georgia and Russia also have a considerable impact according to Table 3.

Figure 4 shows the real GDP per capita trajectory of Bulgaria and Romania and their synthetic counterparts for the 1994-2019 period using the weights reported in Table 3. The trajectories of the synthetic real GDP per capita of Romania displayed in Figures 1 and 5 are very similar and the positive large difference in GDP per capita between the actual and synthetic Romania observed in Figure 1 continues to exist. On the other hand, Figure 4 produces a slightly larger synthetic GDP per capita of Bulgaria relative to Figure 1 and it is almost the same as the actual value of the same variable at the end of the sample. However, synthetic Bulgaria is already higher than the actual historical real GDP per capita before the EU accession. As argued by Abadie *et al*. (2015), the synthetic control becomes less credible when it does not track well the treated unit's pre-treatment outcome. Our sensitivity analysis confirms this argument. We observed similar growth effects for Romania in our baseline model

and sensitivity analysis since SCM produces outcome values very similar to the actual pre-EU accession values whereas growth effects disappear for Bulgaria due to poor pre-treatment fit. Moreover, synthetic Bulgaria has a large exposure to developments only in one control country, Belarus. However, sensitivity analysis also confirmed that actual growth in real GDP per capita starts exceeding the synthetic growth following 2014 as in the baseline estimation for both countries indicating the effects of the EU accession on growth become noticeable after this year.

Table 3. Synthetic weights for Bulgaria and Romania: First sensitivity analysis

Treated country	Donor pool country	Synthetic control weight
Bulgaria	Belarus	0.8946
	Russia	0.0658
	Turkey	0.0396
Romania	Belarus	0.4116
	Georgia	0.2049
	Macedonia	0.0510
	Russia	0.2552
	Turkey	0.0772

Source: own study.

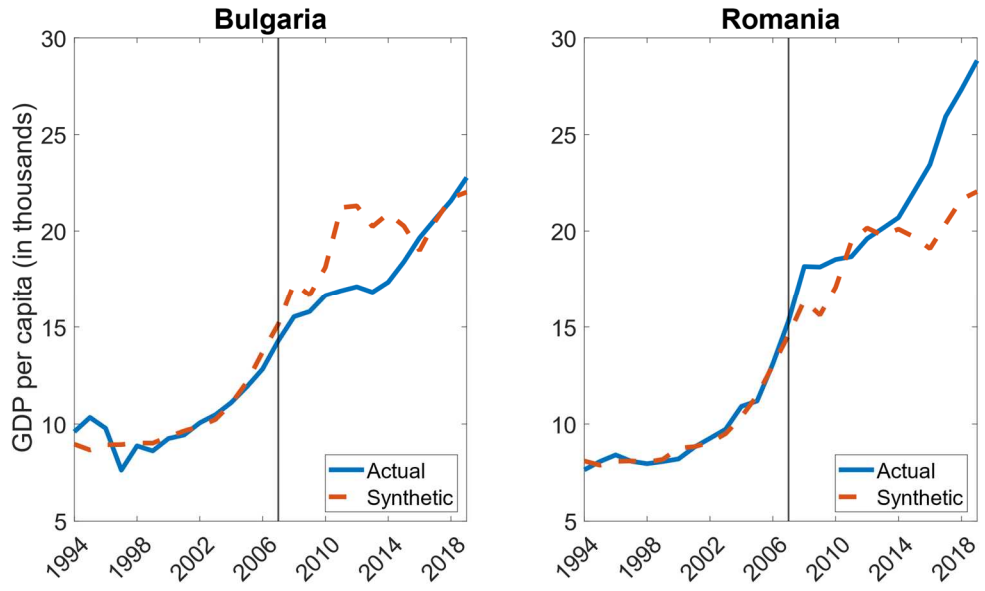

Figure 4. Trends in GDP per capita: Actual versus synthetic
Source: own elaboration.

In the second sensitivity analysis, we changed the predictors of real GDP per capita. In the baseline, we relied on the empirical growth literature in the selection of predictors but now, we relied on theoretical growth literature. According to the human capital augmented Solow model with technological progress model developed by Mankiw *et al*. (1992), the long-run real GDP per capita is determined by the following factors; shares of physical and human capital in the production, investment rates in physical and human capital, population growth rate, technological progress, and depreciation rates of capitals. Hence, our new vector of predictors consists of investment share (share of gross capital formation in GDP), population growth, human capital, total factor productivity (TFP) level, and labour share in production (share of labour compensation in GDP) from Penn World Table. This exercise allowed us to assess the sensitivity of the baseline results to a different set of predictors.

Table 4 shows the average actual and synthetic values of the predictors and Table 5 shows the weights of the countries in the synthetic units for Bulgaria and Romania with respect to the second sensitivity analysis. In general, the synthetic units closely mimic the predictors. The only exception

was TFP for Bulgaria. Relative to the weights obtained in the baseline model, Egypt and Kyrgyzstan enter while Malaysia and Tajikistan drop from synthetic Bulgaria and instead of Malaysia, Serbia takes place in synthetic Romania.

Table 4. Pre-treatment characteristics: Second sensitivity analysis

Indocators	Bulgaria		Romania	
	Actual	Synthetic	Actual	Synthetic
Real GDP per capita	9994.3	9969.0	9186.5	9186.3
Predictors				
Human capital	2.90	2.90	2.93	2.84
Labour share in GDP	0.46	0.54	0.50	0.53
Investment rate	0.12	0.15	0.15	0.15
TFP	1.16	0.83	0.76	0.76
Population growth	-0.01	0.01	-0.01	0.00

Source: own study.

Table 5. Synthetic weights for Bulgaria and Romania: Second sensitivity analysis

Treated country	Donor pool country	Synthetic control weight
Bulgaria	Egypt	0.1304
	Israel	0.0745
	Kyrgyzstan	0.2800
	Russia	0.5151
Romania	Egypt	0.1828
	Israel	0.0277
	Russia	0.4601
	Serbia	0.2176
	Tajikistan	0.1117

Source: own study.

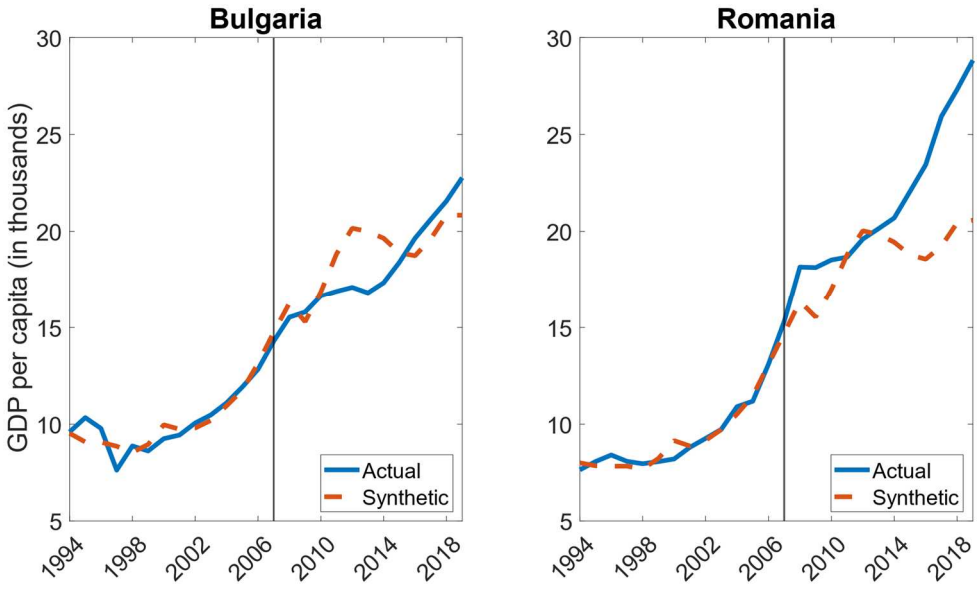

Figure 5. Trends in GDP per capita: Actual versus synthetic
Source: own elaboration.

Figure 5 displays the evolution of the actual real GDP per capita of Bulgaria and Romania for the 1994-2019 period and the synthetic counterpart using the weights reported in Table 5. Synthetic Bulgaria and Romania closely mimic the pre-treatment trajectories of the actual real GDP per capita values. Moreover, the positive differences in GDP per capita between the actual and synthetic Bul-

garia and Romania in Figure 5 are very similar to the results from the baseline analysis. The actual growth rates exceeded synthetic ones starting from 2014 and actual real GDP per capita was approximately 15% and 40% larger than the synthetic counterparts of Bulgaria and Romania, respectively, in 2019 as in the baseline model.

Discussion

We estimate that EU accession accelerated the economic growth in Bulgaria and Romania, although at different levels. Our results indicate a larger impact of EU membership on growth compared to Campos *et al*. (2019). We believe this is due to the different length of the post-EU accession period. As we showed, a sizable number of post-intervention periods are required to reliably assess the effect of the EU accession whereas the post-treatment period is short in Campos *et al*. (2019) and limited to four years. On the other hand, our results are in line with the findings of Cieślik and Turgut (2021) who found a significant effect of the 2004 EU enlargement on the new members. Finally, our estimates are comparable to the findings of Hagemejer *et al*. (2021) in which the authors found approximately 15 and 35% positive impact of the EU accession on the real GDP per capita of Bulgaria and Romania, respectively, after 12 years of membership. Although our control group and growth predictors were different from the ones in Hagemejer *et al*. (2021), similar findings between our and their articles confirmed the unquestionable positive effects of EU membership on the economic growth of these countries.

CONCLUSIONS

We estimated the growth effects of the 2007 EU accession for its two new members using the SCM. We found that this enlargement had a continuously positive effect on the economic growth of Bulgaria and Romania after the end of the European debt crisis. We estimated that over the entire 2007-2019 period, the real GDP per capita of Bulgaria and Romania grew by about 188 and 644 USD per year on average relative to the synthetic counterparts over the entire 2007-2019 period, respectively. In relative terms, the average growth rate of the real GDP per capita in the real Bulgaria and Romania was 1.5 and 2 times larger than the synthetic counterparts, respectively. In 2019, per capita GDP in the real Bulgaria and Romania was found to be about 12% and 40% higher than in the synthetic versions, respectively. The placebo test and sensitivity analyses confirmed our findings. Thus, our results document the significant positive effects of the EU accession on the rates of growth in Bulgaria and Romania.

We employed the SCM in our empirical study as it allowed us to assess the effects of the treatment by constructing a counterfactual, which was an indispensable element in comparative studies. Nonetheless, this research methodology has some potential limitations. In particular, we assumed that the countries in the control group were not affected by the 2007 EU enlargement. However, some of the countries in our donor pool maintain economic links with the treated countries through trade and financial channels which can potentially create some spill-over effects. These effects can bias our estimates and pose a threat to our results. However, it is not easy to determine the direction of the potential bias as spill-over effects could be positive for some countries, while negative for the other. For example, these effects could be positive since higher economic growth of the new members due to the EU membership can increase the demand and production in the control countries or could be negative since lower trade barriers in the NMS can hamper exports in the control countries.

An additional threat is the multi-stage nature of the EU accession process that cannot be captured by a specific single date as a result of some conditionalities. In particular, even though Bulgaria and Romania officially accessed the EU in 2007, the work restrictions for their citizens in Western Europe were removed only gradually starting in 2012, and mostly in 2014. Hence, our estimates might not fully reflect the effects of the EU accession since free labour mobility is an integral part of the single market. This may play a role in no positive effects of the EU accession reported between 2007 and 2013. As a result, our estimates may not be interpreted as the effects of the full EU accession during this period. The assembled empirical evidence supports this view since the effects of the EU accession on growth became noticeable starting in 2014.

With regard to the latter point, extending the SCM to account for multiple treatment effects, such as the EU accession and free movement of labour, could be an important research agenda for future studies. This kind of extension would be useful in differentiating between the effects of partial and full economic integration. Another possible extension could be to identify and evaluate the effects of particular growth channels of the EU membership. In this article, we studied only the overall effects of the EU accession on growth. However, assessing the effects of particular growth channels such as increased international openness to trade and foreign direct investment, or improved institutional quality would allow for providing more specific policy recommendations. Finally, SCM could also be useful in assessing how the effects of European integration vary with the degree of monetary integration. Again, this might require the SCM to account for the multiple treatment effects from the EU perspective: first, the accession to the EU, and then to the Eurozone membership.

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The contribution share of authors is equal and amounted to 50% for each of them. Andrzej Cieślik – conceptualisation, literature writing, Mehmet Burak Turgut – methodology, calculations, discussion.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Salient monetary policy decisions and non-experts' trust in central banks

Maqsood Aslam, Etienne Farvaque, Hira Iqbal, Piotr Stanek

ABSTRACT

Objective: The objective of the article is to shed new light on the relationship between central bank communication and the trust monetary institutions can obtain from ordinary citizens via a comparison of the European Central Bank (ECB) with the Federal Reserve (the Fed).

Research Design & Methods: We used the Eurobarometer and Booth Chicago/Kellogg School Financial Trust Index to study the evolutions of trust by non-experts in the Fed and the ECB during two episodes of salient monetary policy decisions: 2012-2013 and 2020-2021. Utilizing logistic regressions on representative samples of American and EU citizens, we show which among the recent key decisions in monetary policy by the two major central banks significantly affected the levels of trust (and in which directions).

