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Game Change in Retail: A Managerial Perspective on the Importance of Key Components in Creating Business Models in Grocery Retail

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Abstract

The creation of business models reflects the transformation that retail is undergoing. The aim of the paper is to fill the gap in scientific discourse and practice with an orientation to the current state of business model creation in grocery retail based on a managerial perspective using a comprehensive approach to the perception of the micro- and macroenvironment. The results reflect the statements of 251 managerial retail grocery units in the capital of Slovakia. Using exploratory factor analysis, new elements of business models were identified, with the key ones being the retail ecosystem, strategic marketing, the economic and political situation, and cost orientation. The dimensions are interconnected and create a complex retail grocery business model. It can be stated that the method of applying these dimensions of business model creation is conditioned by the size of retail and the implementation of loyalty programmes. From an academic perspective, a shift in the theoretical basis of strategic management and business model innovation can be noted in terms of identifying the interrelatedness between business model components that not only capture the internal and external microenvironment but also reflect the dynamic macroenvironment. From a managerial practice perspective, the research creates a basis for supporting decision-making by top and middle management in the transformation of the retail business model.

Key words

retail, grocery retail, business models, management, business model components.

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Introduction

Business model development in food retail is a key topic due to the specificities of this area, such as high competition (Aranda et al., 2018), pressure on supply chain efficiency (Jie & Gengatharen, 2019), and dynamically changing end consumer behaviour (Čvirik & Cagaňová, 2025; Kita et al., 2024). The traditional Business Model Canvas is considered outdated in this context (Braun et al., 2021; Sibalija et al., 2021), as it provides a static and simplified view of the functioning of the company without adapting to the macro environment, globally affecting the dynamics of relationships in the value chain. Therefore, this study considers the issue of business models in retailing for a specific area

in reducing tension (Do Vale et al., 2025) between supply chain members and consumer market preferences. The study incorporates sales directly to end customers as a decision variable in the proposed model that affects the functioning of the entire micro- and macro-environment, which brings an opportunity not only for optimisation but also for creating a relationship with customers (which brings value) and innovation (An & Han, 2020; Jocevski, 2020; Keiningham et al., 2020; Palmié et al., 2022). Retail thus gains innovative potential, which is crucial, especially in retail food units, where low product (assortment) differentiation can be identified. It is the services that make up the overall portfolio offered that appear to be factors of differentiation in the sense of the above (Coughlan, 2006).

In terms of focus and scope, the study focuses on food retail from the perspective of management practice to support top and middle management decision-making in the transformation of the business model in response to omnichannel strategies with an emphasis on regulatory and value-creating market requirements. The study thus follows up on the criticism of traditional frameworks (e.g., the Business Model Canvas) in academic literature and contributes to the expansion of theoretical discourse with empirically based knowledge from the highly competitive and low-margin food retail sector in the context of generating a new retail business model from the perspective of not only the microenvironment but also the broader macroenvironment, which is inevitably reflected in business models. At the same time, it is necessary to emphasise that while the microenvironment is to some extent influenced by management strategies, the impact of the macroenvironment is only slightly influenced, and management practice must therefore reflect it.

Consequently, a successful business model for retail food units must reflect this fact, bringing higher value, better relationships, and a positive experience to customers (Grewal et al., 2009). Sorescu et al. (2011) state that a retail business model needs to address at least three components, namely: (1) format—represents a way of solving key retail activities (Diamond et al., 2009) with an emphasis on technology (Padgett & Mulvey, 2007); (2) activities—orientated towards customer experience (Borghini et al., 2009); and (3) partner management (Basuroy et al., 2001). In the context of BM theory, the findings of the article encourage managers to consider a change in traditional economic thinking in the future and to embrace both market-driving and market-driven approaches (Carpenter, 2023; Do Vale et al., 2025; Kwiliński et al., 2025).

The aim of the paper is to fill the gap in scientific discourse and practice with an orientation to the current state of business model creation in grocery retail based on a managerial perspective using a comprehensive approach to the perception of the micro- and macroenvironment. First of all, it is necessary to examine and identify potential components of the business model from a managerial perspective. Subsequently, the creation of a factor structure helps to identify and systematise the operation of latent components of the business model. Examining differences in the perception of latent structures by retail food units based on their characteristics helps to typologise business model specifications. Given the above, the following research questions were formulated for the comprehensive fulfilment of the objective:

RQ1: How can the importance of the identified key components of business models be assessed by managers of retail food units?

RQ2: What key dimensions are behind the creation of business models?

RQ3: How do the selected characteristics of retail food units shape the identified dimensions?

The paper is structured to meet the formulated research objective. The literature review points out the importance of retailing, the importance and current setting of business models, as well as potential empirical and theoretical components of business models from the perspective of the micro- and macroenvironment. In the methodology, the data and methods were characterised. The data result from primary collection using surveys of 251 managers of retail food units in Bratislava. In the context of the objective and research questions, descriptive statistics were used to identify the significance (keyness) of potential components of business models. To identify the dimensionality (latent factor structure) of business models, exploratory factor analysis (EFA), which increases the analytical clarity

and theoretical consistency of the model, was used. The subsequent examination of differences (using non-parametric statistical tests) in the perception of latent factors based on the characteristics of retail food units helped to identify the current setting of business model typologies in the context of their specificities.

1. Literature review

In recent years, retail has been undergoing a significant transformation in the world (Jin & Shin, 2020; Mostaghel et al., 2022) and in Slovakia (Kunc & Križan, 2022; Križan & Bilková, 2022), which must necessarily be reflected in the understanding and creation of its business model. Of course, not only does the business environment play a key role in entrepreneurship, but also elements of the macro- and microenvironment of individual enterprises. Survival and growth in the market mean knowing and applying your competitive advantage, creating value for customers, and applying new technologies, as well as identifying and adapting to new trends (Har et al., 2022; Chanchaichujit et al., 2020; Kwiliński & Reznik, 2025). The term “business model” represents a certain reaction to the changes in the markets brought about by information technologies in the late 1990s (Dubosson-Torbay et al., 2002). A business model can be understood as “a process template for creating customer value with the help of operational and strategic activities influenced by the microenvironment and macroenvironment of a particular enterprise with an emphasis on generating a positive economic result for the enterprise” (Čvirik & Kita, 2024).

The literature suggests that it is necessary to consider the current situation and the perception of the micro and macro environment by managers, which is generated by business models (Barrero, 2022; Hill et al., 2021). In this spirit, it is necessary to identify not only the components of business models that are fundamental for a given time and place but also their perceived importance (Wirtz, 2020; Ritter & Pedersen, 2020; Hanaysha et al., 2021). Several studies focus on the components of business models (Osterwalder et al., 2010; Evers et al., 2023; Shakeel et al., 2020; Grabowska, 2022; Kita et al., 2023a), which point to the key importance of certain components that are universal, but it is important to note that their importance changes over time (Lanzolla & Markides, 2021; Filser et al., 2021). Standard business models primarily focus on the internal and external microenvironment of the company, which significantly limits the global view and macro perspective, thereby reducing the dynamism, adaptability, and flexibility of the business model. At the same time, it is necessary to realize that the macro and micro environments are significantly interconnected, where, for example, a macro problem in the form of poverty is reflected in the micro environment of low purchasing power and price sensitivity (Šoltés et al., 2023).

One of the key components of business models in retail is technology, which has the potential to increase customer comfort and service and thus bring customer value, which is also reflected in profitability. Digitalisation, as a current trend in retail, is a component that every successful business model should include (Ranta et al., 2021; Vaska et al., 2021). It goes without saying that the economic environment in which the retail business unit is located is identified (Thornton, 2024), while it is appropriate to identify the economic situation of the domestic country but also within the world forum given the trend of internationalisation and globalisation (Čvirik, 2023; Ramadan & Morshed, 2024). From a macro-environmental perspective, the political situation (Haaker et al., 2021; Valaskova et al., 2022) and demographics (Chatterjee et al., 2022; Karahan et al., 2024; Gagnon et al., 2021) are also fundamental, which is reflected in the generation of business models. Customers (Keiningham et al., 2020) and their needs (Mostaghel & Chirumalla, 2021) are an elementary element of business models that are directly orientated towards customer value. The other side of the distribution channel (suppliers) represents the input component of business models and thus influences the entire process of profit generation (Von Delft & Zhao, 2021; Sahabuddin et al., 2023). Marketing (Rangaswamy et al., 2020) and strategic marketing, whose emphasis is on competition (Zhao et al., 2020; Saura et al., 2023), are also essential for success in business models. Financial

indicators that influence the business model (Osterwalder et al., 2010), especially sales and costs (Chen et al., 2020), are also important.

In general, it can be assumed that there are twelve components of business models with an emphasis on their comprehensive perception. Of course, the effect of individual components is questionable, since retail food units have significant specificities in generating business models that must be applied in managerial decision-making (Kita & Čvirik, 2024). Generating the structure of the business model is important, while it is appropriate to examine latent dimensions that are not directly observable but affect its functionality, efficiency and performance (Zakrzewska-Bielawska et al., 2023). A factor-orientated business model can function as a concept in the sector under study. From a managerial point of view, the factor structure allows for strategic orientation on key areas of the business model, which supports targeted management and flexible adaptation of the business model and at the same time reduces the potential risk of isolated managerial decisions (Hristov et al., 2022; Roscoe et al., 2022).