Findings: Our findings suggest that the 'taper tantrum' speech by Ben Bernanke negatively impacted the trust in the Fed, whereas the 'whatever it takes' speech by Mario Draghi significantly increased the trust in the ECB. On the other hand, significant policy reactions to the COVID-19 pandemic did not affect trust in central banks as could have been expected neither for the ECB nor the Fed. Our inference is based on the estimates considering the standard control variables and for both central banks are robust to a relevant placebo test.

Implications & Recommendations: Our results suggest that well-communicated salient monetary policy decisions can boost public trust in central banks, notably in the contexts where the central banks are perceived as the key actors.

Contribution & Value Added: Thus, our analysis contributes to the literature, by focusing on how salient decisions can influence the degree of trust in the central bank by non-experts.

Article type: research article
Keywords: European Central Bank; Federal Reserve; trust; Global Financial Crisis; COVID-19 crisis
JEL codes: E58; E52; G53; H11

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INTRODUCTION

Are non-experts influenced by central banks' messages? Although the question is of importance if only for the realization of central banks' mandates, the response is not fully settled yet. If the reaction of financial markets (bond markets, stock markets, currency markets, *etc.*) to monetary policy decisions has fed a long tradition of research, the influence central banks can have on lay persons or non-experts, is less ensured, and the recent results are not that reassuring for central banks.

De Fiore *et al.* (2021), for example, study the impact of the Federal Reserve's monetary policy decisions on households' expectations, and analyze the evolution of responses to the Survey of Consumer Expectations before and after Federal Open Market Committee (FOMC) meetings, over the period 2013-2019. They show that the Fed's decisions affect the expectations of interest rates on savings accounts, but that the response is conditional on respondents' levels of financial and numerical liter-

acy. More troubling, they show that monetary policy announcements have a much more limited impact on inflation expectations. Hirsch *et al.* (2023) also find that if central bank decisions are not covered by the media, their impact on the general audience is almost lost.

These results converge with those of the literature survey on central bank communication with the general public realized by Blinder *et al.* (2024). The authors insist on the fact that getting ordinary people to listen and understand central banks is no easy task, as central banks are competing for attention with numerous other message providers. This may explain another lesson the authors take from the literature: that central bank messages are poorly understood by non-experts. In turn, this may feed a public distrust in the central bank, or at least put trust at threat. Blinder *et al.* (2024) thus conclude that 'building trust may be the most important objective of central bank communication with the general public,' even though 'no country will ever become a nation of monetary policy experts'. In other words, central bank communication with the general public is desirable and feasible, but still in its infancy (Haldane & McMahon, 2018).

These conclusions tend to contrast with the results obtained in experimental settings. For example, in the spirit of Cavallo *et al.* (2017), Angino and Secola (2022) first define 'instinctive trust,' the on-the-spot judgement on the institution's trustworthiness, and 'reflective trust,' *i.e.* a more pondered opinion on the matter. Using a (representative) survey experiment, they show that instinctive trust reacts more strongly than reflective one. However, the question can be raised of the specificity of the experiment concerning the way central banks tend (and have) to communicate in real-life situations. Moreover, it can be argued that trust has several dimensions, including an ethical and a hierarchical one, when it comes to money (Vallet, 2022), which may not be fully captured in lab experiments.

We aimed to contribute to this new and burgeoning literature on the relationship between central bank communication and the trust monetary institutions can obtain from ordinary citizens. We first compared the situation of the European Central Bank (ECB) with the one of the Federal Reserve Board (the Fed), as they are arguably among the most important central banks presently, as well as being among the most aware of the importance of communicating to large audiences to enhance their credibility and the effectiveness of their policies.

Secondly, we focused on specific historical episodes, providing background contexts in which central banks have communicated strongly, allowing us to focus on the most salient monetary policy decisions that these institutions had to take. We thus selected the following declarations: the 'taper tantrum' by Ben Bernanke in May 2013, the 'whatever it takes' by Mario Draghi in July 2012, and the announcements by Christine Lagarde and Jerome Powell of policy packages in response to the COVID-19 crisis. We based our choice on the fact that these episodes are the most important recent ones, with clear dates and essential consequences, with important communication implications for the general public.

Our focus was on non-experts' degree of trust in central banks, and we thus made use of survey data. Their advantage was the degree of information they allowed one to obtain. The drawback is that the date of collection of the answers was not necessarily close to the policy decisions on which we will focus. However, we considered this as an advantage given our research question: if the trust in central banks is impacted, it has to be by very important decisions taken by these institutions. In other words, the degree to which monetary policy decisions will impact non-experts' views should persist over time, especially because we consider salient decisions.

Hence, by focusing on fundamental decisions taken in different contexts, and using non-experts' reactions in a before-and-after setting, we aimed to clarify if the non-experts targeted by the central banks in their communication react by changing the degree of trust they have in these institutions. In other words, we aimed to respond to the following research question: are central banks able to win hearts and minds in hard times (requiring salient decisions)?

Thus, this article contributes to the literature by demonstrating that significant decisions in monetary policy can substantially impact the general public's trust in the central bank. This result holds while confirming that the usual control variables in such a setup are also significant and have expected signs. It is also robust to a placebo test, in which the impact on the trust towards other institutions proves nil.

The structure of the paper is as follows. Firstly, we will review the literature, then we will describe our data and methodology, to subsequently present our results. We will do this separately for the two

episodes of salient monetary policy decisions by the Fed and the ECB. Finally, we will discuss some alternative specifications allowing for placebo effects. The concluding remarks will close the article.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The bulk of attention of the extant research on central bank communication has focused on its influence on financial markets (see, *e.g.* Gertler & Horvath, 2018; Grabowski *et al.*, 2023; Hayo *et al*., 2010; Leombroni *et al.*, 2021; or Rosa, 2011), financial stability (*e.g.* Born *et al.*, 2014) or experts such as professional forecasters (*e.g.* Bauer *et al*., 2024; Dräger *et al.*, 2016; Goyal & Parab, 2021). These studies in general conclude that changes in the policy rate impact financial markets (stock prices or expectations, risk premia on Treasury bonds, *etc*.). This is in many ways reassuring, as experts should be able to interpret the decisions taken by the central banks (even if sometimes not perfectly or not without surprises). This may also be helped by the fact that central bankers stick to a strongly defined goal of price stability, even after the financial crisis (Johnson *et al*., 2019).

Concerning non-experts, the study of determinants of trust in institutions in general, and in central banks in particular, predominantly relies on survey data. Most of the analyses focused on the ECB, notably because the Eurobarometer survey waves regularly include questions on trust in a number of European institutions, including the European Central Bank (ECB). Some of the early works utilizing this type of data aimed at studying the impact of the Global Financial Crisis and the crisis in the euro area on trust in the ECB (*e.g.* Ehrmann *et al*., 2013; Roth *et al*., 2014). These studies show that there are deep determinants of trust, and that among them education, income, and political placement of the respondents are strongly significant. Concretely, more education, a higher level of income, and more conservative political preferences are associated with higher levels of trust in the central bank. These have been confirmed regularly as storing determinants of trust and can be considered as long-run factors influencing the degree of trust – see, for example, Farvaque *et al.* (2017), or Brouwer and de Haan (2022), for a confirmation, and Angino *et al*. (2022) for the relation between culture and trust in central banks.

Furthermore, it has been shown that more aggressive actions by the central bank can have adverse effects on the degree of trust emanating from the more pessimistic households (Albinowski *et al*., 2014). Moreover, van der Cruijsen and Samarina (2022) found that during the COVID-19 pandemic, a loss in trust in the ECB can be associated with a decrease in working hours, whereas higher levels of education, income, and wealth are associated with a higher level of trust in the central bank. This contrasts with Coibion *et al*. (2022), who show that communication between central banks and governments during the COVID-19 period has not impacted households' plans. Moreover, the degree of engagement of the media with the central bank has also been revealed to increase with the clarity of their messages (Ferrara & Angino, 2022) while, in a more general context, political and religious beliefs have been shown to interact strongly with economic messages, messing up an already weak level of knowledge (Nordhaus & Rivers, 2023).

However, the evidence on how the communication by the central bank can influence non-experts' degree of trust in the institution is much scarcer and somewhat less conclusive. There are some hints that more informed households' inflation expectations are more anchored following the announcement of the 2% inflation target by the Fed (Binder, 2017). Nevertheless, as mentioned in the introduction, De Fiore *et al.* (2021) find a very limited (if any) impact of the Fed's decisions on inflation expectations, while Rumler and Valderrama (2020) show that more literate people have lower inflation expectations and trust more the central bank. This can mean, which we subsequently try to formally test, that only salient decisions in monetary policy which are extensively communicated, can influence the general public's perceptions and, ultimately, trust in the institution. Moreover, some recent experimental evidence also suggests that well-designed central bank communication has a stabilizing effect on individual and aggregate outcomes (Kryvtsov & Petersen, 2021). Thus, our analysis contributes to this strand of the literature, by focusing on how salient decisions can influence the degree of trust in the central bank by non-experts.

These prior empirical results allowed us to hypothesize:

H1: Salient monetary policy decisions are the ones which are highly commented on or debated, due to their importance in the context they are announced. For the public, they are thus more publicized than regular decisions (on policy rates, typically). They should thus exert an impact on the level of trust expressed by the general public towards the central bank.

H2: Salient monetary policy decisions should have a positive impact on the public's trust in the central bank.

RESEARCH METHODOLOGY

Our strategy relied on identifying key monetary policy decisions, important by themselves, but also the most susceptible to have received coverage in the media. This ensures that our respondents have been aware of the decisions, and of their impact(s), potential or realized, at the time of the survey. Table 1 summarizes the information on the episodes we have selected that cover the ECB and the Fed, the global financial crisis and its European consequences, and the COVID-19 crisis. Both periods have been associated with important decisions by each central bank.

Salient Monetary Policy Decisions

Below, we will first describe the monetary policy episodes covered by our analysis and then detail the corresponding datasets, to elaborate subsequently on the identification and estimation strategies.

Table 1. Summary of salient monetary policy decisions under scrutiny

Central bank	Financial Crisis	COVID-19 Crisis
Fed	22/05/2013: 'Taper tantrum' Declaration by Ben Bernanke 1 survey per quarter of 2013 (Q1 reference, Q3 of main interest)	15/03/2020: Policy package Declaration by Jerome Powell (November) 2020 vs. (November) 2019
ECB	26/07/2012: 'Whatever it takes' Declaration by Mario Draghi November 2012 vs. May 2012	12/03/2020: Policy package Declaration by Christine Lagarde August 2020 vs. Nov-Dec 2019

Source: own study.

In the case of the Global Financial Crisis, the episode we looked at for the Fed was the declaration by Ben Bernanke, then Chairman of the Board of Governors, made in May 2013. As stated by, *e.g.* Jensen and Robertson (2021) 'no substantive discussion about the Fed shrinking its asset purchases had taken place.' In between two meetings of the Federal Open Market Committee, Ben Bernanke testified to Congress that the FOMC 'could in the next few meetings... take a step down in our pace of purchases' (congressional testimony, made on 22 May 2013). Bernanke's comments have triggered an important uncertainty, reflected in market expectations, for when the Fed would end its accommodative policy, creating the now-so-called 'taper tantrum' disorder in the Treasury market. One can expect this episode to affect negatively the level of trust in the institution.

Though we can see it as a speech with a purely financial impact, Figure 1 illustrates the importance of the fact that the influence of this talk by Bernanke goes beyond the markets and attracts a large public interest. We used Google trends to compare the importance of searches for 'taper tantrum' and 'Boston marathon' (where a terrorist attack took place on April 15, 2013). As we can see, the subject reached in some periods (between April and December 2013) an even greater importance than the Boston attack, and searches did not stop after the next meeting (in June 2013) of the FOMC.

For the ECB, the important moment we looked at was the declaration by Mario Draghi, the ECB's Governor that the institution will do 'whatever it takes,' on July 26, 2012, to save the euro. This comment is generally acknowledged as one of the defining ones for the euro area and the institution chaired by Draghi.

This comment is generally considered to have had a huge impact on (calming) speculative attacks taking place at that time. More generally, it has been shown to have strongly reduced financial risk premia (Cieslak & Schrimpf, 2019), bond yields (Afonso *et al*., 2018), and influenced stock markets (Haitsma *et al*., 2016). We here expect a positive impact on trust.