When implementing business models of retail food units, it is appropriate to examine the impact of specifics, which is reflected not only in the completion of the knowledge base but also in the specification of recommendations for management. Based on the literature, it can be assumed that the key characteristics of retail food units that have an effect on the business model will be 1) the type of assortment offered (Yang et al., 2024), 2) the implementation of the loyalty programme (Belli et al., 2022), and 3) the size of the store (Kita & Čvirik, 2024). When identifying the offered assortment, managers determined whether it was a retail unit offering exclusively food products or a retail unit offering both food and non-food products.

2. Methodology

2.1. Data

The population was defined as managers of retail food units in the capital of Slovakia. The choice of Bratislava as an empirical environment for business model research is not accidental. First of all, Bratislava represents the most developed retail market in Slovakia with a concentration of international and domestic retail chains (Križan et al., 2016), a variety of sales formats with strong competitive pressure and innovative implantation (Kita et al., 2023a; Križan et al., 2016), which emphasizes the importance of business models as well as their better empirical investigation. From the perspective of context-specific findings, the research reflects local conditions in the selected location, but offers potentially generalizable knowledge at the level of business model components and the factor structure of business model creation. The presented structure is also based on elements of the macroenvironment, so it is not tied exclusively to the studied geographical location, but to the managerial and process logic of the functioning of retail business models. Bratislava thus serves as an analytical case within which we empirically investigate and develop a theoretical framework with the possibility of application in Central Europe in locations with a comparable market structure. The definition of the population was based on the participant's position within their managerial function. Managers have deep knowledge of their operations (Wang et al., 2020) and significantly influence their operational and strategic character (Jung et al., 2021). It is equally important to consider the location (Chaloupková & Kunc, 2022; Kita et al., 2023b) and control it since both the micro and macro environments (Singh et al., 2022) change in the context of the location, which affects the generation of the business model (Yun & Liu, 2019). Since it is not possible to include the entire population, it was chosen to generate a sample. The sample was generated randomly. 251 managers of retail food units in Bratislava participated in the primary survey. Based on the population and its sample sizes, the greatest statistical error (with 95% confidence) is around 5%.

2.2. Methods

Several research methods are chosen in the paper. In the context of evaluating the primary survey, was used elements of both descriptive and inductive statistics. The purpose of descriptive statistics is to explain the perspective of the managers who participated in the survey, and the meaning of

inductive statistics was to create a generalisation of the population, both of which are important in the evaluation of the primary survey (Guetterman, 2019). To identify latent dimensions, was used a multivariate statistical analysis tool, namely exploratory factor analysis (EFA). Methodological studies oriented towards statistical applications were used as a basis (e.g., Reio & Shuck, 2015; Howard, 2016; Watkins, 2018; Krasňanská et al., 2021; Schreiber, 2021; Čvirik, 2024; Goretzko et al., 2024, Ölveczká et al., 2024, Kwiliński et al., 2025, etc.), for the relevant use of the analysis, verification of its assumptions is necessary. For this purpose, 1) verification of the existence of correlation between the elements of the analysis, 2) use of suitability verification using the Kaiser-Meyer-Olkin test and 3) Bartlett's Test verifying matrix identity (non-zerosness of relationships). Given the nature of the data, it is appropriate to use Spearman's correlation coefficient to examine relationships (Eden et al., 2022). In the case of the Kaiser-Meyer-Olkin test, values higher than 0.8 are generally considered acceptable. Bartlett's test is required as significant to fulfil the assumption of using EFA. To determine the number of latent dimensions, it is currently recommended to use parallel analysis, which represents a simulation technique (Monte Carlo) and thus achieves current results closest to the modelled reality (Beauducel & Hilger, 2021). However, it is advisable to verify the model idea based on indicators, and it is generally recommended that the standardised root mean square residual (SRMR) values be less than 0.08, the Tucker Lewis Index (TLI) be greater than 0.9 and the comparative fit index (CFI) be greater than 0.9 (ideally greater than 0.95) (Cho et al., 2020; Goretzko et al., 2024). Based on the identified dimensions, a factor score can be determined, the type of which needs to be determined based on the factoring method used and any rotation, and this score is then used as a dimension score and subjected to statistical testing (Devlieger et al., 2016). Since the data did not meet the conditions for using parametric tests, was used non-parametric testing. Specifically, for two groups, was used the Mann-Whitney test (to determine the effect of the relationship, was used rank biserial correlation), and for comparison of multiple groups, was used Kruskal-Wallis (to determine the effect of the relationship, was used rank ϵ^2), and if the Kruskal-Wallis test is significant, it is appropriate to use Dunn's Post Hoc Comparisons Test with Bonferroni's correction (Clark et al., 2023; Okoye & Hosseini, 2024). For statistical analysis, was used the R programming language and its packages and extensions.

3. Research results

First of all, it was necessary to examine and identify potential components of the business model from a managerial perspective (RQ1). Based on the literature, it was identified twelve possible key components of business models, and within the first research question, study examined the perceived importance of these components by managers of retail food units. Managers assessed individual components on a seven-point bipolar scale, with extreme values defined as 1 – absolutely unimportant and 7 – absolutely important. The results were processed using descriptive statistics in Table 1.

Table 1. Perceived importance of key components of business models.

Component	Code	Valid	Missing	Median	Mean	Std. Dev.	Min	Max
Technologies	Q1	251	0	7	6.32	1.10	1	7
Economy of SR	Q2	251	0	7	6.20	1.11	1	7
World economy	Q3	251	0	6	5.44	1.52	1	7
Customer needs	Q4	251	0	7	6.78	0.64	1	7
Suppliers	Q5	251	0	7	6.67	0.77	1	7
Sales	Q6	251	0	7	6.72	0.60	3	7
Political situation	Q7	251	0	4	3.58	1.99	1	7
Competition	Q8	251	0	7	6.29	1.22	1	7
Marketing	Q9	251	0	7	6.39	1.01	3	7
Demographics	Q10	251	0	7	6.16	1.11	2	7
Costs	Q11	251	0	7	6.63	0.80	1	7
Customers	Q12	251	0	7	6.87	0.55	1	7

Source: Own processing.

As we can see (Table 1), the identified key components achieved relatively high scores. From the perspective of median values, the political situation can be identified as the least important component. This result is also supported by the calculation of the average value; however, it should be noted that this component had a high standard deviation, which indicates a difference in the assessment of individual actors. The most important component can be identified as the customers' component, which also achieved the lowest standard deviation, which indicates a consensus of managers in terms of importance.

Subsequently, the creation of a factor structure helps to identify and systematise the operation of latent components of the business model (RQ2). It can be assumed that the components have a common drive and consist of certain dimensions that represent the basis for decision-making in the creation of a business model from the perspective of managers. To investigate the possible existence of latent dimensions, it was used exploratory factor analysis (EFA). Data was verified whether are suitable for EFA and, therefore, whether the items are correlated with each other. The correlations in the form of a correlation matrix are in Table 2.

Table 2. Spearman's correlation coefficient.

r _s	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Q1	—											
Q2	0.46*	—										
Q3	0.276*	0.591*	—									
Q4	0.4*	0.383*	0.202*	—								
Q5	0.407*	0.355*	0.186*	0.638*	—							
Q6	0.470*	0.373*	0.180*	0.626*	0.538*	—						
Q7	-0.106	0.129*	0.360	-0.065	-0.092	-0.095	—					
Q8	0.307*	0.394*	0.292*	0.316*	0.318*	0.440*	0.045	—				
Q9	0.477*	0.360*	0.343*	0.396*	0.385*	0.457*	0.034	0.501*	—			
Q10	0.427*	0.311*	0.288*	0.288*	0.362*	0.338*	-0.042	0.317*	0.493*	—		
Q11	0.277*	0.253*	0.209*	0.377*	0.429*	0.569*	0.031	0.393*	0.395*	0.365*	—	
Q12	0.348*	0.302*	0.118	0.606*	0.531*	0.479*	-0.109	0.287*	0.389*	0.310*	0.423*	—

Note: *Alpha = 0.05.

Source: Own processing.

As we can see (Table 2), there are strong links between some components, and sometimes the links were not confirmed. This result points to the possibility of the existence of latent dimensions. It was also examined the assumptions orientated towards the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test. It can be stated that Bartlett's test was significant ($p = 1.376 \times 10^{-236}$), and the result of the KMO test was also acceptable (MSA overall = 0.820). Based on the above, it was possible to do EFA. Within the EFA, it was used the factoring method principal axis factoring. The number of latent dimensions was determined using parallel analysis. Since the initial solution did not bring unambiguous results, it was used rotation, and given the expected connection between the dimensions, it was selected oblique rotation, namely promax. EFA results are recorded in Table 3.

Table 3. Generic overview of EFA.

Factor Loadings	Factor 1	Factor 2	Factor 3	Factor 4	Factor Loadings	Factor 1	Factor 2	Factor 3	Factor 4
Customer needs	1.02				Competition		0.424		
Suppliers	0.865				World economy			0.826	
Customers	0.862				Political situation			0.515	
Sales	0.562				Costs				0.779
Technologies	0.448				Eigenvalues	4.752	1.663	1.189	0.985
Economy of SR	0.425		0.557		Proportion var.	0.272	0.132	0.111	0.072
Marketing		0.97			Cumulative	0.272	0.404	0.515	0.588
Demographics		0.592							

Note. The applied rotation method is promax. Only factor loadings greater than 0.4 are shown for better clarity.

Source: Own processing.

As can be seen from Table 3, were identified four latent dimensions, with the first dimension consisting of customer needs, suppliers, customers, sales and technologies; the second dimension consisting of marketing, demographics and competition; the third dimension consisting of the economic situation of the home country, the economic situation in the world and the political situation; and the last dimension focusing on only one component, which is costs.

Based on the semantics of the individual components and their interconnection, factor 1 can be designated as the retail ecosystem, factor 2 as the strategic marketing dimension, factor 3 as the economic-political dimension, and factor 4 as the cost dimension. All dimensions form a system for generating business models, with positive correlations of varying intensity between the dimensions in the interval from 0.179 to 0.664. Based on analysis was identified the strongest correlation between the retail system and the strategic marketing dimension (0.664). This was followed by the correlation between the strategic marketing dimension and the cost dimension (0.488) and the retail ecosystem and cost dimension (0.384). From the perspective of the quality of the model, it can be stated that it explains approximately 58.8% of the variability, which is acceptable. In terms of indices, it can be stated that the model is of high quality and reliably reflects reality (SRMR = 0.023; TLI = 0.915; CFI = 0.969).

Based on EFA, it was generated factor scores (due to the factoring method and rotation, a regression factor score was chosen) for individual operations, which we subsequently used in a deeper investigation (RQ3). When examining the possibilities of using parametric tests, it was concluded on the basis of the Shapiro-Wilk test that it is necessary to use non-parametric tests. To examine the differences in the context of individual factors, it was used the Mann-Whitney test ($\alpha = 0.05$). In the context of the results, it can be stated that the type of assortment offered does not affect the assessment of the retail ecosystem dimension ($p\text{-value} = 0.207$), the economic-political dimension ($p\text{-value} = 0.638$), or the cost dimension (0.623). Potentially, a certain effect can be expected within the Strategic Marketing Dimension ($p\text{-value} = 0.038$); however, the effect size given by the rank biserial correlation is low (0.203). Managers whose retail food units also offer non-food goods tend to perceive this dimension as more important in generating a business model.

Study also examined the effect of loyalty programme implementation. Due to the nature of the data, it was used the Mann-Whitney test ($\alpha = 0.05$). In the context of the results, it can be stated that loyalty program implementation had a significant effect on the perception of the retail ecosystem dimension ($p\text{-value} = 0.03$; effect size = 0.165), the economic-political dimension ($p\text{-value} = 1.5 \times 10^{-4}$; effect size = 0.288) and the strategic marketing dimension ($p\text{-value} = 0.02$; effect size = 0.176). Within these dimensions, it can be stated that, on average, managers whose retail units implement activities related to the loyalty programme attribute higher importance to individual dimensions when generating a business model. In the case of the cost dimension, managers whose retail food units do not implement a loyalty program tend to perceive its importance to a higher extent; however, it is necessary to add that this statement can be generalised to the population ($p\text{-value} = 0.196$). In other words, it is possible that this dimension does not reach differentiation in the population and therefore acts as universal in terms of perceived importance by managers when creating a business model. The size of the retail operation was identified by managers within four size groups. Given the number of groups and the characteristics of the data, it was used non-parametric testing, namely the Kruskal-Wallis Test ($\alpha = 0.05$). The results showed that within the cost dimension there are no differences between the two groups, and therefore it can be expected that managers of different-sized groups of retail food units perceive this dimension very similarly, which again points to the universality of this dimension.

In the case of the retail ecosystem dimension ($p\text{-value} = 0.003$; Rank $\epsilon^2 = 0.064$), the strategic marketing dimension ($p\text{-value} = 4.253 \times 10^{-5}$; Rank $\epsilon^2 = 0.101$), and the economic-political dimension ($p\text{-value} = 1.841 \times 10^{-5}$; Rank $\epsilon^2 = 0.109$), it can be assumed that at least between two size groups there are significant differences in the context of the perception of the importance of these dimensions. As indicated by the relatively low value of rank ϵ^2 , it can be expected that these differences will not be

between all groups, and therefore it is appropriate to use post-hoc tests to demonstrate specific groups. Therefore, it was used Dunn's post hoc comparisons using Bonferroni's correction. For clarity, was presented the results of only those comparisons that were found to be significant (Table 4).

Table 4. Dunn's Post Hoc Comparisons for Size Categories.

Dimension	Comparison	Wi	Wj	rrb	pbonf	Note
Retail Ecosystem	to 40m ² - over 700 m ²	102.383	152.621	0.359	0.017	*
	to 100m ² - over 700 m ²	108.386	152.621	0.356	0.005	**
Strategic Marketing Dimension	to 40m ² - over 700 m ²	98.783	157.682	0.436	0.002	**
	to 100m ² - over 700 m ²	100.402	157.682	0.457	5.820×10 ⁻⁵	***
Economic-Political Dimension	to 100m ² - to 700m ²	93.765	148.841	0.442	0.021	*
	to 100m ² - over 700 m ²	93.765	156.379	0.506	7.238×10 ⁻⁶	***
	to 400m ² - over 700 m ²	120.291	156.379	0.311	0.042	*

Notes: * p < .05, ** p < .01, *** p < .001.

Source: Own processing.

Table 4 shows that in the retail ecosystem dimension, differences were identified between retail units with an area of up to 40 m² and retail units with an area of more than 700 m², but also between retail units with an area of up to 100 m² and retail units with an area of over 700 m². The same was true within the strategic marketing dimension. In the case of the economic-political dimension, was identified differences between the size categories of retail food units up to 100 m² and up to 700 m²; up to 100 m² and over 700 m²; and also up to 400 m² and over 700 m². In terms of the differences found, it can generally be stated that managers of retail food units with a larger sales area tended to perceive factors as more important.

4. Discussion

Many studies focusing on business models differ in identifying the components of business models. It is necessary to create a comprehensive picture of the components based on both the microenvironment and the macroenvironment. In this sense, study present an overview in which identify the key components of business model generation. It can be stated that managers attach the highest importance to customers and their needs when creating business models. This is logical, since the purpose of a business model is to generate profit by bringing value to the customer (Costa Climent & Haftor, 2021).

When examining the key dimensions of business model generation, was identified four factors. Nailor and Buttriss (2020) consider that the concept of microenvironment and macroenvironment is undergoing an evolution that reflects the needs of the current era. It can be considered interesting that the retail ecosystem dimension and the strategic marketing dimension do not respect the division of components in terms of microenvironment and macroenvironment but contain both components, thus creating a connection between these environments. This suggests the need to perceive components beyond the boundaries of a simple categorisation into micro- and macro-elements. The significant role of the retail ecosystem stems from the very nature of retail, which is orientated towards end consumers. This ecosystem consists of input components such as suppliers, process components such as technologies, customers and their needs, and finally output components, which represent sales. Within the economic-political dimension, components of the macroenvironment can be identified, which are, however, perceived as less important in generating a business model. Costs represent such a different component that they contain their own dimension, which is important in pricing for the end consumer but also for creating innovation potential (Keiningham et al., 2020). The cost dimension of the business model has a high degree of conceptual autonomy in practice, which is also confirmed by the lower degree of nexus with the other dimensions. It is also necessary to note that the food sector is significantly affected by the fast-moving goods market and low margins

(Froulík et al., 2023), which can lead managers to an isolated understanding of cost as a critical aspect of generating both customer value and profit (Lueg & Ilieva, 2024). Based on the results, the strategic marketing dimension can be identified as a significantly interconnected dimension, which is logical when was considered the need for strategic planning at all levels of the retail food unit. Similarly, the cost item showed a moderately strong correlation in all dimensions.

Given the high standard deviation for some components, it can be assumed that other determinants also enter into the perceived importance, which may include 1) the type of assortment offered (Popp, 2020), 2) the implementation of loyalty programmes (Alshurideh et al., 2020; Chen et al., 2021) and 3) the size of the store (Kita & Čvirik, 2024). The results indicate that the type of assortment offered had a certain impact on the strategic marketing dimension. In this sense, it can be assumed that it is the assortment composition that influences strategic marketing decisions, while a broader assortment composition requires greater emphasis on a given dimension in terms of strategic planning at the retail unit level but also within the product portfolio (Gupta & Ramachandran, 2021).

From the perspective of the implementation of loyalty programmes, a different perception of the -importance of dimensions can be identified (except for the cost dimension, which appears to be universal in this context). Greater commitment to customer orientation can also be reflected in the context of implementing loyalty programmes, which brings value to the customer (Chen et al., 2021) and thus changes the importance of business model components.

Several studies point to the difference in business model generation (Kita & Čvirik, 2024), but they also indicate the need for a deeper examination of the managerial perspective. The size of the business operation had a certain impact on the managerial perception of importance, and it can be assumed that managers of large-scale retail food units perceived the dimensions as more important. However, the cost dimension was again perceived similarly at all levels.

In this spirit, it can be stated that costs are a fairly universal dimension in the creation of business models. This may be mainly due to the fact that costs can be controlled, corrected, regulated and optimised for the possibility of achieving sales and therefore profit (Massa et al., 2017; DaSilva & Trkman, 2014), while other dimensions contain a significant share of uncertainty and impossibility of control.