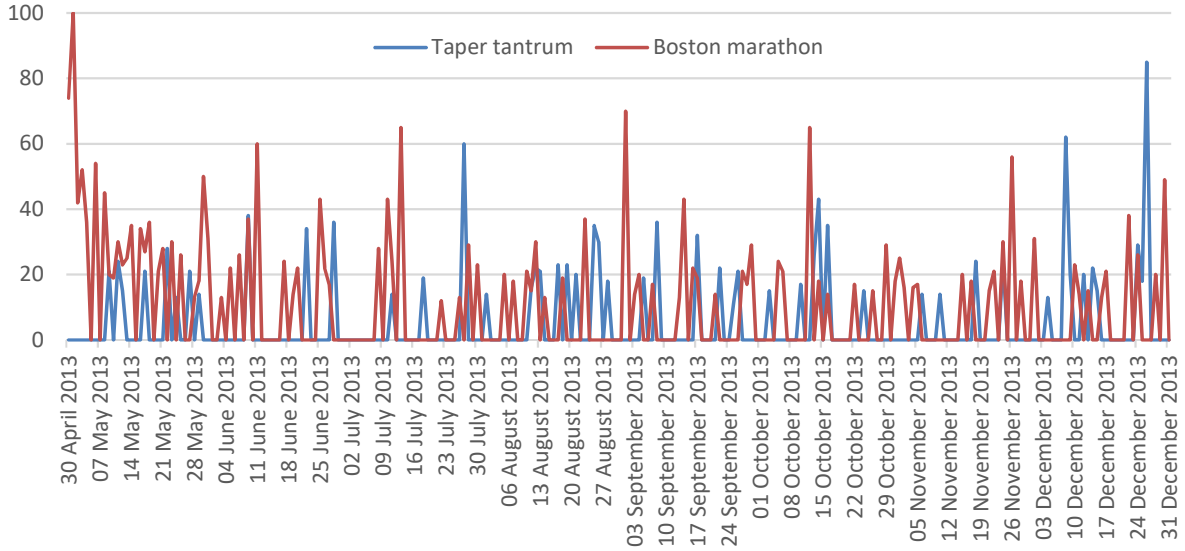

Figure 1. Google Trends searches: Taper tantrum (May to December 2013)

Note: Google Trends is a publicly available search activity tool (see Stephens-Davidowitz & Varian, 2015 for a description), allowing to check how a search term (or set of terms) tends to be searched for relative to other terms within a region, country, or globally (see, for example https://support.google.com/trends/answer/4365533?hl=en); Left-hand axis: number of occurrences. Numbers are scaled on a range of 0 to 100 based on a topic's proportion to all searches on all topics.
Source: own elaboration based on Google trends analytics.

The significance of this moment for the general public cannot be discarded, as exemplified in Figure 2. We used Google trends to compare the importance of searches for 'whatever it takes,' 'Draghi' and 'London Olympics' (as these took place in July 2012). As we can see, if the ECB-related subjects did not beat the Olympics as they take place, the interest for them would last for much longer, confirming the importance of this episode for our purposes.

Figure 2. Google Trends searches: 'Whatever it takes' (May to December 2013)

Note: Left-hand axis: number of occurrences. Numbers are scaled on a range of 0 to 100 based on a topic's proportion to all searches on all topics; see also Figure 1.
Source: own elaboration based on Google trends analytics.

Our second period of observation was the COVID-19 crisis. There is probably no need to convince of the importance of this period for the economy and the general public. Interestingly, in front of this crisis, the two central banks have taken relatively comparable decisions, in about the same period. Both announced in March 2020, that they would support their economy. Which we expect to have a positive impact on the level of trust they receive from non-experts.

For the Fed, the FOMC declaration dates from 15 March 2020 (https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm.).

The ECB made an almost parallel declaration, on 12 March 2020 (https://www.ecb.europa.eu/press/pressconf/2020/html/ecb.is200312~f857a21b6c.en.html.)

Our premise in the analysis presented below is that these four policy decisions have been important, even salient ones. We have shown that this is indeed the case, and the related literature validates the argument (see, *e.g.* Ortmans & Tripier, 2021). Besides, the four salient decisions have been announced by different chairpersons (in chronological order: Mario Draghi, Ben Bernanke, Christine Lagarde, and Jerome Powell). This precludes that any change in the impact of the decisions taken on trust that we could observe is not related to a change in the personal 'confidence capital' of one of the central bankers present in the period we cover.

Trust Data for the Fed

We rely on the Booth Chicago/Kellogg School Financial Trust Index that is a quarterly measure of Americans' confidence in the private institutions in which they can invest their money. The Financial Trust Index measures investors' trust in the stock market, banks, mutual funds, and large corporations. In different quarters, this information is supplemented with data on additional topics (*e.g.* real estate investment, and opinion about recent events). Trust is defined as an expectation that a person (or institution) will perform actions that are beneficial or at least not detrimental to others. Data is collected on a quarterly basis, based on interviews of more than 1000 American households, randomly chosen, and surveyed via phone by Social Science Research Solutions.[1] To our knowledge, this is the first time that this data has been used in such a context.

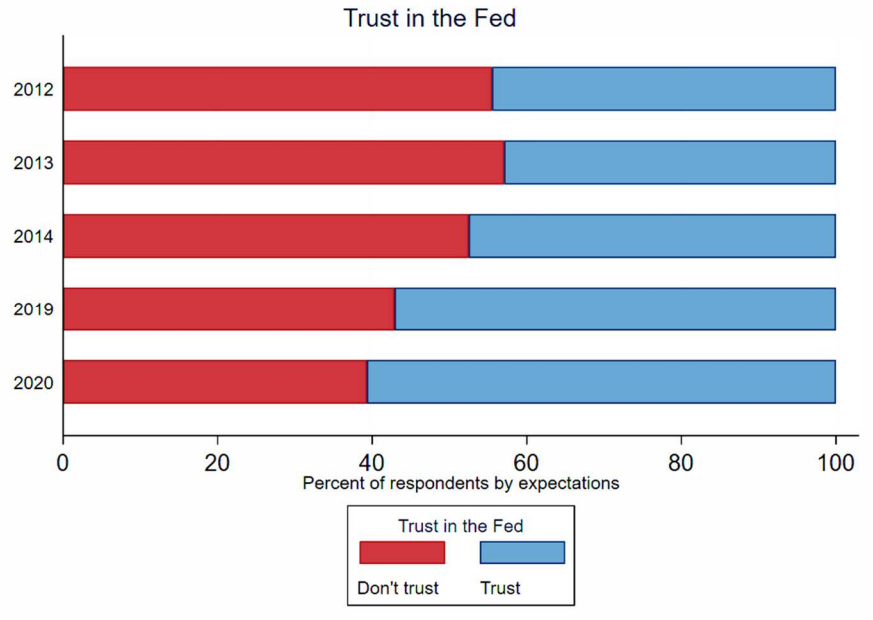

Figure 3. Trust in the Fed, 2012-2014, and 2019-2020
Source: own elaboration based on the Financial Trust Index project and elaborated with Stata.

[1] The data were originally published on the Financial Trust Index website (http://www.financialtrustindex.org/), and has been used in, *e.g.* Guiso *et al.* (2008).

Table A3 in the Appendix delivers the descriptive statistics for this dataset, and the Appendix also contains the glossary of variables, while Figure 3 displays the data on trust in the Fed around the two periods we consider. For the Global Financial Crisis period, the surveys we used are available on a quarterly basis, which made it possible to compare the evolution of trust in the central bank over time, during the three years (2012 to 2014), and inside each year, over the quarters. This was not the case for the COVID-19 period, during which the surveys have been realized on a yearly basis, forcing us to compare the year 2019 to 2020. As the respondents were surveyed after the above-reported decisions taken by the Fed, we can look at how the degree of trust has been impacted by the March 2020 decisions.

As Figure 3 shows, the degree of trust was much higher in the last period compared to the first one, as it barely reached 50% in 2014, while it was largely over 50% in 2019 and 2020. Moreover, 2013 seems to be a bad year for the Fed, as distrust reached a maximum that year. Table 2 details for each period the personal characteristics of the surveyed person in the samples. Even though there were fewer observations in the second sample, the characteristics did not appear different from one period to the other, which supports the use of both samples in the analysis.

Trust Data for the ECB

Concerning the ECB, we used Eurobarometer survey waves, selecting those waves of the survey that included the question on trust in the ECB we were interested in. Precisely, these were 77.3 (May 2012) and 78.1 (November 2012) for the first period, and survey waves 92 (Autumn 2019) and 93.1 (July-August, 2020). The waves of the survey we employed (Table 2) covered all then-current euro area member countries. Among other questions, we asked respondents about the importance of the major European institutions, and their trust in them, in particular in the ECB (*e.g.* Question A17 in Eurobarometer 77.3). The responses were recorded in the following way: 1 for 'Tend to trust,' 2 for 'Tend not to trust,' and 3 for 'Don't know.' We measured the trust in the European Central Bank by transforming this categorical variable into a binary one, excluding the responses coded 3 that did not express an explicit opinion. The binary discrete choice variable thus obtained became our dependent variable for the ECB case.

Figure 4 displays a summary view of the degree of trust in the two periods under consideration. As in the case of the Fed, the degree of trust is superior in the last period, compared to the first one, with much more than 50% of the surveyed population declaring to have trust in the ECB. Interestingly, the level of trust is strongly similar, for both periods, before and after the salient decisions we considered. Table 2 presents the summary statistics on the degree of trust in the ECB.

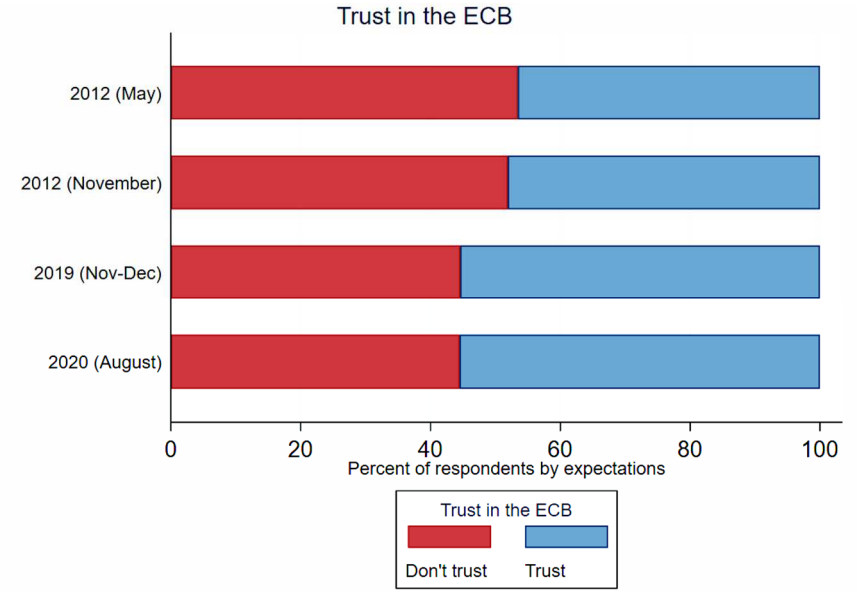

Figure 4. Trust in the ECB (2012, and 2019-2020)
Source: own elaboration based on Eurobarometer data and elaborated with STATA.

Table 2. Descriptive statistics: Trust in the ECB

Variables	Financial Crisis				COVID-19 Crisis			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Married	0.650	0.477	0	1	0.645	0.478	0	1
Employed	0.568	0.495	0	1	0.542	0.498	0	1
Age categories								
25-34 years	0.151	0.358	0	1	0.118	0.323	0	1
35-44 years	0.182	0.386	0	1	0.146	0.353	0	1
45-54 years	0.190	0.392	0	1	0.173	0.379	0	1
55-64 years	0.169	0.375	0	1	0.201	0.401	0	1
65 years and older	0.206	0.405	0	1	0.280	0.449	0	1
Male	0.480	0.500	0	1	0.476	0.499	0	1
Education	2.700	2.175	1	4	4.365	2.865	1	4
Observations	27284	27284	27284	27284	29824	29824	29824	29824

Source: own elaboration based on Eurobarometer data.

Logistic Regressions' Specifications

The two types of surveys we used were not completely comparable. This is understandable as their goals are different (the American survey is financial institutions-oriented, while the European one is more general), but this induces that, to make our analysis as comparable as possible over the two institutions, we restricted the set of characteristics of the respondents to the core of variables that were available or comparable in the two cases. This means that we considered age, education, employment status, gender, and marital status as our core variables. Moreover, given their importance in the American context, and thanks to their availability, we also included in the American estimates the respondents' declared ethnicity and some variables related to their political placement and registration.

Therefore, our baseline empirical model took the following form:

$$Trust_{i(t)j} = f\left(Dem'_{i(t)j}; Pol'_{i(t)j}; D_{it}; C_t; c\right) + \varepsilon_{i(t)j} \quad (1)$$

in which:

$$Dem'_{i(t)j} = \left(GD_{i(t)j}; Age_{i(t)j}; \left[Edu_{i(t)j};\right] Empl_{i(t)j}; \left[Inc_{i(t)j}\right]\right)'$$
$$Pol'_{i(t)j} = \left(Democrat_{i(t)j}; Registered_{i(t)j}\right)'$$

$Trust_{i(t)j}$ is the opinion of a respondent *i* at time/wave *t* of the survey in country / zone *j*. The 'demographic' vector $Dem'_{i(t)j}$ contains the gender of the *i*-th respondent to the *t*-th survey wave – the dummy $GD_{i(t)j}$ -, and other categorical variables: $Age_{i(t)j}$ is the age group of the respondent, either in ordered categories: 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65+ years or as a continuous variable; $Edu_{(t)j}$ is the education level of the respondent in number of years of education at the time of obtaining the highest degree; $Empl_{i(t)j}$ is the dummy for the employment status; $Inc_{i(t)j}$ is the income of the respondent, for the US case. The 'political' vector $Pol'_{i(t)j}$ contains, for the US case, the variables related to the political placement, $Democrat_{i(t)j}$, and a dummy for the registered voters, $Register_{i(t)j}$. State and country (for the euro case) fixed effects, C_t, capture unobservable specific variables. $\varepsilon_{i(t)j}$ is the individual disturbance in the regression and *c* – the constant term.