Conclusions

Business models must reflect the current time and dynamic environment in order to be effective and efficient. The article examines the managerial perspective on business model generation in grocery retail. The aim of the paper is to fill the gap in scientific discourse and practice with an orientation to the current state of business model creation in grocery retail based on a managerial perspective using a comprehensive approach to the perception of the micro- and macro-environment. To achieve this aim, study focused on answering three research questions (RQ).

The results of RQ1 indicate based on descriptive statistics the dominant importance of customers as a component of the business model. On the contrary, macroenvironmental elements such as the political situation are of lower importance in the generation of business models. Based on EFA was examined RQ2, whose result indicates the existence of 4 dimensions affecting the creation of a business model, namely the retail ecosystem, the strategic marketing dimension, the economic-political dimension, and the cost dimension. The results indicate the universality of the perception of the high importance of the cost dimension, which may be due to its controllability by managers. The nexus between the individual dimensions indicates the need for their process cooperation in the creation and modification of business models. The strategic marketing dimension emphasises the market importance in the creation of business models, while the connection of this dimension points to the effect of strategic managerial decision-making when considering other dimensions and creating complex conclusions. It can be stated based on non-parametric statistical testing that the characteristics of retail units (RQ3), such as the type of assortment offered, the implementation of the

loyalty programme, and the size of the sales area, have certain effects on the perception of individual dimensions.

From an academic perspective, a shift in the theoretical basis of strategic management and business model innovation can be noted in terms of identifying the interrelatedness between business model components that not only capture the internal and external microenvironment but also reflect the dynamic macroenvironment. The research results thus provide a new comprehensive view of business model creation, reflecting the shift from static to dynamic business models. The study thus contributes to the discussion on the direction of modern business models and contributes to the expansion of theoretical knowledge with empirically based knowledge from the highly competitive food retail sector.

From a managerial practice perspective, the research creates a basis for supporting decision-making by top and middle management in the transformation of the retail business model. The research provides managers with an incentive to identify key components of the business model with the highest strategic impact and enables its more effective creation. Based on the identification of the impact of retail characteristics, they can use the results as a decision-making basis but also as a strategic tool for competitive struggle.

The paper also contains certain limits, among which the orientation to a certain location can be included. Of course, its specification is necessary, but this also represents a limit in terms of generalisation of the results. In the future, it would therefore be appropriate to investigate other locations (cities, regions or states). In the study, was indicated the effects of selected company characteristics. In the future, it would be appropriate to expand this portfolio for a deeper investigation of decision-making motivators. Managerial characteristics may also play an important role. In future research, it would be appropriate to examine the impact of these effects. Studies suggest that the character, gender or even age of managers can influence their decision-making (Deitz et al., 2021; Karademir & Tutar, 2024), which may also have an effect on the creation of business models.

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Reference

1. Alshurideh, M., Gasaymeh, A., Ahmed, G., Alzoubi, H., & Kurd, B. A. (2020). Loyalty program effectiveness: Theoretical reviews and practical proofs. *Uncertain Supply Chain Management*, 8, 599–612. <https://doi.org/10.5267/j.uscm.2020.2.003>.
2. An, M., & Han, S.-L. (2020). Effects of experiential motivation and customer engagement on customer value creation: Analysis of psychological process in the experience-based retail environment. *Journal of Business Research*, 120, 389–397. <https://doi.org/10.1016/j.jbusres.2020.02.044>.

3. Aranda, E., Martín, V. J., & Santos, J. (2018). Competitive convergence in retailing. *Economic Research-Ekonomska Istraživanja*, 31(1), 206–227. <https://doi.org/10.1080/1331677X.2018.1429288>.
4. Barrero, J. M. (2022). The micro and macro of managerial beliefs. *Journal of Financial Economics*, 143(2), 640–667. <https://doi.org/10.1016/j.jfineco.2021.06.007>.
5. Basuroy, S., Mantrala, M. K., & Walters, R. G. (2001). The Impact of Category Management on Retailer Prices and Performance: Theory and Evidence. *Journal of Marketing*, 65(4), 16–32. <https://doi.org/10.1509/jmkg.65.4.16.18382>.
6. Beauducel, A., & Hilger, N. (2021). On the Detection of the Correct Number of Factors in Two-Facet Models by Means of Parallel Analysis. *Educational and Psychological Measurement*, 81(5), 872–903. <https://doi.org/10.1177/0013164420982057>.
7. Belli, A., O'Rourke, A.-M., Carrillat, F. A., Pupovac, L., Melnyk, V., & Napolova, E. (2022). 40 years of loyalty programs: How effective are they? Generalizations from a meta-analysis. *Journal of the Academy of Marketing Science*, 50(1), 147–173. <https://doi.org/10.1007/s11747-021-00804-z>.
8. Borghini, S., Diamond, N., Kozinets, R. V., McGrath, M. A., Muñiz, A. M., & Sherry, J. F. (2009). Why Are Themed Brandstores So Powerful? Retail Brand Ideology at American Girl Place. *Journal of Retailing*, 85(3), 363–375. <https://doi.org/10.1016/j.jretai.2009.05.003>.
9. Braun, A.-T., Schöllhammer, O., & Rosenkranz, B. (2021). Adaptation of the business model canvas template to develop business models for the circular economy. *Procedia CIRP*, 99, 698–702. <https://doi.org/10.1016/j.procir.2021.03.093>.
10. Carpenter, G. S. (2023). Market driving, market driven, or both? Toward a concept of dual market orientation. *Industrial Marketing Management*, 113, 357–359. <https://doi.org/10.1016/j.indmarman.2023.02.003>.
11. Chaloupková, M., & Kunc, J. (2022). Locality selection matters. Investigating creative hubs in the Czech urban environment. *City, Culture and Society*, 28, Article number 100440. <https://doi.org/10.1016/j.ccs.2022.100440>.
12. Chanchaichujit, J., Balasubramanian, S., & Charmaine, N. S. M. (2020). A systematic literature review on the benefit-drivers of RFID implementation in supply chains and its impact on organizational competitive advantage. *Cogent Business & Management*, 7(1), Article number 1818408. <https://doi.org/10.1080/23311975.2020.1818408>.
13. Chatterjee, S., Chaudhuri, R., Vrontis, D., & Thrassou, A. (2022). SME entrepreneurship and digitalization – the potentialities and moderating role of demographic factors. *Technological Forecasting and Social Change*, 179, Article number 121648. <https://doi.org/10.1016/j.techfore.2022.121648>.
14. Chen, P., Zhao, R., Yan, Y., & Li, X. (2020). Promotional pricing and online business model choice in the presence of retail competition. *Omega*, 94, Article number 102085. <https://doi.org/10.1016/j.omega.2019.07.001>.
15. Chen, Y., Mandler, T., & Meyer-Waarden, L. (2021). Three decades of research on loyalty programs: A literature review and future research agenda. *Journal of Business Research*, 124, 179–197. <https://doi.org/10.1016/j.jbusres.2020.11.057>.
16. Cho, G., Hwang, H., Sarstedt, M., & Ringle, C. M. (2020). Cutoff criteria for overall model fit indexes in generalized structured component analysis. *Journal of Marketing Analytics*, 8(4), 189–202. <https://doi.org/10.1057/s41270-020-00089-1>.
17. Clark, J. S. C., Kulig, P., Podsiadło, K., Rydzewska, K., Arabski, K., Białecka, M., Safranow, K., & Ciechanowicz, A. (2023). Empirical investigations into Kruskal-Wallis power studies utilizing Bernstein fits, simulations and medical study datasets. *Scientific Reports*, 13(1), Article number 2352. <https://doi.org/10.1038/s41598-023-29308-2>.

18. Costa Climent, R., & Haftor, D. M. (2021). Value creation through the evolution of business model themes. *Journal of Business Research*, 122, 353–361. <https://doi.org/10.1016/j.jbusres.2020.09.007>.
19. Coughlan, A. T. (Ed.). (2006). *Marketing channels* (7th ed). Pearson/Prentice Hall.
20. Čvirik, M. (2023). Perceived Price and Quality of Food of European Union Countries of Origin by Slovaks: The Influence of Ethnocentric Tendencies. *Central European Business Review*, 12(1), 97–114. <https://doi.org/10.18267/j.cebr.314>.
21. Čvirik, M. (2024). The importance of music as a mood regulator: Adaptation of Music in Mood Regulation Scale in the conditions of Slovakia. *Ceskoslovenska Psychologie*, 68(3), 255–272. <https://doi.org/10.51561/cspsych.68.3.255>.
22. Čvirik, M., & Cagaňová, D. (2025). Ethical Perceptions of Foreign Product Purchases Among Generation Z: The Impact of Patriotism, Ethnocentrism, and Worldmindedness. *Business Systems Research Journal*, 16(2), 198–218. <https://doi.org/10.2478/bsrj-2025-0025>.
23. Čvirik, M., & Kita, P. (2024). *Inovatívne obchodné modely formátov maloobchodných potravinárskych jednotiek v Bratislave*. Univerzita Komenského v Bratislave.
24. DaSilva, C. M., & Trkman, P. (2014). Business Model: What It Is and What It Is Not. *Long Range Planning*, 47(6), 379–389. <https://doi.org/10.1016/j.lrp.2013.08.004>.
25. Deitz, G., Hansen, J. D., DeCarlo, T., & Babakus, E. (2021). How store managers' employee climate perceptions affect frontline employee, customer and store performance outcomes: An examination in the small-store setting. *European Journal of Marketing*, 55(10), 2620–2648. <https://doi.org/10.1108/EJM-02-2020-0107>.
26. Devlieger, I., Mayer, A., & Rosseel, Y. (2016). Hypothesis Testing Using Factor Score Regression: A Comparison of Four Methods. *Educational and Psychological Measurement*, 76(5), 741–770. <https://doi.org/10.1177/0013164415607618>.
27. Diamond, N., Sherry, J. F., Muñiz, A. M., McGrath, M. A., Kozinets, R. V., & Borghini, S. (2009). American Girl and the Brand Gestalt: Closing the Loop on Sociocultural Branding Research. *Journal of Marketing*, 73(3), 118–134. <https://doi.org/10.1509/jmkg.73.3.118>.
28. Do Vale, G., Collin-Lachaud, I., & Lecocq, X. (2025). Resolving paradoxical tensions during business model innovation for sustainability in retailing: The role of the ecosystem. *Journal of Retailing*, 101(4), 564–582. <https://doi.org/10.1016/j.jretai.2025.06.001>.
29. Dubosson-Torbay, M., Osterwalder, A., & Pigneur, Y. (2002). E-business model design, classification, and measurements. *Thunderbird International Business Review*, 44(1), 5–23. <https://doi.org/10.1002/tie.1036>.
30. Eden, S. K., Li, C., & Shepherd, B. E. (2022). Nonparametric estimation of Spearman's rank correlation with bivariate survival data. *Biometrics*, 78(2), 421–434. <https://doi.org/10.1111/biom.13453>.
31. Evers, N., Ojala, A., Sousa, C. M. P., & Criado-Rialp, A. (2023). Unraveling business model innovation in firm internationalization: A systematic literature review and future research agenda. *Journal of Business Research*, 158, Article number 113659. <https://doi.org/10.1016/j.jbusres.2023.113659>.
32. Filser, M., Kraus, S., Breier, M., Nenova, I., & Puumalainen, K. (2021). Business model innovation: Identifying foundations and trajectories. *Business Strategy and the Environment*, 30(2), 891–907. <https://doi.org/10.1002/bse.2660>.
33. Froulík, R., Zdeněk, R., & Lososová, J. (2023). The Economy of Retail Chains in the FMCG Sector: The Case of Czechia. *Review of Applied Socio-Economic Research*, 25(1), 20–33. <https://doi.org/10.54609/reaser.v25i1.345>.
34. Gagnon, E., Johannsen, B. K., & López-Salido, D. (2021). Understanding the New Normal: The Role of Demographics. *IMF Economic Review*, 69(2), 357–390. <https://doi.org/10.1057/s41308-021-00138-4>.

35. Goretzko, D., Siemund, K., & Sterner, P. (2024). Evaluating Model Fit of Measurement Models in Confirmatory Factor Analysis. *Educational and Psychological Measurement*, 84(1), 123–144. <https://doi.org/10.1177/00131644231163813>.
36. Grabowska, S. (2022). Key components of the business model in an Industry 5.0 environment. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 2022(158), 191–199. <https://doi.org/10.29119/1641-3466.2022.158.13>.
37. Grewal, D., Levy, M., & Kumar, V. (2009). Customer Experience Management in Retailing: An Organizing Framework. *Journal of Retailing*, 85(1), 1–14. <https://doi.org/10.1016/j.jretai.2009.01.001>.
38. Guetterman, T. C. (2019). Basics of statistics for primary care research. *Family Medicine and Community Health*, 7(2), e000067. <https://doi.org/10.1136/fmch-2018-000067>
39. Gupta, S., & Ramachandran, D. (2021). Emerging Market Retail: Transitioning from a Product-Centric to a Customer-Centric Approach. *Journal of Retailing*, 97(4), 597–620. <https://doi.org/10.1016/j.jretai.2021.01.008>.
40. Haaker, T., Ly, P. T. M., Nguyen-Thanh, N., & Nguyen, H. T. H. (2021). Business model innovation through the application of the Internet-of-Things: A comparative analysis. *Journal of Business Research*, 126, 126–136. <https://doi.org/10.1016/j.jbusres.2020.12.034>.
41. Hanaysha, J. R., Al Shaikh, M. E., & Alzoubi, H. M. (2021). Importance of Marketing Mix Elements in Determining Consumer Purchase Decision in the Retail Market: *International Journal of Service Science, Management, Engineering, and Technology*, 12(6), 56–72. <https://doi.org/10.4018/IJSSMET.2021110104>.
42. Har, L. L., Rashid, U. K., Chuan, L. T., Sen, S. C., & Xia, L. Y. (2022). Revolution of Retail Industry: From Perspective of Retail 1.0 to 4.0. *Procedia Computer Science*, 200, 1615–1625. <https://doi.org/10.1016/j.procs.2022.01.362>.
43. Hill, A. D., Johnson, S. G., Greco, L. M., O’Boyle, E. H., & Walter, S. L. (2021). Endogeneity: A Review and Agenda for the Methodology-Practice Divide Affecting Micro and Macro Research. *Journal of Management*, 47(1), 105–143. <https://doi.org/10.1177/0149206320960533>.
44. Howard, M. C. (2016). A Review of Exploratory Factor Analysis Decisions and Overview of Current Practices: What We Are Doing and How Can We Improve? *International Journal of Human-Computer Interaction*, 32(1), 51–62. <https://doi.org/10.1080/10447318.2015.1087664>.
45. Hristov, I., Camilli, R., & Mechelli, A. (2022). Cognitive biases in implementing a performance management system: Behavioral strategy for supporting managers’ decision-making processes. *Management Research Review*, 45(9), 1110–1136. <https://doi.org/10.1108/MRR-11-2021-0777>.
46. Jie, F., & Gengatharen, D. (2019). Australian food retail supply chain analysis. *Business Process Management Journal*, 25(2), 271–287. <https://doi.org/10.1108/BPMJ-03-2017-0065>.
47. Jin, B. E., & Shin, D. C. (2020). Changing the game to compete: Innovations in the fashion retail industry from the disruptive business model. *Business Horizons*, 63(3), 301–311. <https://doi.org/10.1016/j.bushor.2020.01.004>.
48. Jucevski, M. (2020). Blurring the Lines between Physical and Digital Spaces: Business Model Innovation in Retailing. *California Management Review*, 63(1), 99–117. <https://doi.org/10.1177/0008125620953639>.
49. Jung, J. H., Yoo, J. J., & Arnold, T. J. (2021). The influence of a retail store manager in developing frontline employee brand relationship, service performance and customer loyalty. *Journal of Business Research*, 122, 362–372. <https://doi.org/10.1016/j.jbusres.2020.09.010>.
50. Karademir, Ö., & Tutar, H. (2024). Manager’s Decision-Making Styles: A Case Study On Family Enterprises. *Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi*, 21(1), 344–357. <https://doi.org/10.33437/ksusbd.1178446>.
51. Karahan, F., Pugsley, B., & Şahin, A. (2024). Demographic Origins of the Start-up Deficit. *American Economic Review*, 114(7), 1986–2023. <https://doi.org/10.1257/aer.20210362>.