We also add other dummies, D'_{jt}, in the versions of *(1)* we estimate. These are our variables of interest, as they will capture the impact of the period in which the survey has been rolled out on the average level of trust in each institution, for each period we analyzed. Hence, for the Global Financial Crisis period, in the American case, we associated each dummy with a specific quarter for each of the years 2012 to 2013, the first quarter being the reference for each year (for 2014, we only had observations for the fourth quarter). In the European case, we associated the dummy with the surveys taken in November 2012, to be compared to May. For the COVID-19 crisis, the dummy, in the American case, was for each of the years covered, 2020 being compared to the answers given in 2019. For the European case, it corresponded to August 2020, to be compared with November – December 2019.

Everything else being equal, this method boils down de facto to a before vs. after method: we compared the probability of declaring to have trust in each respective central bank after the salient monetary policy decision, comparing it to the before-the-event level. Note that, as events that would have mattered can have happened between the central bank's action and the survey waves, our results would probably suffer from an underestimation bias.

We utilized dynamic logit regressions, following the prevailing micro-econometric literature on binary-choice dependent variables, to estimate the parameters of our general empirical model in equation (1).

Consequently, we assumed that our measure of trust in the central bank, $Trust_{i(t)j} \equiv Y_{i(t)j}$ – which can be thought of as the conditional probability of a 'yes' response $P(Y_{i(t)j} = 1 \mid x_{i(t)j})$ to the relevant survey question given the covariates, or 'predictors,' collected in the vector of explanatory variables, $x_{i(t)j}$ – more specifically follows a logistic distribution, so that:

$$P\left(Y_{i(t)j} = 1 \,\middle|\, x_{i(t)j}\right) = \frac{1}{1 + e^{-(c + T_t + \beta' x_{i(t)j})}} \quad (2)$$

Then, a higher level of $c + T_t + \beta' x_{i(t)j}$ would imply a higher level of trust for the particular definition of the employed (sub)sample, with β denoting the vector of estimated coefficients.[2]

RESULTS AND DISCUSSION

The Fed's Case

Table 3 contains the results of the estimates for both periods in the case of the Fed. The control variables had the expected signs (Democrats, for example, expressing more support for the Fed than their Republican and Independent counterparts, as well as more educated Americans).

However, for the next period under review, the policy package announced in March 2020, whatever its importance, has not moved the level of trust of the respondents to the Financial Trust Index survey. This result is similar to the ones obtained by Coibion *et al.* (2022), and it may be because the level of trust was already high (as we commented above), that the central bank has not reached the audience it targeted, or that other actors have played a more important role during this specific period. Below, we will test these alternative interpretations by running placebo estimates.

To sum up, if our estimates for the first period capture an impact of monetary policy communication on non-experts' perception when the decision is a salient one, this is not the case for the second period. Moreover, the influence of the regressors is unstable over time. We now turn to the ECB, to check if the observed pattern is repeated for this institution.

Results for the ECB

As for the Fed's case, the variables of control had signs and significance levels that conformed with the observations from studies using similar data types (Brouwer & de Haan, 2022; *e.g.* Farvaque *et al*., 2017; van der Cruijsen & Samarina, 2022), both in the absence (in columns 1 and 3 of Table 4) or presence (respectively, in columns 2 and 4) of country-specific fixed effects. For example, employed and young people tend to express a higher level of trust in the institution and a higher level of education brings a higher degree of trust.

With regard to the variables of interest, we observed that the policy decision of 2012 was associated with a positive (and strongly significant) impact on the level of trust expressed by respondents to the Eurobarometer survey. This was expected but acts as confirmation that the salient monetary policy declaration by Draghi has been strongly perceived (and positively interpreted) by the European general audience.

[2] See *e.g.,* Moulton (1990), for a methodological description of the type of analysis we implemented.

Table 3. Determinants of trust in the Fed

Dependent Variable: Trust in the Fed	Financial Crisis			COVID-19 Crisis
	2012	2013	2014	2019 and 2020
Married	-0.032 (0.024)	-0.022 (0.023)	-0.008 (0.033)	-0.001 (0.031)
Employed	0.022 (0.025)	0.027 (0.025)	-0.061* (0.036)	0.081** (0.038)
Age	0.001 (0.001)	0.002*** (0.001)	0.000 (0.001)	0.003*** (0.001)
Democrat	0.258*** (0.028)	0.251*** (0.028)	0.169*** (0.042)	0.159*** (0.037)
Others	0.042 (0.026)	0.043 (0.026)	-0.009 (0.038)	-0.024 (0.038)
Register	-0.060* (0.034)	-0.086** (0.034)	-0.080* (0.043)	-0.013 (0.050)
Male	-0.042* (0.021)	-0.030 (0.021)	-0.030 (0.030)	-0.033 (0.030)
White Non-Hispanic	0.098* (0.055)	0.076 (0.053)	0.190*** (0.061)	0.070 (0.058)
Black Non-Hispanic	0.096 (0.066)	0.085 (0.061)	0.150** (0.074)	-0.021 (0.084)
White Hispanic	0.302*** (0.071)	0.272*** (0.068)	0.294*** (0.083)	0.099 (0.079)
Black Hispanic	0.330** (0.131)	0.205* (0.117)	0.364** (0.143)	0.297** (0.119)
Unspecified Hispanic	-0.002 (0.143)	0.042 (0.127)	0.443*** (0.109)	0.027 (0.107)
Income	0.009* (0.005)	0.010** (0.005)	0.008 (0.007)	0.007 (0.007)
Education	0.029*** (0.007)	0.035*** (0.007)	0.041*** (0.010)	0.021* (0.011)
Q2	0.009 (0.030)	-0.029 (0.030)	–	–
Q3	0.060** (0.030)	-0.088*** (0.029)	–	–
Q4	0.022 (0.030)	-0.071** (0.029)	0.038 (0.029)	–
Year = 2020	–	–	–	0.023 (0.029)
State F.E	Y	Y	Y	Y
Observations	2108	2120	1093	1095

Notes: The Table presents marginal effects from a logit regression on the determinants of trust in the Fed. Standard errors (in brackets) are robust to arbitrary heteroskedasticity, clustered at the state level. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.
Source: own elaboration in STATA.

However, we did not observe this result in the case of the COVID-19 crisis, for which we observed the pattern found in the American case and also in the European one (*i.e.* no significant response when country-fixed effects are included in the estimate). As this comes unexpectedly with regard to our working assumption, while the COVID-19 policy packages can clearly be considered as important and significant policy decisions, we now look to alternative estimates that can bring further explanation to these results.

Table 4. Determinants of trust in the European Central Bank

Dependent Variable: Trust in ECB	Financial Crisis		COVID-19 Crisis	
	1	2	3	4
Married (ref: unmarried)	0.026*** (0.007)	0.032*** (0.006)	0.024*** (0.006)	0.026*** (0.006)
Employed (ref: unemployed)	0.116*** (0.008)	0.080*** (0.008)	0.049*** (0.007)	0.036*** (0.007)
Age				
25-34 years	0.068*** (0.014)	0.046*** (0.014)	-0.101*** (0.014)	-0.108*** (0.013)
35-44 years	0.081*** (0.015)	0.056*** (0.014)	-0.113*** (0.014)	-0.117*** (0.013)
45-54 years	0.092*** (0.015)	0.059*** (0.015)	-0.118*** (0.013)	-0.128*** (0.013)
55-64 years	0.144*** (0.015)	0.088*** (0.015)	-0.76*** (0.013)	-0.103*** (0.012)
65 years and older (ref: 15-24 years)	0.213*** (0.015)	0.145*** (0.015)	-0.014 (0.012)	-0.054*** (0.012)
Male (ref: female)	0.025*** (0.006)	0.027*** (0.006)	-0.002 (0.006)	0.002 (0.006)
Education	0.042*** (0.002)	0.032*** (0.002)	0.033*** (0.001)	0.024*** (0.001)
November 2012 (ref: May 2012)	0.013*** (0.006)	0.013*** (0.006)	–	–
August 2020 (ref: November – December 2019)	–	–	-0.123*** (0.008)	-0.093 (0.008)
Country F.E	N	Y	N	Y
Observations	27703	27703	29824	29824

Notes: The Table presents marginal effects from a logit regression on the determinants of trust in the Fed. Standard errors (in brackets) are robust to arbitrary heteroskedasticity, clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.
Source: own computations in STATA.

Alternative Hypotheses: Placebo Estimates

Tables 5 and 6 expose the results of alternative estimates, in which the trust in the central bank is replaced by the trust in the government as the dependent variable. More precisely, for the American case, the question is about the trust in the federal government, while the corresponding question considered for the European case is the trust in the national government of each respondent. The methodology and the variables are the same as previously, allowing one to easily compare the results. Hence, these alternative estimates provide both robustness and placebo tests of the previous results.

Interestingly, for each case, we observed a pattern which is symmetric to the one obtained for the trust in the central bank: for the first crisis period, trust in the government was either not affected (estimates for the dummies associated with, respectively, 2013 and 2014, for the US) or negatively affected (in the European case). On the opposite, for the US case, the trust stated by respondents was significantly higher in 2020. For the euro area, the response was negative, which may be related to distrust towards the national governments, with debates about how they have dealt with the restrictions related to the COVID-19 crisis (François *et al*., 2023).

In our view, this confirms that, if salient monetary policy decisions can affect the level of trust expressed by non-experts, the COVID-19 crisis may stand apart. Firstly, the central banks have articulated their decisions as being taken in consultation with, or in support of, their respective governmental policy packages. Secondly, it may be the case that the communication channel of the central bank with the general public may have been broken during this period, if only because the other branches of policy-making have also communicated a lot during this period. This interpretation would be sup-

ported by the results of, *e.g.* Leibrecht and Scharler (2022), who showed how trust evolves in strong relation with GDP. However, a third interpretation, less favourable and for the moment untested, is that the public has understood that given the fiscal policies implemented, central banks were entering a phase of 'fiscal dominance,' in which governments have logically a more important role to play than monetary authorities. For example, Benigno *et al*. (2022) analyzed the fiscal space the ECB may have opened by its decisions, while Dimakopoulou *et al*. (2022) showed the importance of trust in the success of fiscal policy package. This would unfortunately mean that the barriers put in front of the 'road to nowhere' of central bank communication with non-experts would have been reinforced, to use the analogy of Ehrmann and Wabitsch (2022).

Table 5. Placebo test – US: Determinants of trust in the federal government

Dependent Variable: Trust in Government	**Financial Crisis**		**COVID-19 Crisis**	
	2012	**2013**	**2014**	**2019 and 2020**
Married	0.028 (0.019)	-0.009 (0.019)	-0.026 (0.028)	0.074** (0.030)
Employed	0.008 (0.020)	0.028 (0.020)	-0.022 (0.029)	0.157*** (0.034)
Age	0.001* (0.001)	0.001** (0.001)	0.002** (0.001)	0.001 (0.001)
Democrat	0.346*** (0.025)	0.295*** (0.025)	0.284*** (0.038)	-0.012 (0.037)
Others	0.056*** (0.020)	0.052*** (0.020)	0.091*** (0.030)	-0.103*** (0.035)
Register	-0.070** (0.030)	-0.053* (0.029)	-0.035 (0.037)	0.030 (0.049)
Male	-0.013 (0.018)	0.029 (0.018)	0.010 (0.026)	-0.001 (0.029)
White Non-Hispanic	-0.070 (0.048)	-0.071 (0.048)	0.081* (0.047)	-0.051 (0.060)
Black Non-Hispanic	0.033 (0.057)	-0.005 (0.054)	0.144** (0.062)	-0.095 (0.074)
White Hispanic	0.200*** (0.068)	0.119* (0.065)	0.447*** (0.076)	-0.005 (0.082)
Black Hispanic	0.311** (0.137)	0.082 (0.095)	0.364** (0.148)	0.434** (0.171)
Unspecified Hispanic	0.074 (0.125)	0.102 (0.122)	0.346*** (0.104)	0.003 (0.113)
Income	-0.001 (0.004)	-0.005 (0.004)	0.000 (0.006)	-0.014** (0.007)
Education	0.030*** (0.006)	0.021*** (0.006)	0.030*** (0.009)	0.006 (0.011)
Q2	0.009 (0.024)	0.022 (0.026)	–	–
Q3	0.052** (0.025)	-0.037 (0.025)	–	–
Q4	-0.006 (0.024)	-0.040* (0.024)	-0.011 (0.025)	
Year = 2020	–	–	–	0.091*** (0.029)
State F.E	Y	Y	Y	Y
Observations	2207	2251	1114	1097

Notes: The Table presents marginal effects from a logit regression on the determinants of trust in the federal government. Standard errors (in brackets) are robust to arbitrary heteroskedasticity, clustered at the state level. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.
Source: own elaboration in STATA.

Table 6. Placebo test – Euro area: Trust in national government

Dependent Variable: Trust in government	Financial Crisis		COVID-19 Crisis	
	1	2	3	4
Married (ref: unmarried)	0.023*** (0.006)	0.031*** (0.006)	0.036*** (0.006)	0.029*** (0.006)
Employed (ref: unemployed)	0.087*** (0.007)	0.053*** (0.007)	0.025*** (0.007)	0.011 (0.007)
Age				
25-34 years	0.048*** (0.012)	0.022*** (0.012)	-0.052*** (0.014)	-0.060*** (0.013)
35-44 years	0.072*** (0.013)	0.041*** (0.013)	-0.060*** (0.014)	-0.068*** (0.013)
45-54 years	-0.082*** (0.013)	0.039*** (0.013)	-0.053*** (0.013)	-0.065*** (0.013)
55-64 years	0.138*** (0.013)	0.072*** (0.013)	-0.03 (0.013)	-0.029*** (0.012)
65 years and older (ref: 15-24 years)	0.265*** (0.014)	0.175*** (0.014)	0.084*** (0.012)	0.042*** (0.012)
Male (ref: female)	0.012** (0.006)	0.012** (0.005)	0.002 (0.006)	-0.004 (0.005)
Education	0.036*** (0.002)	0.024*** (0.002)	0.021*** 50.001)	0.014*** (0.001)
November 2012 (ref: May 2012)	-0.021*** (0.006)	-0.020*** (0.005)	–	–
August 2020 (ref: November – December 2019)	–	–	-0.025*** (0.008)	-0.06*** (0.008)
Country F.E	N	Y	N	Y
Observations	28995	28995	29824	29824

Notes: The Table presents marginal effects from a logit regression on the determinants of trust in the national government. Standard errors (in brackets) are robust to arbitrary heteroskedasticity, clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.
Source: own elaboration in STATA.

CONCLUSIONS

Our findings suggest that the 'taper tantrum' speech by Ben Bernanke negatively impacted the trust in the Fed, whereas the 'whatever it takes' speech by Mario Draghi significantly increased the trust in the ECB. On the other hand, significant policy reactions to the COVID-19 pandemic did not affect trust in central banks on either side of the Atlantic, while it affected one of the government(s), as they have probably been considered as 'dominating' the respective central bank in such circumstances. Thus, we were able to positively verify the research hypothesis H1 that salient monetary policy decisions may impact the general public's trust towards the central bank. However, under some communication mishaps (surrounding 'taper tantrum') the effect turned out to be negative, whereas the governments' dominance (over the COVID-19 policy reaction and communication) resulted in a muted response of trust. These remarks confirm the research hypothesis H2.

Overall, our results are striking and, for policymakers, indicate that, if non-experts can be reached in extraordinary times (what we have called here 'salient decisions'), it can however never be considered that their attention is easy to keep, especially in periods where the monetary and fiscal policies are aligned – in which case our results show that the public attributes the moves to the government, not to the central bank. Our results can thus be considered as a rejoinder to Romer and Romer's (2013) conclusion: as central banks have to navigate between humility and hubris, one of the pitfalls to avoid would be to consider that non-experts' trust is established. Central banks have to win the hearts and minds of large audiences. This is even more important as people tend to have biased beliefs about

economics and economic policies (Stantcheva, 2020), and communicating rightly thus has far-reaching consequences, as shown for example by the experiment reported by Mochhoury (2023).

Nevertheless, it has to be considered that our results are probably partial, as it has also been shown in the literature that, as long as inflation is low, households do not pay attention to monetary policy. For instance, Hayo and Neumeier (2020) show that in New Zealand, the country with the longest tradition of inflation targeting, even after a public debate on a reform of the monetary policy objectives, less than 10% of the population are able to state the official inflation target. It is also possible that central bank trust may not easily change, even when people are delivered information about monetary policy. For instance, Brouwer and de Haan (2022) do not find any impact in their information treatment and Hayo and Méon (2024) only do after conditioning a specific group of respondents. This provides a limitation to our study.

Another potential limitation is that we assumed that trust in the central bank mainly arises out of monetary policy communications. However, as it can be claimed that people's understanding of monetary policy is rather unclear, other events may potentially influence their trust. For example, Hayo and Neuenkirch (2014) found that the most important predictor of trust in the ECB is trust in institutions. It could then happen that an increase in people's institutional trust benefits the central bank.

As a consequence, an interesting extension of our study would be also to compare the reaction of 'laymen' and 'expert' opinions in the spirit of the research on the effects of free trade areas by Beck *et al.* (2019).

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Appendix I: Trust in the FED

Variable	Definition
Trust in the FED	Dummy variable code as 1 if respondent reports trust in the FED and 0 otherwise.
Married	Dummy variable coded as 1 if respondent is married and 0 otherwise.
Employed	Employed is dummy variable and coded as 1 if respondent is employed and 0 otherwise.
Age	Age of respondent.
Political affiliation	The political affiliation of respondent: Republican, Democrat, and other.
Registered voter	Dummy variable coded as 1 if respondent is registered to vote and 0 otherwise.
Male	Male vs. female. It is a dummy variable coded as 1 if respondent is male and 0 otherwise.
Ethnicity	Ethnicity of respondent: White Non-Hispanic, Black Non-Hispanic, White Hispanic, Black Hispanic, Unspecified Hispanic and other / mixed.
Income	An ordinal variable ranging from 1 to 11 for different ranges of income.
Education	Highest school class that is passed by respondent.

Variable	Definition
Trust in ECB	Dummy variable code as 1 if respondent tends to trust ECB and 0 otherwise.
Married	Dummy variable coded as 1 if respondent is married and 0 otherwise.
Employed	Employed is dummy variable and coded as 1 if respondent is employed and 0 otherwise.
Age	Age of respondent in different categories.
Male	Male vs. female. It is a dummy variable coded as 1 if respondent is male and 0 otherwise.
Income	Dummy variable code as 1 if household live in a rural area and 0 otherwise. Source: Pakistan Time Use Survey.
Education	A variable indicating the different education levels of respondents.

Appendix II: Trust in the ECB

Table A3. Descriptive statistics – Trust in the Fed

Variables	Financial Crisis				Covid-19 Crisis			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Married	0.572	0.495	0	1	0.553	0.497	0	1
Employed	0.564	0.496	0	1	0.624	0.485	0	1
Age	55.300	16.903	18	99	54.001	18.215	18	99
Democrat	0.346	0.476	0	1	0.359	0.480	0	1
Others	0.358	0.479	0	1	0.325	0.469	0	1
Register	0.875	0.331	0	1	0.895	0.307	0	1
Male	0.513	0.500	0	1	0.531	0.499	0	1
White Non-Hispanic	0.798	0.402	0	1	0.758	0.428	0	1
Black Non-Hispanic	0.099	0.299	0	1	0.068	0.251	0	1
White Hispanic	0.049	0.217	0	1	0.065	0.246	0	1
Black Hispanic	0.008	0.089	0	1	0.007	0.085	0	1
Unspecified Hispanic	0.005	0.072	0	1	0.030	0.171	0	1
Income	6.687	2.830	1	11	7.395	2.604	1	11
Education	3.521	1.628	1	6	3.939	1.532	1	6
Observations	2108	2108	2108	2108	1095	1095	1095	1095

Source: Authors' calculations based on the Financial Trust Index project data.

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The contribution share of authors is equal and amounted to 25% for each of them.

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Conflict of Interest

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The influence of prospector and defender strategies on dynamic capabilities, innovation, and financial effectiveness in Vietnamese service SMEs

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ABSTRACT

Objective: The article examines the relationships between prospector and defender-oriented SMEs, dynamic capabilities, innovation, and financial effectiveness within the service sector through the resource-based view (RBV) and dynamic capabilities view (DCV) perspectives.

Research Design & Methods: We tested a research model using data collected from 421 usable responses of service SME founders and managers in Southeast Vietnam. We employed PLS-SEM through SmartPLS software for analysis.

Findings: We found that prospectors significantly enhance dynamic capabilities more than defenders. Prospectors positively influence innovation, whereas defenders do not. However, dynamic capabilities drive innovation within SMEs. While we found no direct link between dynamic capabilities and financial effectiveness, innovation was a key predictor of SME effectiveness. Moreover, dynamic capabilities and innovation mediate the relationship between strategic orientations and SME effectiveness.

Implications & Recommendations: This study holds valuable implications for both SME strategists and scholars. It sheds light on the strategic pathways crucial for service SMEs, stressing the significance of aligning strategic directions with dynamic capabilities and innovation to boost SME financial effectiveness.

Contribution & Value Added: This research offers a novel perspective on strategic pathways for service SMEs in emerging markets, enriching RBV and DCV frameworks with insights specific to developing economies. It extends the Miles and Snow framework by integrating the adaptive cycle, illustrating how dynamic capabilities and innovation empower both prospectors and defenders to navigate change. Moreover, it addresses a gap in the literature by exploring the application of BSC for measuring financial effectiveness within service sectors, paving the way for its integration in measuring SME success in dynamic environments.

Article type: research article

Keywords: prospector; defender; dynamic capabilities; innovation; SME effectiveness

JEL codes: O31, L80

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INTRODUCTION

The service sector in Vietnam has emerged as a pivotal force in the nation's economic landscape, undergoing a transformative journey fuelled by the economic reforms of 1986 and global integration initiatives since its entry into the World Trade Organization in 2007 (Leung, 2010). Historically overshadowed by a manufacturing-centric focus, the sector has experienced a paradigm shift in recognition of its crucial role in driving economic growth. Government initiatives, including eased regulations for foreign investors, have led to a surge in capital inflows, particularly in key areas such as finance, insurance, real estate, and advisory services (Kim & Poensgen, 2019). Small and medium enterprises (SMEs) are the lifeblood of

Vietnam's service sector, fostering a dynamic and diverse service landscape. Their deep local roots enable them to cater to specific community needs, while the ease of entry allows new businesses to emerge, fostering a competitive market environment (Rand & Tarp, 2020). This combination of localized expertise and a constantly evolving service landscape fuels the growth and dynamism of Vietnam's service sector. With diverse economic activities encompassing wholesale and retail, finance, transportation, and accommodation services, the service industry is positioned to sustain Vietnam's productivity growth and propel its journey towards achieving high-income status by 2045 (Marwah *et al.*, 2021). Notably, recent statistics highlight the sector's robust expansion, with a notable growth rate of 9.99% in 2022, outpacing other key sectors such as industry, construction (7.78%), and agriculture (3.36%), according to the General Statistics Office of Vietnam. However, the service sector is facing some roadblocks that impede its performance, positioning it behind peer countries like Malaysia, the Philippines, and Indonesia (*Taking Stock, March 2023: Harnessing the Potential of the Services Sector or Growth*, 2023).

The contemporary business landscape demands a shift from traditional performance measurement methods towards more holistic and forward-looking approaches (Kumar *et al.*, 2022). The Balanced Scorecard (BSC) stands out as a valuable tool in this regard, offering multifaceted advantages over conventional metrics by enabling organizations to evaluate their progress towards strategic objectives (Sureka *et al.*, 2021). This emphasis on financial health is particularly crucial in today's competitive environment, where success hinges on the ability to achieve significant cost reductions and enhanced return on investment (Kumar *et al.*, 2022). Small and medium-sized enterprises (SMEs) have adopted adaptive strategies to navigate uncertainty. This involves addressing three key domains – entrepreneurial, engineering, and administrative – to align resources and adapt to changing market conditions (Sollosy *et al.*, 2019). Dynamic capabilities and innovation play pivotal roles in tackling the challenges faced by SMEs within this adaptive framework (Ferreira *et al.*, 2020). The capability-based perspective highlights the critical importance of dynamic capabilities in shaping firm performance, allowing organizations to proactively adjust to changing environments and seize new opportunities (Ingram & Kraśnicka, 2023; Jie *et al.*, 2023). Additionally, by fostering a culture of experimentation, innovation allows SMEs to embrace new ideas and service offerings in response to capitalize on opportunities and mitigate disruptions (Dyduch, 2019).

While the Miles and Snow framework offers a foundation for understanding strategic orientations, research often focuses solely on strategic types, neglecting the adaptive cycle that guides strategic decision-making (Anwar *et al.*, 2021). Dynamic capabilities are crucial for companies to adapt and innovate in changing environments by continually reconfiguring their resource base to create value (Ruiz-Ortega *et al.*, 2023). Research on the antecedents of dynamic capabilities has mostly focused on internal resources like experience, human capital, and leadership (Bitencourt *et al.*, 2020), as well as culture and organizational structure (Spanuth *et al.*, 2020). Integrating dynamic capabilities with broader strategic management is needed (Randhawa *et al.*, 2021; Ruiz-Ortega *et al.*, 2023). Although the relationship between business strategies, firm capabilities, and performance has been extensively researched (Desarbo *et al.*, 2005; Chereau & Meschi, 2019; Thoumrungroje & Racela, 2022), there is a gap in studies specifically examining these dynamics in the context of emerging tiger markets like Vietnamese service SMEs. This study focuses on the distinct and contrasting characteristics of prospector and defender strategies, enabling an exploration of a wide spectrum of strategic behaviours within Vietnamese SMEs. Strategic orientation is crucial for establishing new resource configurations and driving dynamic capabilities (Randhawa *et al.*, 2021). However, there is a lack of empirical studies examining the direct relationship between strategic orientation and dynamic capabilities, particularly in service SMEs. Moreover, the established link between dynamic capabilities and firm effectiveness needs further exploration within the service sector, considering potential cultural and institutional variations that might impact their effectiveness (Jie *et al.*, 2023; Zhang *et al.*, 2017). Furthermore, service innovation research, though growing, is less developed compared to its manufacturing counterpart (Saunila, 2020). Existing research on the BSC also highlights a lack of studies focusing on service sectors (Kumar *et al.*, 2022). The gaps identified in prior research create a compelling opportunity for this study. The article aims to examine the direct impact of dynamic capabilities on innovation and SME effectiveness, the influence of prospector- and defender-oriented SMEs on dynamic capabilities and innovation, and the mediating

roles of dynamic capabilities and innovation in the effectiveness of service SMEs in emerging economies like Vietnam. This study employs a theoretical lens informed by dynamic capabilities theory and the resource-based view to guide the investigation of the following three research questions:

RQ1: *Do dynamic capabilities directly impact innovation and SME effectiveness?*

RQ2: *Do prospector-oriented and defender-oriented SMEs directly influence dynamic capabilities and innovation?*

RQ3: *Do dynamic capabilities and innovation mediate the relationships between prospector-oriented and defender-oriented SMEs on SME effectiveness?*

This research has the potential to make significant contributions. While existing studies predominantly focus on manufacturing, exploring the strategic management framework within the service sector of emerging markets can yield crucial insights. This study examines how service SMEs in Vietnam, an emerging economy, leverage strategic orientation to enhance firm effectiveness through the combined lenses of the RBV and DCV. By understanding potential cultural and institutional variations, this research provides a comprehensive understanding of these relationships across different contexts. Additionally, by extending the Miles and Snow framework to integrate the adaptive cycle and examining the mediating roles of both dynamic capabilities and innovation, this study offers a nuanced perspective on how these factors interact to drive firm effectiveness. Finally, by recognizing the limited research on using the BSC to measure firm success in the service sector, this study paves the way for integrating this framework into performance evaluation for service SMEs, offering a more holistic approach to assessing success.