52. Keiningham, T., Aksoy, L., Bruce, H. L., Cadet, F., Clennell, N., Hodgkinson, I. R., & Kearney, T. (2020). Customer experience driven business model innovation. *Journal of Business Research*, 116, 431–440. <https://doi.org/10.1016/j.jbusres.2019.08.003>.
53. Kita, P., & Čvirik, M. (2024). Retailer processes centred on the food market as the main determinate of business models in the context of retail size. *Journal of Retailing and Consumer Services*, 81, Article number 103937. <https://doi.org/10.1016/j.jretconser.2024.103937>.
54. Kita, P., Čvirik, M., & Maciejewski, G. (2024). The Business Model of a Retailer Based on the Consumer-Centric Approach in Building the Value of a Loyalty Programme on the Food Market. *Forum Scientiae Oeconomia*, 12(4), 47–65. https://doi.org/10.23762/FSO_VOL12_NO4_3.
55. Kita, P., Čvirik, M., Maciejewski, G., Žambochová, M., & Kitová Mazalánová, V. (2023a). Activities of Retail Units as an Element of Business Model Creation. *Polish Journal of Management Studies*, 27(1), 133–147. <https://doi.org/10.17512/pjms.2023.27.1.08>.
56. Kita, P., Žambochová, M., Čvirik, M., & Mazalánová, V. K. (2023b). The Key Elements of Business Models of Slovak Retail Companies as a Basis for Their Ability to Respond to European Challenges in Terms of Environmental, Social, and Economic Aspects of Their Value Offer for the Customer. In G. Pellat, J. Zafiroski, & M. Šuplata (Eds), *Cooperation and Enlargement: Two Challenges to be Addressed in the European Projects—2022* (Vol. 500, pp. 281–298). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-42253-9_14.
57. Krasňanská, D., Komara, S., & Vojtková, M. (2021). Keyword Categorization using Statistical Methods. *TEM Journal*, 10(3), 1377–1384. <https://doi.org/10.18421/TEM103-47>.
58. Križan, F., & Bilková, K. (2022). 3 The transformation of Slovak retail. In J. Kunc, M. Novotná, F. Križan, K. Bilková, T. Sikos T., D. Ilnicki, & R. Wyeth, *Thirty years of retail transformation in V4 countries* (pp. 53–74). Sciendo. <https://doi.org/10.2478/9788367405065-003>.
59. Križan, F., Bilková, K., Kita, P., & Siviček, T. (2016). Transformation of retailing in post-communist Slovakia in the context of globalization. *E+M Ekonomie a Management*, 19(1), 148–164. <https://doi.org/10.15240/tul/001/2016-1-011>.
60. Kunc, J., & Križan, F. (2022). 1 Thirty years of post-socialist retail transformation in Central Europe. In J. Kunc, M. Novotná, F. Križan, K. Bilková, T. Sikos T., D. Ilnicki, & R. Wyeth, *Thirty years of retail transformation in V4 countries* (pp. 7–14). Sciendo. <https://doi.org/10.2478/9788367405065-001>.
61. Kwiliński, A., & Reznik, O. (2025). Governance of Artificial Intelligence Technologies and Systems in the EU and Ukraine: Legal Foundations and Institutional Mechanisms. *Forum Scientiae Oeconomia*, 13(2), 8–52. https://doi.org/10.23762/FSO_VOL13_NO3_1.
62. Kwiliński, A., Rohoza, M., Hudz, T., & Kamińska, B. (2025). Heuristic Approaches to Studying the Dynamics of Economic Development for Resource Allocation in Crisis Management. *Forum Scientiae Oeconomia*, 13(4), 111–145. https://doi.org/10.23762/FSO_VOL13_NO4_6.
63. Lanzolla, G., & Markides, C. (2021). A Business Model View of Strategy. *Journal of Management Studies*, 58(2), 540–553. <https://doi.org/10.1111/joms.12580>.
64. Lueg, R., & Ilieva, D. (2024). Customer Profitability Analysis in decision-making—The roles of customer characteristics, cost structures, and strategizing. *PLOS ONE*, 19(5), Article number e0296974. <https://doi.org/10.1371/journal.pone.0296974>.
65. Massa, L., Tucci, C. L., & Afuah, A. (2017). A Critical Assessment of Business Model Research. *Academy of Management Annals*, 11(1), 73–104. <https://doi.org/10.5465/annals.2014.0072>.
66. Mostaghel, R., & Chirumalla, K. (2021). Role of customers in circular business models. *Journal of Business Research*, 127, 35–44. <https://doi.org/10.1016/j.jbusres.2020.12.053>.
67. Mostaghel, R., Oghazi, P., Parida, V., & Sohrabpour, V. (2022). Digitalization driven retail business model innovation: Evaluation of past and avenues for future research trends. *Journal of Business Research*, 146, 134–145. <https://doi.org/10.1016/j.jbusres.2022.03.072>.

68. Nailer, C., & Buttriss, G. (2020). Processes of business model evolution through the mechanism of anticipation and realisation of value. *Industrial Marketing Management*, 91, 671–685. <https://doi.org/10.1016/j.indmarman.2019.04.009>.
69. Okoye, K., & Hosseini, S. (2024). Mann–Whitney U Test and Kruskal–Wallis H Test Statistics in R. In K. Okoye & S. Hosseini, *R Programming* (pp. 225–246). Springer Nature Singapore. https://doi.org/10.1007/978-981-97-3385-9_11.
70. Osterwalder, A., Pigneur, Y., & Clark, T. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*. Wiley.
71. Ölveczká, D., Tomašových, A., Reháková, D., Schlögl, J., & Michalík, J. (2024). Assessing temporal transition between microgranular and hyaline tests of calcareous microplankton during the Late Jurassic. *Marine Micropaleontology*, 190, Article number 102379. <https://doi.org/10.1016/j.marmicro.2024.102379>.
72. Padgett, D., & Mulvey, M. S. (2007). Differentiation Via Technology: Strategic Positioning of Services Following the Introduction of Disruptive Technology. *Journal of Retailing*, 83(4), 375–391. <https://doi.org/10.1016/j.jretai.2007.03.010>.
73. Palmié, M., Miehé, L., Oghazi, P., Parida, V., & Wincent, J. (2022). The evolution of the digital service ecosystem and digital business model innovation in retail: The emergence of meta-ecosystems and the value of physical interactions. *Technological Forecasting and Social Change*, 177, Article number 121496. <https://doi.org/10.1016/j.techfore.2022.121496>.
74. Popp, B. (2020). Kundenzufriedenheit in Zeiten von Omni-Channel-Retailing und digitalen Ökosystemen. In S. Roth, C. Horbel, & B. Popp (Eds.), *Perspektiven des Dienstleistungsmanagements* (pp. 409–434). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-28672-9_21.
75. Ramadan, A., & Morshed, A. (2024). Optimizing retail prosperity: Strategic working capital management and its impact on the global economy. *Journal of Infrastructure, Policy and Development*, 8(5), Article number 3827. <https://doi.org/10.24294/jipd.v8i5.3827>.
76. Rangaswamy, A., Moch, N., Felten, C., Van Bruggen, G., Wieringa, J. E., & Wirtz, J. (2020). The Role of Marketing in Digital Business Platforms. *Journal of Interactive Marketing*, 51(1), 72–90. <https://doi.org/10.1016/j.intmar.2020.04.006>.
77. Ranta, V., Aarikka-Stenroos, L., & Väisänen, J.-M. (2021). Digital technologies catalyzing business model innovation for circular economy—Multiple case study. *Resources, Conservation and Recycling*, 164, Article number 105155. <https://doi.org/10.1016/j.resconrec.2020.105155>.
78. Reio, T. G., & Shuck, B. (2015). Exploratory Factor Analysis: Implications for Theory, Research, and Practice. *Advances in Developing Human Resources*, 17(1), 12–25. <https://doi.org/10.1177/1523422314559804>.
79. Ritter, T., & Pedersen, C. L. (2020). Digitization capability and the digitalization of business models in business-to-business firms: Past, present, and future. *Industrial Marketing Management*, 86, 180–190. <https://doi.org/10.1016/j.indmarman.2019.11.019>.
80. Roscoe, S., Aktas, E., Petersen, K. J., Skipworth, H. D., Handfield, R. B., & Habib, F. (2022). Redesigning global supply chains during compounding geopolitical disruptions: The role of supply chain logics. *International Journal of Operations & Production Management*, 42(9), 1407–1434. <https://doi.org/10.1108/IJOPM-12-2021-0777>.
81. Sahabuddin, M., Alam, M. S., Khokhar, M., Hossain, M. A., Alam, M. F., & Khan, W. (2023). Circular value creation: Business models and supply chain strategies. *Environmental Science and Pollution Research*, 30(47), 103898–103909. <https://doi.org/10.1007/s11356-023-29718-9>.
82. Sibalija, J., Barrett, D., Subasri, M., Bitacola, L., & Kim, R. B. (2021). Understanding value in a healthcare setting: An application of the business model canvas. *Methodological Innovations*, 14(3), 20597991211050477. <https://doi.org/10.1177/20597991211050477>.

83. Schreiber, J. B. (2021). Issues and recommendations for exploratory factor analysis and principal component analysis. *Research in Social and Administrative Pharmacy*, 17(5), 1004–1011. <https://doi.org/10.1016/j.sapharm.2020.07.027>.
84. Shakeel, J., Mardani, A., Chofreh, A. G., Goni, F. A., & Klemeš, J. J. (2020). Anatomy of sustainable business model innovation. *Journal of Cleaner Production*, 261, Article number 121201. <https://doi.org/10.1016/j.jclepro.2020.121201>.
85. Singh, R., Sarangal, R. K., & Singh, G. (2022). The Impact of Micro and Macro Environment on Entrepreneurial Success: Case of J&K MSMEs. *FIIB Business Review*, 11(1), 94–106. <https://doi.org/10.1177/23197145211061809>.
86. Sorescu, A., Frambach, R. T., Singh, J., Rangaswamy, A., & Bridges, C. (2011). Innovations in Retail Business Models. *Journal of Retailing*, 87, S3–S16. <https://doi.org/10.1016/j.jretai.2011.04.005>.
87. Šoltés, E., Komara, S., & Šoltésová, T. (2023). Exploration of poverty and social exclusion of Slovak population via contrast analysis associated with logit models. *Quality & Quantity*, 57(6), 5079–5105. <https://doi.org/10.1007/s11135-022-01573-9>.
88. Thornton, H. C. (2024). Business model change and internationalization in the sharing economy. *Journal of Business Research*, 170, Article number 114250. <https://doi.org/10.1016/j.jbusres.2023.114250>.
89. Valaskova, K., Gajdosikova, D., & Pavic Kramaric, T. (2022). How Important Is the Business Environment for The Performance of Enterprises? Case Study of Selected European Countries. *Central European Business Review*, 11(4), 85–110. <https://doi.org/10.18267/j.cebr.300>.
90. Vaska, S., Massaro, M., Bagarotto, E. M., & Dal Mas, F. (2021). The Digital Transformation of Business Model Innovation: A Structured Literature Review. *Frontiers in Psychology*, 11, Article number 539363. <https://doi.org/10.3389/fpsyg.2020.539363>.
91. Von Delft, S., & Zhao, Y. (2021). Business models in process industries: Emerging trends and future research. *Technovation*, 105, Article number 102195. <https://doi.org/10.1016/j.technovation.2020.102195>.
92. Wang, Y., Xu, R., Schwartz, M., Ghosh, D., & Chen, X. (2020). COVID-19 and Retail Grocery Management: Insights From a Broad-Based Consumer Survey. *IEEE Engineering Management Review*, 48(3), 202–211. <https://doi.org/10.1109/EMR.2020.3011054>.
93. Watkins, M. W. (2018). Exploratory Factor Analysis: A Guide to Best Practice. *Journal of Black Psychology*, 44(3), 219–246. <https://doi.org/10.1177/0095798418771807>.
94. Wirtz, B. W. (2020). *Business Model Management: Design - Process - Instruments*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-48017-2>.
95. Yang, Y., Liu, M., Huang, J., & Wan, X. (2024). Making choices of food and non-food products: A comparison between virtual stores and online shopping. *International Journal of Food Science & Technology*, 59(3), 1644–1652. <https://doi.org/10.1111/ijfs.16918>.
96. Yun, J. J., & Liu, Z. (2019). Micro- and Macro-Dynamics of Open Innovation with a Quadruple-Helix Model. *Sustainability*, 11(12), Article number 3301. <https://doi.org/10.3390/su11123301>.
97. Zakrzewska-Bielawska, A., Czakon, W., & Kraus, S. (2023). Relational orientation in B2B strategies: Measurement scale development and validation. *Journal of Business Research*, 160, Article number 113791. <https://doi.org/10.1016/j.jbusres.2023.113791>.