The next sections of this paper are structured as follows: The second section reviews the relevant literature and develops the study's hypotheses, synthesizing key theories and prior research. The third section outlines the research methodology used in the study. The fourth section presents and discusses the results. Lastly, the fifth section offers a summary and conclusion of the paper.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Prospector-oriented SME (PR) and Defender-oriented SME (DE)

The strength of the Miles and Snow typology lies in its focus on organizational adaptation to market changes, balancing internal and external factors for competitive advantage amidst uncertainty (Anwar & Shah, 2021). SMEs, often resource-constrained, can leverage this framework's flexibility to adjust strategies and utilize existing strengths for a competitive edge. Analyzer and reactor strategies, which involve detailed analysis and flexible resource allocation, can slow down decision-making or result in a lack of clear direction (Handoyo *et al.*, 2023). However, adopting prospector and defender strategies can empower SMEs to make quick decisions and adapt effectively to the dynamic environment (Handoyo *et al.*, 2023).

Prospector-oriented SMEs in the service sector are characterized by their innovative and externally focused approach (Anwar *et al.*, 2021; Avci *et al.*, 2011). These firms actively lead their market by introducing new products, services, and technologies, exhibiting a willingness for risk-taking and industry leadership. With a broad domain in both products/services and markets, they swiftly adapt to capitalize on emerging opportunities. Unlike defender-oriented SMEs that prioritize internal optimization, prospectors maintain an outside-in perspective, constantly seeking new customer needs and market openings (Osorio-Londoño *et al.*, 2020). They closely monitor customer behaviour, collaborate with forward-thinking users to anticipate trends, and conduct market experiments to validate new service concepts (Kathuria & Lucianetti, 2024). Through these proactive strategies, prospectors gather real-world feedback to refine and innovate their service offerings, ensuring alignment with evolving customer demands in the dynamic service sector. Contrastingly, defender-oriented SMEs adopt an inside-out perspective, prioritizing stability by concentrating on a narrow range of products or services tailored to specific market segments (Anwar *et al.*, 2021; Avci *et al.*, 2011). These firms prioritize market penetration rather than expanding beyond their established niche, guarding their territory and emphasizing long-term planning to enhance efficiency and cost reduction. They

tend to pursue established, low-risk opportunities, leveraging internal strengths such as customer relationships and service delivery processes to maximize efficiency and customer retention (Lukito-Budi *et al.*, 2023). By concentrating on optimizing existing capabilities, defender-oriented SMEs effectively compete within their limitations while adjusting their service offerings within internal boundaries to navigate the dynamic landscape of emerging markets.

Dynamic Capabilities (DC)

Dynamic capabilities (DC) refer to the routines and processes through which these firms continually reconfigure their resource base, encompassing shedding, acquiring, integrating, and deploying resources to formulate value-creating strategies that capitalize on existing and emerging opportunities (Jiang *et al.*, 2020; Salvato & Vassolo, 2018). Dynamic capabilities in service and trade SMEs involve three essential areas: Sensing Capabilities, which include identifying and assessing opportunities and threats by scanning the market and understanding customer needs and technological trends; Seizing Capabilities, which require mobilizing resources to capture opportunities through strategic decisions and aligning resources for new ventures; and Transforming Capabilities, which involve reconfiguring and renewing the firm's resource base to adapt to changes by restructuring and developing new skills (Teece, 2007; Jiang *et al.*, 2020). This concept underscores the importance of SMEs' ability to exploit their current assets and strategic positions while exploring new technologies and markets.

Prospector-oriented organizations focus on new product/market development and a willingness for risk-taking (Anwar *et al.*, 2021). To meet these needs, they develop dynamic capacity based on their strength lies in the ability to sense new market opportunities, seize them, and continuously reconfigure resources to thrive in the dynamic service landscape (Bonyadi Naeini & Jalilian Ahmadkalaei, 2022). This includes systems thinking to identify connections between current and potential resources, divergent thought processing to assess diverse opportunities, and reflective abilities for decision-making amid uncertainty. Previous research indicates a positive correlation between prospector strategies and dynamic capabilities (Marozau *et al.*, 2023; Nasution *et al.*, 2021). Defenders prioritize internal efficiency, fostering a dynamic capability centred on incremental adaptation of resources and processes for competitiveness (Adegbite *et al.*, 2018). This approach allows them to optimize operations, and allocate resources to enhance existing service offerings (Restuti *et al.*, 2023). Moreover, their focus on customer retention serves as another dynamic capability, involving continuous monitoring and adaptation to meet customer preferences within their market (Lukito-Budi *et al.*, 2023). Therefore, we proposed the hypotheses as follows:

H1a: Prospector-oriented SME has a positive impact on dynamic capabilities.

H1b: Defender-oriented SME has a positive impact on dynamic capabilities.

Innovation (IN)

Coombs and Miles (2000) present three perspectives on service innovation: assimilation, demarcation, and synthesis. The synthesis approach acknowledges differences in service innovation due to unique characteristics but suggests applying insights from manufacturing innovation management processes (Witell *et al.*, 2016). Exploratory and exploitative innovations represent two distinct strategies that organizations employ to enhance competitiveness (AlAbri *et al.*, 2021). For trade and service SMEs, exploratory innovation is vital for adapting to market changes, creating unique value propositions, and ensuring long-term sustainability through the continuous pursuit of new opportunities. This approach also allows SMEs to leverage emerging technologies, thereby improving customer experiences and operational efficiencies (AlAbri *et al.*, 2021; Gustafsson *et al.*, 2020). By adhering to the synthesis perspective and exploratory innovation, this study defines innovation as the introduction of new services through technology and creativity to fulfil customer needs and open market opportunities, aiming to deliver innovative and value-added solutions to clients (García-Morales *et al.*, 2012; Gustafsson *et al.*, 2020).

The prospector strategy emphasizes proactive innovation through activities like monitoring emerging trends, establishing new ventures, and actively seeking resources and opportunities, which enables

SMEs to respond to market demands and capitalize on innovative prospects (Al-Ansaari *et al.*, 2014; Kim *et al.*, 2024). Conversely, defender-oriented SMEs often prioritize stability over innovation, focusing on retrenchment rather than embracing change. This conservative approach may hinder innovation efforts due to risk aversion, potentially undermining resilience during turbulent periods (Kim *et al.*, 2024; Lukito-Budi *et al.*, 2023). Consequently, we hypothesised:

H2a: Prospector-oriented SME has a positive relationship with Innovation.

H2b: Defender-oriented SME has a negative relationship with Innovation.

Service innovation is essential for service firms' growth and success in today's competitive landscape (Ziyae *et al.*, 2022). These firms strive to provide value to customers through innovative services tailored to their preferences, but implementation challenges persist, partly due to the difficulty in measuring innovation in the service sector (Intriago *et al.*, 2023). Dynamic capabilities encompass a firm's distinctive abilities to integrate and reconfigure internal and external competencies (Jiang *et al.*, 2020). These capabilities enable firms to adapt to changing market conditions by achieving new resource configurations. Dynamic capabilities include resource accumulation, firm attributes, capabilities, and innovative activities, all essential for business development and growth (Tsou & Chen, 2020). The dynamic capabilities view applies to conceptualizing service innovation, as it emphasizes the development of dynamic capabilities through innovative activities to recognize and seize opportunities (Ziyae *et al.*, 2022). Hence, we proposed:

H3: Dynamic capabilities are positively related to innovation.

SME Effectiveness (SE)

While financial metrics were traditionally the sole indicator of a company's health, Kaplan and Norton's (1992) balanced scorecard (BSC) introduced a more nuanced approach (Kumar *et al.*, 2022). For SMEs, achieving financial effectiveness is about reaching specific financial goals tightly linked to their overall corporate strategy (Albuhisi & Abdallah, 2018; Kumar *et al.*, 2022). This ensures a clear cause-and-effect relationship between financial decisions and strategic objectives (Freudenreich *et al.*, 2020). The BSC perspective emphasizes that financial effectiveness for SMEs extends beyond mere profitability, requiring a balanced set of metrics reflecting both short-term and long-term health. SME financial effectiveness encompasses the achievement of specific financial goals tightly integrated with the overarching corporate strategy, which includes robust sales growth, efficient profit generation, and vigilant cash flow management to uphold operational stability (Kumar *et al.*, 2022; Yoshikuni & Albertin, 2018).

Unlike large firms, service SMEs often face unique circumstances such as smaller resource bases, a lack of communication systems, and stronger local embeddedness (Ho *et al.*, 2023). In this context, integrative dynamic capabilities, both internal and external, play a pivotal role (Jiang *et al.*, 2020). External integrative dynamic capabilities enable SMEs to leverage resources and knowledge from external stakeholders, including suppliers, customers, and the local community, thereby addressing challenges at lower costs and adapting to market demands. This continuous adaptation enhances market performance and financial effectiveness (Cyfert *et al.*, 2021). Internally, integrative dynamic capabilities foster knowledge exchange and collaboration among employees, reducing duplication and fostering trust (Jiang *et al.*, 2020). This internal collaboration enhances operational effectiveness, reputation, and customer attraction, ultimately contributing to improved financial effectiveness for service SMEs. Furthermore, an innovation advantage involves providing customers with cutting-edge and high-value products, leading to greater satisfaction, loyalty, and perceived quality (Tai *et al.*, 2021). Similarly, firms with a market differentiation advantage can create distinct brand images, boosting customer loyalty and satisfaction, allowing them to charge premium prices and sustain higher profits (Yuliansyah *et al.*, 2021). Moreover, innovation facilitates customer attraction, and adaptation to market changes (Gustafsson *et al.*, 2020). The direct relationship between innovation and financial effectiveness has long been established (Abid *et al.*, 2023; Yuliansyah *et al.*, 2021).

Therefore, we formulate the following hypotheses:

H4: Dynamic capabilities are positively related to SME effectiveness.

H5: Innovation is positively related to SME effectiveness.

The Mediating Roles of Dynamic Capabilities and Innovation

The adaptive approach of Miles and Snow (1978), particularly emphasizing the entrepreneurial and engineering domains, along with insights from the RBV and DCV, elucidates how strategic orientations impact financial effectiveness in dynamic service sectors (Ambrosini *et al.*, 2022). Prospectors, with their external focus, can leverage strong dynamic capabilities to sense opportunities, seize them through innovation, and reconfigure resources for continual adaptation (Bonyadi Naeini & Jalilian Ahmadkalaei, 2022). This fosters the development of VRIN service offerings, leading to a positive impact on financial effectiveness (Yuliansyah *et al.*, 2021). Defender-oriented SMEs, prioritizing internal efficiency and market stability, frequently face challenges in innovating within dynamic landscapes (Chih-Yi & Bou-Wen, 2021). However, defenders can harness dynamic capabilities to optimize existing services, gaining cost advantages and enhancing overall effectiveness (Restuti *et al.*, 2023). While radical innovation may not be their strength, dynamic capabilities empower them to adapt and compete effectively in the dynamic service sector. Accordingly, we hypothesize the following:

H6a: Dynamic capabilities and Innovation mediate the relationship between Prospector and SME effectiveness.

H6b: Dynamic capabilities and Innovation mediate the relationship between Defender and SME effectiveness.

Figure 1 presents our research model.

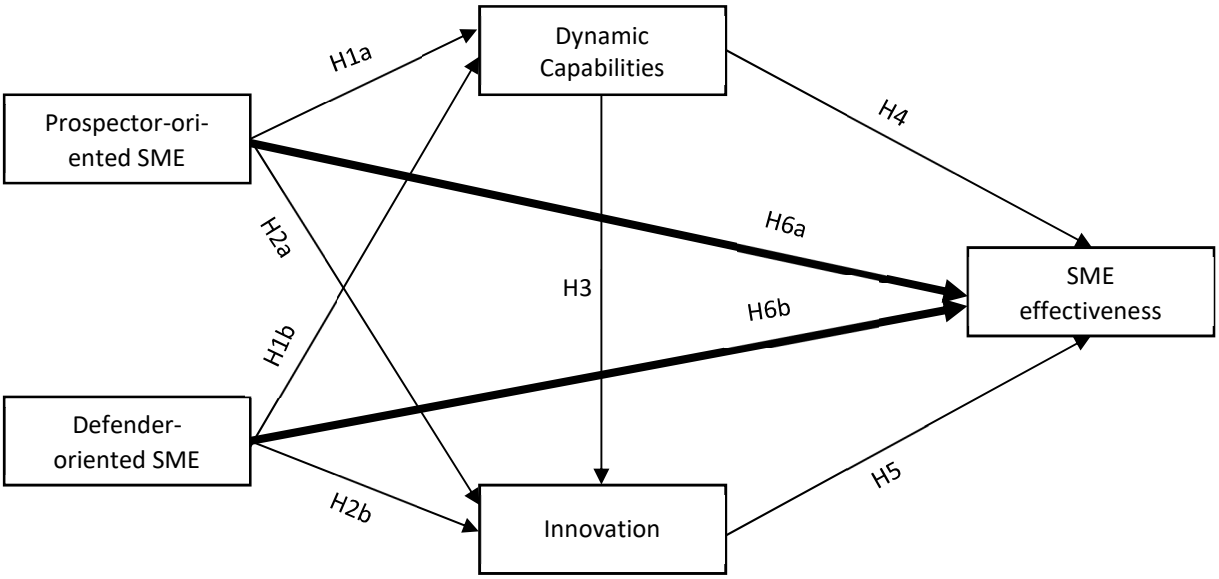

Figure 1. Research model

Source: own elaboration.

RESEARCH METHODOLOGY

Sampling and Data Collection

This research centres on service SMEs in Vietnam's Southeast Key Economic Region (SKER) due to compelling reasons. SKER represents a critical pillar of Vietnam's service sector, boasting substantial contributions to the nation's GDP (32% of the country's GDP) and state budget revenue (44.7% of the total state budget revenue) (Vietnam General Statistic Office, 2022). With prominent urban centres like Ho Chi Minh City, Dong Nai, and Binh Duong, SKER serves as a magnet for businesses, talent, and investment, fostering an environment conducive to the flourishing of service industries (Long & Ngu-

yen, 2024). SMEs and large corporations differ significantly in organizational structure, business settings, and legal contexts, with SMEs confronting unique governance challenges amidst diverse legal and regulatory environments (Hermawati & Gunawan, 2021). Moreover, Vietnam's divergent business cultures exert a substantial influence on regional decision-making approaches: while the Southern region favours collaborative and consensus-driven processes, the Northern counterpart prioritizes hierarchical structures and procedural adherence (Mai *et al.*, 2009). This regional contrast in decision-making styles may potentially contribute to variations in risk aversion strategies among businesses operating in different regions of the country (Tran, 2021). Therefore, there exists a critical need to delve deeper into the specific context of service SMEs in SKER, considering their unique attributes and operating environments, to better understand how they leverage dynamic capabilities, innovation, and strategic perspectives to enhance financial effectiveness.

The items for all constructs were sourced from previously validated scales, with slight modifications to fit the context. Face and content validity were ensured through literature examination and feedback from managers of service SMEs and business management scholars. The questionnaire underwent back-translation from English to Vietnamese and vice versa with the aid of three bilingual experts (Rafiq *et al.*, 2022). A pilot survey was conducted to validate the data set, and respondents' feedback was gathered to address any encountered issues.

This study utilizes a questionnaire survey approach to collect data for assessing the research hypotheses in the proposed model. Due to the lack of company list of trade and service SMEs, a sampling frame was unavailable. To address this, we employed judgmental sampling aiming for analytic generalization (Allaberganov *et al.*, 2021), and supplemented this with snowball sampling to expand our respondent pool through initial participants' networks. These techniques were applied from the fourth quarter of 2022 to the fourth quarter of 2023. Data collection was conducted through both article and online self-administered surveys. To ensure the reliability of the data, we used verified email lists from reputable sources, including the Southern Small and Medium Enterprise Association (ASMES) (https://asmes.org.vn/) and the SME portal in Vietnam (https://sme.com.vn/). We distributed article surveys at events organized by SME associations and agencies, such as the Saigon Exhibition and Convention Center (SECC) and the WORLD TRADE CENTER – WTC Binh Duong New City. Screening questions at the beginning of both online and article surveys confirmed that respondents were indeed founders, co-founders, or managers of trade and service SMEs, thus filtering out unqualified responses. Informed consent was also obtained from all participants, ensuring adherence to ethical standards. The study achieved a validity rate of 70.17% with 421 completed responses out of 600 distributed questionnaires. Refer to Table 1 for an overview of the surveyed firms and respondents' profiles.

Table 1. Profile of firms and respondents (N = 421)

Firms	No.	%	Respondents	No.	%
Number of employees			*Gender*		
Less than 10	121	28.74%	Male	174	41.33%
10-50	134	31.82%	Female	247	58.67%
51-100	101	24.00%	*Educational level*		
101-200	65	15.44%	High school	14	3.33%
Capital			College	8	1.90%
Less than 10 billion VND	271	64.37%	Bachelor/ Engineer	306	72.68%
10-100 billion VND	150	35.63%	Postgraduate	93	22.09%
–			*Job position*		
			Founder	98	23.28%
			Co-founder	216	51.30%
			Manager	107	25.42%

Source: own study.

Measurement Constructs

All constructs were assessed using a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). Prospector and defender orientations were evaluated with items adapted from Andrews *et al.* (2007) and Avci *et al.* (2011), with five items for the prospector and four for defender. Innovation was measured using nine items from García-Morales *et al.* (2012), while dynamic capabilities were assessed with six items from Jiang *et al.* (2020). We gauged the SME effectiveness using three items focusing on financial effectiveness, adapted from Yoshikuni and Albertin (2018) based on the Balanced Scorecard framework developed by Kaplan and Norton (Kaplan *et al.*, 2001) (See Appendix).

Analytical Procedures

The research employed partial least squares structural equation modelling (PLS-SEM) for analyzing the proposed model. PLS-SEM is well-suited for regression analysis with mediation and is particularly beneficial for assessing complex and simple research models, providing successive approximations for estimates of loadings and structural parameters (Hair Jr *et al.*, 2017; Sarstedt *et al.*, 2021). It considers various features of the model, such as common characteristics and error differences, making it suitable for measuring predictive ability (Hair Jr *et al.*, 2017). Moreover, it has been widely used in previous studies of SME strategic management (Akbar *et al.*, 2020; Kim, 2022). The two-step evaluation of PLS-SEM involves initial checks for multicollinearity and common method bias, followed by a thorough assessment of the measurement and structural models using SmartPLS (Hair Jr *et al.*, 2019). We evaluated multicollinearity using VIF values (Kock & Lynn, 2012), while we assessed common method bias using techniques like Harman's single-factor test (Kock, 2015). The measurement model assessment ensured constructs' reliability and validity, focusing on convergent validity (AVE), discriminant validity (HTMT ratio), and reliability (Cronbach's alpha and composite reliability). The structural model assessment examines the relationships between constructs, considering path coefficients, variance explained (R-squared), and predictive accuracy (Q-squared).

RESULTS AND DISCUSSION

Common Method Bias

To assess potential common method bias (CMB), we. conducted various analyses. Initially, we performed a Harmon single-factor test on five factors: prospector, defender, dynamic capabilities, innovation, and SME effectiveness, using IBM SPSS. Results indicated that CMB was not a significant concern, as all factors were present and the highest covariance explained by one factor was 44.5%, below the 50% cutoff value (Kock, 2015). Moreover, we conducted a full collinearity test to identify any constructs with variance inflation factor (VIF) values equal to or higher than 3.3. All VIF values were below 3.3, indicating no significant CMB concerns (Kock & Lynn, 2012).

Measurement Model

We used Cronbach's alpha, indicator reliability, and composite reliability to assess internal consistency, while convergent and discriminant validity were evaluated to ensure the measure captured the intended construct and differed from other constructs (Hair Jr *et al.*, 2017). All indicators showed outer loadings exceeding the 0.6 threshold (Yana *et al.*, 2015), while both Cronbach's Alpha and Composite reliability (CR) values exceeded 0.7, indicating robust internal consistency (Hair Jr *et al.*, 2017; Henseler *et al.*, 2017) (Table 2). The average variance extracted (AVE) for all constructs surpassed 0.5, indicating satisfactory convergent validity (Fornell & Larcker, 1981). Additionally, discriminant validity was evaluated using the Heterotrait-Monotrait (HTMT) ratio, as shown in Table 3. The results indicate that all HTMT values are below the threshold of 0.90 (Henseler *et al.*, 2017). This confirms the discriminant validity of the constructs. Thus, the measurement model in this study met the established criteria for reliability and validity.

Table 2. Constructs' reliability and validity

Constructs	Factor loading	α	CR	AVE
Prospector-oriented SME (PR)		**0.857**	**0.898**	**0.638**
PR1	0.800	–	–	–
PR2	0.829	–	–	–
PR3	0.801	–	–	–
PR4	0.829	–	–	–
PR5	0.730	–	–	–
Defender-oriented SME (DE)		**0.811**	**0.876**	**0.638**
DE1	0.794	–	–	–
DE2	0.795	–	–	–
DE3	0.772	–	–	–
DE4	0.834	–	–	–
Dynamic capabilities (DC)		**0.870**	**0.902**	**0.606**
DC1	0.784	–	–	–
DC2	0.816	–	–	–
DC3	0.822	–	–	–
DC4	0.735	–	–	–
DC5	0.734	–	–	–
DC6	0.775	–	–	–
Innovation (IN)		**0.897**	**0.916**	**0.549**
IN1	0.757	–	–	–
IN2	0.684	–	–	–
IN3	0.704	–	–	–
IN4	0.746	–	–	–
IN5	0.719	–	–	–
IN6	0.758	–	–	–
IN7	0.756	–	–	–
IN8	0.797	–	–	–
IN9	0.743	–	–	–
SME effectiveness (SE)		0.841	0.904	0.758
SE1	0.870	–	–	–
SE2	0.874	–	–	–
SE3	0.869	–	–	–

Source: own study.

Table 3. Discriminant validity: HTMT ratio

Constructs	PR	DE	DC	IN	SE
PR	–	–	–	–	–
DE	0.897	–	–	–	–
DC	0.873	0.811	–	–	–
IN	0.714	0.674	0.642	–	–
SE	0.663	0.652	0.586	0.822	–

Notes: PR = prospector-oriented SME, DE = defender-oriented SME, DC = dynamic capabilities, IN = Innovation, SE= SME effectiveness.
Source: own study.

Structural Model

Hypothesis testing employed a bootstrapping procedure with 5 000 resamples (Hair *et al.*, 2019), allowing the computation of t-values. Thresholds for significance were set at t-values exceeding 1.96 (at a 5% significance level) and 2.57 (at a 1% significance level), following standard two-tailed hypothesis testing practice.

The findings from Table 4 and Figure 2 indicate that both prospector-oriented and defender-oriented SMEs have a significant positive impact on dynamic capabilities (β = 0.571, t-value = 9.696, p-value < 0.01, and β = 0.211, t-value = 3.649, p-value < 0.01), supporting H1a and H1b. Moreover, prospector-oriented SMEs exhibited a stronger influence on dynamic capabilities compared to defender-oriented SMEs. However, only prospector-oriented SMEs positively affected innovation (β = 0.359, t-value = 4.673, p-value < 0.01), confirming H2a, while the impact of defender-oriented SMEs on innovation was rejected (p-value > 0.05). Regarding the direct relationship among dynamic capabilities, innovation, and SME effectiveness, the study supported H3, showing that dynamic capabilities positively impact (β = 0.243, t-value = 2.656, p-value < 0.01). However, H4, which proposed a positive relationship between dynamic capabilities and SME effectiveness, was not supported (p-value > 0.05). Conversely, H5, suggesting a positive association between innovation and SME effectiveness, was confirmed (β = 0.556, t-value = 9.870, p-value < 0.01).

In terms of mediating effects, the results confirmed both H6a and H6b, indicating that dynamic capabilities and innovation concurrently mediate the relationships between prospector orientation and SME effectiveness (β = 0.077, t-value = 2.718, p-value < 0.01), as well as between defender orientation and SME effectiveness (β = 0.029, t-value = 2.140, p-value < 0.05). Moreover, prospector exerted a greater indirect impact on SME effectiveness compared to defender.

Table 4. Hypotheses testing

Relationships	Original Sample	T Statistics	P Values	Decision
Direct effects				
H1a: PR -> DC	0.571	9.696	0.000**	*Accepted*
H1b: DE -> DC	0.211	3.649	0.000**	*Accepted*
H2a: PR -> IN	0.359	4.673	0.000**	*Accepted*
H2b: DE -> IN	0.106	1.755	0.079	*Rejected*
H3: DC -> IN	0.243	2.656	0.008**	*Accepted*
H4: DC -> SE	0.066	0.995	0.320	*Rejected*
H5: IN -> SE	0.556	9.870	0.000**	*Accepted*
Mediating effects				
H6a: PR -> DC -> IN->SE	0.077	2.718	0.007**	*Accepted*
H6b: DE -> DC -> IN->SE	0.029	2.140	0.032*	*Accepted*

Notes: t-value ≥2.57 considers significant level at **p <0.01 and t-value ≥ 1.96 considers significant level at *p<0.05;
PR = Prospector-oriented SME, DE = Defender-oriented SME, DC = Dynamic capabilities, IN = Innovation, SE= SME effectiveness.
Source: own study.