What Lies Between Organisational Culture and Management Style? A Dual VOS-PLS/SEM Analysis with Sustainable Development-oriented Implications

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Abstract

This paper employs inductive and deductive methodologies to analyse 846 documents (1974–2024) from the Scopus scientific database using VOSviewer and PLS/SEM analysis. It focuses on understanding the interrelationships between organisational culture and management style in the context of Sustainable Development. This includes outlining the current state of knowledge in this area and identifying directions for future research, as well as aiding businesses in aligning their strategies with environmental objectives. The study reveals that the interrelationship between organisational culture and management style significantly impacts the implementation of sustainability principles and the well-being of employees. It highlights the critical role of leadership in fostering integrity between organisational culture and management style, which constitutes a central contribution of this research. The research is predominantly a literature review and may not fully capture the diversity of industry contexts. The paper suggests the need for empirical studies to further validate the interconnections between organisational culture and management style in the Sustainable Development context. The evidence is bibliometric and therefore non-causal. The proposed PLS/SEM should be estimated on primary data using bootstrap inference to test mediation and robustness. The findings assist business practitioners in harmonising organisational culture and management style, facilitating effective organisational management and the achievement of strategic goals. The paper offers insights into achieving business goals and competitive advantage in the modern business environment. This research underscores the importance of sustainable business practices for societal well-being and encourages ethical leadership and responsible management to create a positive social impact. A dual perspective integrates network structure (VOS) with a testable directional model (PLS/SEM) that positions leadership as the transmission belt between organisational culture and management style.

Key words

environmental management, green jobs practice, organisational change, organisational values, management culture, sustainable strategic management.

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Introduction

The relationship between Management Style (MS) and Organisational Culture (OC) has long been surrounded by myths, metaphors, and popular aphorisms (Kaarst-Brown & Robey, 1999). Such an approach often implies a hierarchical subordination, positioning OC as inherently superior to MS,

which oversimplifies their strategic interplay. A prominent example is the oft-repeated aphorism that “organisational culture eats strategy for breakfast” (Kang et al., 2015). Taking this popular distortion as a point of departure, the present article explores and clarifies the complex interrelationships between OC and MS. Therefore, the field between OC and MS remains underexplored.

In this paper, OC is defined as a shared system of values, beliefs, and behavioural norms developed by a group in response to internal and external challenges, which guides members’ perception, thinking, and actions within the organisation (Rezeki, 2023; Sulich et al., 2021), while MS is defined as a relatively consistent and recurring pattern in which a manager influences, directs, and interacts with subordinates, reflecting both personal preferences and adaptation to organisational conditions. MS can be seen as the individual-level expression of OC, translating collective patterns into personal managerial behaviour. This axis of individualism versus collectivism differentiates OC from MS.

The aim of this paper is to investigate the interrelationships between OC and MS in the context of sustainable development. The literature review aims not only to identify what remains unknown but also to highlight research gaps and outline future avenues of inquiry. The pursuit of thematic novelty is undertaken within an otherwise mature area of research. Existing theories and definitions require extension to explicitly incorporate the sustainable development context, which constitutes a core scholarly contribution,

Methodologically, bibliometric mapping using VOSviewer (version 1.6.20) is conducted to identify key terms and research areas that bridge OC and MS, thereby informing a testable PLS/SEM framework for subsequent empirical estimation. The bibliometric insights provide a theoretical foundation for instrument development and future data collection.

The findings of the study suggest numerous practical benefits, including improved management practices, streamlined strategy execution, enhanced ecological focus, innovation, and heightened employee engagement. The underwhelming progress from an environmental standpoint has motivated the search for methods that bolster the attainment of sustainability objectives, particularly those aligned with environmental conservation and resonating with employees who identify with the organisation's ethos (Assoratgoon & Kantabutra, 2023). By employing a rigorous and systematic literature review process and melding both inductive and deductive analytical techniques, this paper endeavours to shed light on the intricate relationships between OC and MS. A salient outcome of the research underscores the central role leadership plays in melding OC and MS, with an emphasis on the importance of human resource management.

This article is organised into five sections – Introduction, Literature Review, Materials and Methods, Results, and Discussion and Conclusions. After the Introduction, the Methods detail a literature base spanning 1974–2024 and delineate the query logic used to identify research gaps. The Results report the bibliometric structure of OC–MS linkages and the meanings of the identified keywords. The Discussion integrates these insights for theory and practice under Sustainable Development (SD), and the Conclusions outline implications for organisational alignment and future inquiry. Throughout, the uncertain interface between OC and MS is conceptualised as leadership-mediated, whereby cultural values are translated into day-to-day managerial routines through leadership practices. This premise motivates a dual approach: VOS mapping to chart the intellectual structure and a testable PLS/SEM framework to specify directional relations for subsequent empirical estimation.

1. Literature review

Among scientists, opinions about the relationship between OC and MS in the SD context that shape organizational resilience and strategic longevity are varied (Mwangi et al., 2015). The differences between OC and MS depend largely on the research context, which shapes their configuration; consequently, the SD context plays a crucial role. New approaches in scientific literature are emerging to the interrelationship between OC and MS, emphasizing growing role of emotional culture management (Yue et al., 2021), employee’s well-being (Pagán-Castaño et al., 2020),

green human resource management and AI (Kozar & Paduszyńska, 2024). Companies then engage in participative management (Shinan-Altman et al., 2023) where all stakeholders participate, bound together by their shared OC (Shahriari et al., 2023) and MS (Rolková & Farkašová, 2015) cutting-edge IT solutions. Companies are actively seeking management practices to become more environmentally friendly; however, they are more eager to be involved in the social dimension of SD (Sulich et al., 2023).

Alongside these studies on the interdependencies between OC and MS, research is also conducted on the factors influencing each component separately (Kaur Bagga et al., 2023). Studying OC and MS in isolation fosters narrative positioning, obscuring their interdependencies and the intervening relational space. Therefore, the exploration of the relationship between OC and MS is rarely undertaken.

The coherence between OC and MS underpins the strategic stability of an organization, serving as a moral filter that prevents greenwashing by aligning managerial behavior with shared values and ensuring credibility towards employees, clients, and stakeholders (Sulich & Soloduch-Pelc, 2024). The strategic consistency between OC and MS are essential for meeting the organization's objectives and values achievement (Bititci et al., 2004; Bowers et al., 2017; Dewi & Wibowo, 2020; Ogbonna & Harris, 2000). In light of recent global disruptive events, the alignment of values held by employees with those of the organization has gained prominence (Lyons et al., 2006; Ryan, 2002). This convergence between OC and MS can lead to internal synergy within the organization, building employee loyalty (Ford et al., 2023). In turn, such disconnect between OC and MS indicates a leadership crisis, reduced efficiency, and waning employees' engagement. Many studies overlook the conflict dimension between OC and MS - a perspective that would indicate organizational incoherence and, by extension, call into future frontier research. Consequently, research in organizations on the relationship between OC and MS has tended to prioritize social and economic aspects while marginalizing the environmental dimension - even though these domains collectively underpin the concept of sustainable development. Accordingly, the article undertakes its analysis explicitly within this context.

Existing studies assume that the relationship between OC and MS is expected to achieve a specific positive outcome (Sulich & Soloduch-Pelc, 2025). Therefore, the relationship between OC and MS affects employee well-being, personnel strategies, and the organization's resilience to challenges, changes, and turmoil. On the other hand, if there is a lack of relationship between OC and MS, various corporate problems arise. Thus far, research has privileged positive OC–MS linkages, and this article contributes by delineating the complete spectrum of their interrelationships.

The literature review in this section shows the year-by-year evolution of research on the relationship between OC and MS in the context of SD from 1999 to 2025. This evolution reflects the progression of scholarly thought and is documented through references assigned to specific years. The review demonstrates how the topic has accelerated and expanded into social and economic dimensions. At the same time, it reveals an underexplored environmental aspect, which opens a critical field for addressing greenwashing.