Model Strength

We assessed the model's predictive accuracy using R2 values, with prospector and defender explaining 56.3%, 42.3%, and 54.0% of the variance in dynamic capabilities, innovation, and SME effectiveness, respectively. These results indicate a moderate predictive accuracy (Hair *et al.*, 2019). Furthermore, we evaluated the model's predictive relevance with Q2 values, which we found to be 33.3% for dynamic capabilities, 22.4% for innovation, and 40.2% for SME effectiveness, all above zero and confirming the model's predictive relevance (Table 5).

The results of our study shed light on the intricate relationships between prospector and defender-oriented SMEs, innovation, dynamic capabilities, and SME effectiveness in Vietnam's service sector, analysed through the perspectives of RBV and the DCV.

Table 5. Model strength

Dimensions	R^2	Q^2
Dynamic capabilities	0.563	0.333
Innovation	0.423	0.224
SME effectiveness	0.540	0.402

Source: own study.

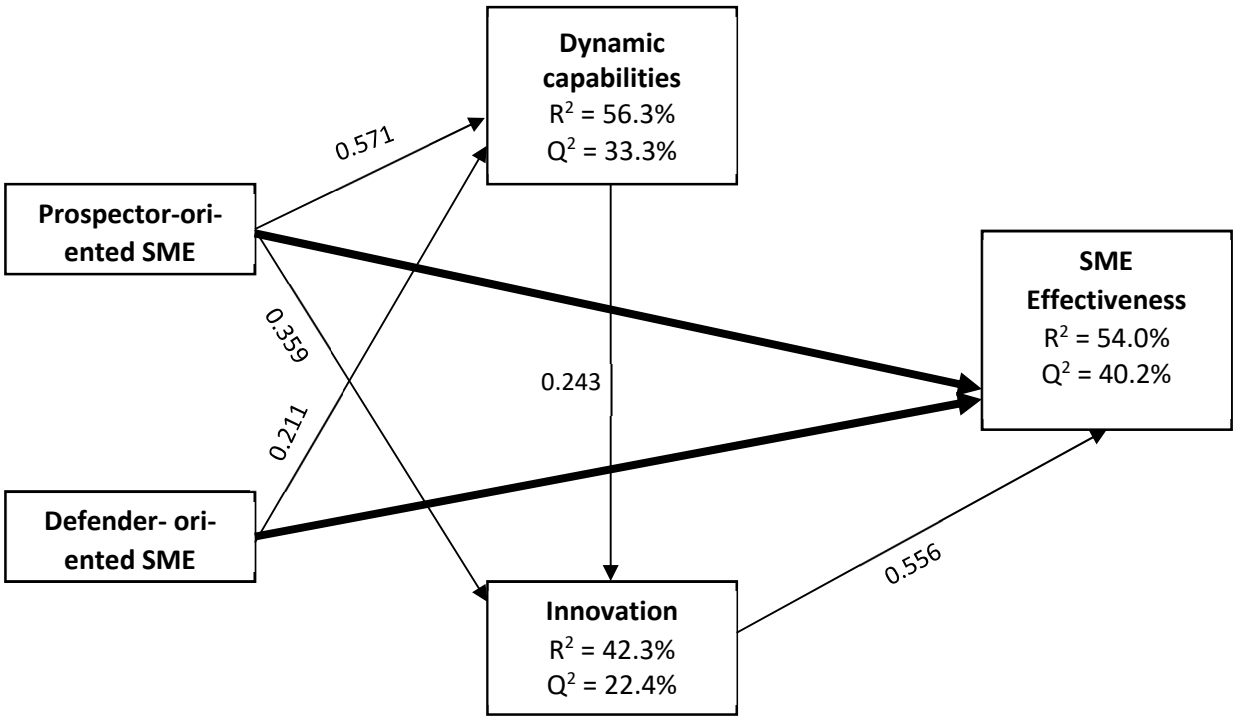

Figure 2. Path analysis
Source: own elaboration.

Both H1a and H1b suggest a positive influence of prospector and defender orientations on dynamic capabilities, consistent with the RBV. Prospector SMEs, driven by an external focus, actively seek new opportunities and technologies, strengthening dynamic capabilities. This aligns with previous studies linking prospectors to dynamic capabilities (Marozau *et al.*, 2023; Nasution *et al.*, 2021). Notably, prospectors exhibit a greater impact on dynamic capabilities compared to defenders. Similarly, defender SMEs, emphasizing efficiency (H1b), likely possess refined internal processes and resource management skills, which can be viewed as a form of dynamic capability, enabling them to optimize existing resources and enhance service offerings (Restuti *et al.*, 2023). Regarding the relationship between strategic orientations and innovation, our study confirmed that prospector-oriented SMEs had a positive relationship with innovation (H2a), reflecting their constant exploration of new market trends and fostering a culture conducive to generating novel service ideas, which is consistent with findings of previous studies (Kim *et al.*, 2024). However, contrary to previous studies (Kim *et al.*, 2024; Lukito-Budi *et al.*, 2023), the research found no significant relationship between defender-oriented SMEs and innovation (H2b). This can be explained by the defender mindset, which prioritizes stability and efficiency over exploratory ventures. Defenders are risk-averse, focusing primarily on optimizing internal resources and processes rather than investing in uncertain exploratory innovation (Chen *et al.*, 2023). Their internal focus leaves less emphasis on external trends, which are crucial for identifying and capitalizing on new opportunities (Handoyo *et al.*, 2023). Consequently, defenders may lack the strong external focus required for exploratory innovation compared to prospectors, who actively seek new market opportunities.

The finding supports H3 that dynamic capabilities are positively related to innovation, aligning with the established views of Tsou and Chen (2020) and Ziyae *et al.* (2022). Dynamic capabilities equip firms with the ability to accumulate and reconfigure resources, crucial for venturing into new and uncertain territories characteristic of exploratory innovation. Furthermore, they foster firm attributes like adaptability and a learning approach, essential for navigating the challenges and uncertainties of exploratory innovation (Ziyae *et al.*, 2022). Next, H4, which posited that dynamic capabilities positively related to SME effectiveness, was rejected, contradicting the findings of Cyfert *et al.* (2021) and Jiang *et al.* (2020). This suggests that although dynamic capabilities may lead to the development of new customers, marketing initiatives, suppliers, and products in a volatile environment, the observable impact on financial effectiveness might be delayed due to the time required to capitalize on these outcomes (Baía & Ferreira, 2024; Nedzinskas *et al.*, 2013). However, the study found that innovation is positively related to SME effectiveness (H5), aligning with previous research by Yuliansyah *et al.* (2021) and Abid *et al.* (2023). By successfully venturing into exploratory innovation, SMEs can create cutting-edge services that set them apart from rivals and boost customer pleasure, loyalty, and eventually financial effectiveness by successfully pursuing exploratory innovation (Yuliansyah *et al.*, 2021).

The accepted mediation hypotheses (H6a & H6b) reveal a critical aspect – dynamic capabilities and innovation act as intermediaries in translating strategic orientations into SME effectiveness, drawing on the combined insights of the RBV and DCV. Prospector SMEs leverage their dynamic capabilities to exploit their innovative service offerings, leading to better financial effectiveness (H6a). This finding is consistent with the established views of Bonyadi Naeini and Jalilian Ahmadkalaei (2022) and Yuliansyah *et al.* (2021). Prospector SMEs, driven by their thirst for novelty, develop strong dynamic capabilities to tackle uncertainty and pursue exploratory innovation (Bonyadi Naeini & Jalilian Ahmadkalaei, 2022). These capabilities empower them to create unique and financially effective service offerings by venturing into uncharted territory, ultimately achieving better financial effectiveness via premium pricing or attracting a larger customer base (Yuliansyah *et al.*, 2021). Despite their reluctance towards exploratory innovation, defenders leverage dynamic capabilities to efficiently adapt and refine their services, mitigating the constraints on innovation (Kim *et al.*, 2024; Lukito-Budi *et al.*, 2023). The acceptance of H6b emphasizes the vital role of dynamic capabilities and innovation in enhancing the financial effectiveness of defender-oriented SMEs, aligning with the insights of Chih-Yi and Bou-Wen (2021).

CONCLUSIONS

Theoretical Implications

This research offers several significant theoretical contributions. Firstly, it examined the direct relationships between prospector and defender orientations, dynamic capabilities, innovation, and financial effectiveness in service SMEs within emerging economies. This provides a comprehensive understanding of these relationships across different contexts. Secondly, by utilizing the combined lenses of the RBV and DCV and extending the Miles and Snow framework with the adaptive cycle, the study demonstrates how dynamic capabilities and innovation empower both prospectors and defenders to navigate change effectively (Ferreira *et al.*, 2020; Thomä & Zimmermann, 2019). The findings highlight dynamic capabilities as crucial in linking strategic orientations and innovation, allowing defenders to achieve effectiveness through incremental improvements. Thirdly, by addressing the lack of research on the BSC in service sectors, this study establishes a foundation for integrating the BSC into performance evaluation for service SMEs, offering a holistic approach to measuring success in dynamic environments (Freudenreich *et al.*, 2020; Kumar *et al.*, 2022).

Practical Implications

The study's empirical results underscore the significance of strategic orientations, specifically prospector and defender, in driving SME effectiveness through dynamic capabilities and innovation. For business practitioners managing service SMEs in emerging markets, these findings offer essential insights. Encouraging a prospector orientation, where there is a continual redefinition of product/service priorities and an active search for new opportunities, enhances dynamic capabilities and enables quick ad-

aptation to market changes. Embracing a growth-oriented strategy and taking calculated risks can drive innovation, thereby increasing SME effectiveness through the development of new products and services and investments in proprietary technologies. Conversely, defender-oriented SMEs should prioritize maintaining stable product/service priorities and operating within known activity areas, which allows for continuous improvement and strengthens dynamic capabilities. By integrating dynamic capabilities, defender-oriented SMEs can adapt to environmental changes and identify new business opportunities, thus enhancing effectiveness through incremental improvements. Practitioners should aim to balance prospector and defender orientations, continually develop and reconfigure operational resources and capabilities, and prioritize innovation to boost organizational effectiveness. Moreover, adopting comprehensive performance metrics like the BSC can provide a well-rounded assessment of SME success in dynamic environments.

Limitations and Future Research Directions

This study illuminated the strategic pathways for Vietnamese service SMEs by examining the interrelationships between prospector and defender-oriented SMEs, dynamic capabilities, innovation, and SME financial effectiveness. However, limitations and promising areas for future research still exist. Firstly, while our model captures key relationships through the lens of RBV and DCV, future studies should consider alternative theoretical frameworks, such as institutional theory, which might interact with prospector and defender orientations in developing dynamic capabilities (Gupta *et al.*, 2020). Investigating the moderating effects of factors like industry and firm age on the relationship between dynamic capabilities and innovation would also be beneficial (Akorede, 2023). Secondly, the sample size of 421 Vietnamese service SMEs may limit the generalizability of our findings. Future research should explore these relationships across diverse geographical and industry contexts to determine if the observed patterns hold true elsewhere (Jie *et al.*, 2023). Thirdly, relying on self-reported data introduces potential biases, such as social desirability bias. Future research could employ a multi-method approach, incorporating interviews with key informants to strengthen the validity of the findings (Farquhar *et al.*, 2020). Lastly, the cross-sectional design limits our ability to establish causal relationships between variables. Longitudinal studies tracking SMEs over time would provide a clearer picture of cause-and-effect dynamics (Ikram *et al.*, 2019). These studies could investigate how dynamic capabilities developed in one period influence innovation and effectiveness in subsequent periods.

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Appendix: Measurement items

Prospector (PRO)

PR1. We continually redefine our products/services priorities.
PR2. It is of primary importance for our organization to develop new services and find new markets for these products/services.
PR3. Searching for new opportunities is a major part of our overall strategy.
PR4. Our organization adopts a growth-oriented strategy.
PR5. Our organization is not afraid of taking risks.

Defender (DEF)

DE1. We seek to maintain stable products/services priorities.
DE2. Our organization prefers to operate in known activity areas.
DE3. Instead of enriching its activities, our organization prefers to improve its present products and services.
DE4. Instead of fast growth, our organization places importance on competing by improving the quality of its available assets.

Dynamic capabilities (DC)

DC1. We actively search for ways to advance our operational resources and capabilities
DC2. We frequently scan the environment to identify new business opportunities
DC3. We are able to act quickly to seize emerging opportunities
DC4. We are flexible enough to invest in new ventures as they arise
DC5. We continuously recombine our resources and capabilities to align with strategic objective
DC6. We reconfigure our resources and capabilities to align with environmental and market changes

Innovation (INO)

In the past three years, indicate whether the following have grown rapidly:
IN1. Organization's emphasis on developing new products or services.
IN2. Rate of introduction of new products or services into the market.
IN3. Organization's spending on new product or service development activities.
IN4. The number of new products or services added by the organization and already on the market.
IN5. The number of new products or services that the organization has introduced for the first time on the market.
IN6. Investment in developing proprietary technologies.
IN7. Emphasis on creating proprietary technologies.
IN8. Organization's emphasis on technological innovation.
IN9. Organization's emphasis on pioneering technological developments in its industry.

SME Effectiveness (SE)

SE1. Our organization reaches its goals of profitability to satisfy shareholders
SE2. Our organization is efficient in terms of spending (*i.e.* cost management, expenses, and investments) to meet productivity goals.
SE3. Our organization reaches its goals with respect to revenues.

Authors

The contribution share of authors is equal and amounted to 50% for each of them.
Ms. Thu-Hang Le – Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the article.
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