2. Methodology

To investigate the interrelationships between organisational culture (OC) and management style (MS) within the context of sustainable development, the study integrates a classical narrative literature review with a systematic review conducted in accordance with the PRISMA protocol. This dual approach is intended to ensure conceptual depth and methodological transparency. The relationship between OC and MS constitutes a research gap, as illustrated in Figure 1.

The idea of the SD provides the context of the performed analysis of relationship between OC and MS. In scientific literature, the relationship between OC and MS is often underrepresented. However, authors of these studies have expressed uncertainty regarding the exact nature or form of the OC and

MS interrelationship. This ambiguity is illustrated in Figure 1, where the area of uncertainty is marked with a question mark.

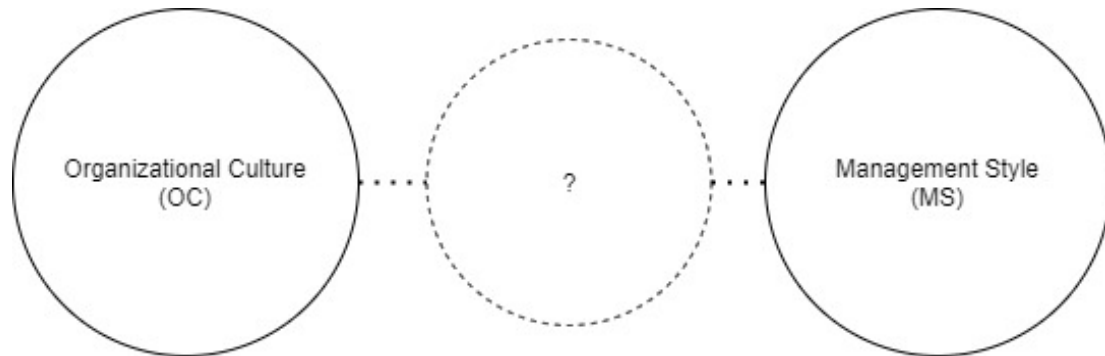


Figure 1. Graphical representation of the research gap between OC and MS.

Source: Authors' elaboration.

Furthermore, this issue is also addressed in the syntax of the queries used in the proposed bibliometric research, as detailed in Table 1.

Table 1. Scopus database exploration queries used in the research.

Query Symbol	Syntax	No. of results
Q1	(TITLE-ABS-KEY (management AND style) AND TITLE-ABS-KEY (organizational AND culture)) AND (LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "DECI")) AND (EXCLUDE (PUBYEAR , 2025))	846
Q2	((TITLE-ABS-KEY (management AND style) AND TITLE-ABS-KEY (organizational AND culture))) AND (colour OR metaphor OR images) AND (LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "DECI")) AND (EXCLUDE (PUBYEAR , 2025))	110
Q3	((TITLE-ABS-KEY (management AND style) OR TITLE-ABS-KEY (organizational AND culture) AND TITLE-ABS-KEY (colour OR metaphor OR images))) AND ("sustainable development goals" OR "sdgs") AND (LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "DECI")) AND (EXCLUDE (PUBYEAR , 2025))	8

Source: Author's elaboration based on Scopus data.

The study is guided by the following research question: What concepts are used in the scientific literature to describe the relationship between OC and MS in the context of SD? These concepts, reflecting the interdependencies between OC and MS, were identified on the basis of keywords obtained through bibliometric analysis.

In this study, publications indexed in the Scopus database are examined as outlined in the research procedure presented in Figure 2. This flowchart depicts a research design cantered on the aim of the paper. Consequently, the flowchart incorporates two bibliometric analysis streams and one classical full-text analysis.

The method combined both full text and PRISMA literature reviews. Such literature analysis allows for the identification of influential works and tracing the evolution of the field. This is because it integrates the results of numerous independent studies addressing the same issue, enabling the formulation of more precise conclusions than other methods (Geyskens et al., 2009). Scopus was chosen as the database for exploration due to its stringent indexing criteria and its recognition among researchers.

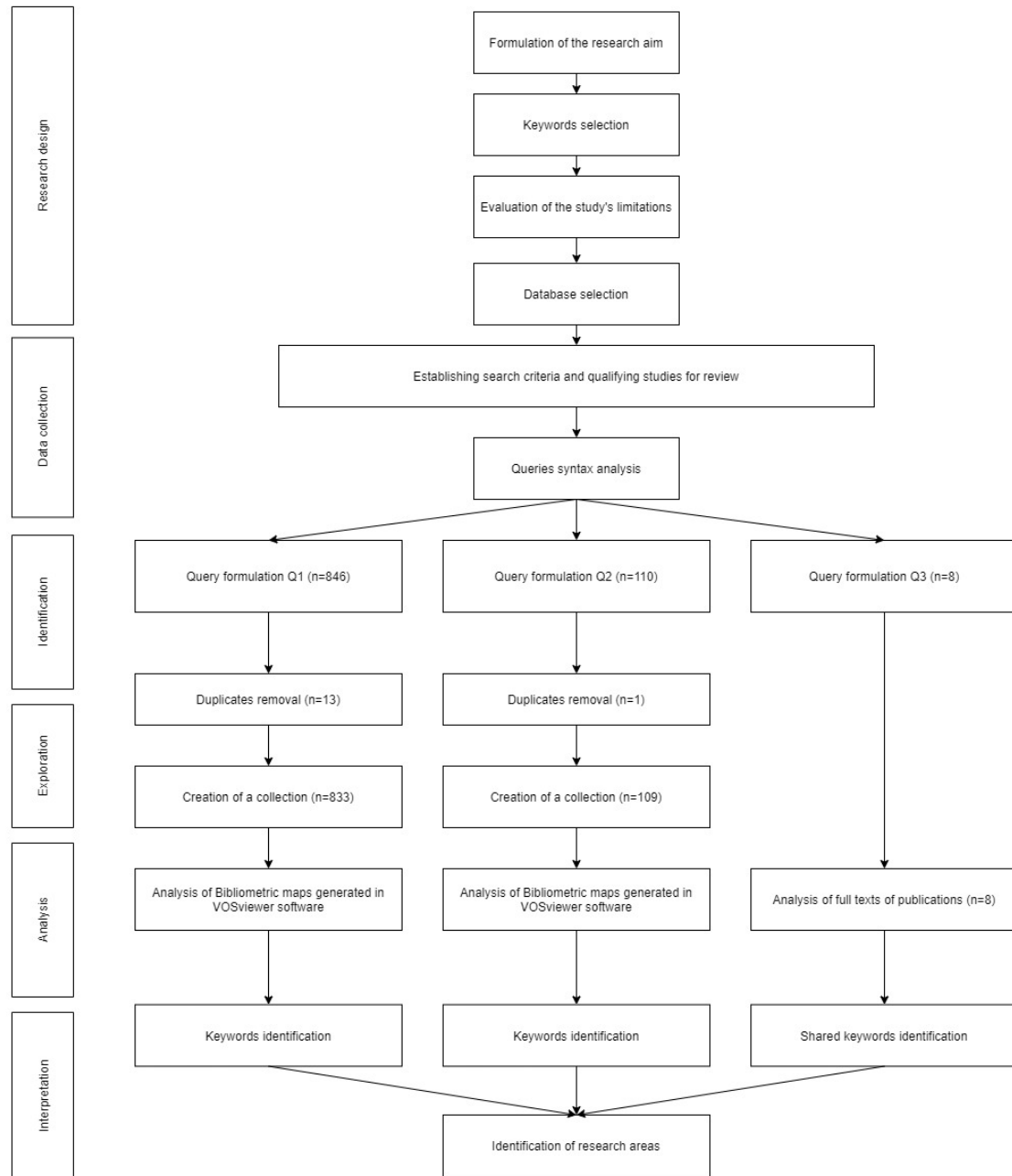


Figure 2. Research PRISMA procedure scheme.

Source: Authors' elaboration.

Consequently, the query for the Scopus database was crafted using a set of keywords, as listed in Table 1. The results from the query, denoted as Q1, comprised 846 documents indexed in Scopus spanning the years 1974-2022. The year 1974 was automatically identified by query and this is based on the first publication indexed in Scopus database. On the other hand, the ongoing year 2025 was excluded. Therefore, the query researched in the Scopus database was formulated with set of keywords (small letters) as in Table 1.

Through refining the Q1 syntax with additional keywords, two more specific queries, Q2 and Q3, were formulated. The differences between Q1, Q2, and Q3 lie not only in the number of results they produced but also in their individual syntax, which accounts for the variance in outcomes. However, a detailed analysis of the results confirmed that the outcomes of Q2 and Q3 are not subsets of Q1. Hence, there are decreasing numbers of identified articles in Table 1. The results from these queries

were downloaded as separate sets of files from the Scopus database in .csv format. During the export from the Scopus database, all fields related to the publication were selected (Figure 2). As bibliometric software recognizes only exact character matches, manual normalization and duplicate removal were necessary to ensure accuracy, particularly concerning the spelling of the researched keywords.

The graphical analysis of the query results from Scopus was carried out using VOSviewer software (version 1.6.20). The analysis of indexed keyword co-occurrences (the full counting method) was the primary method used to explore relations between OC and MS. The scientometric technique of keyword analysis operates on the principle that frequently co-occurring keywords are deemed significant. Furthermore, in instances of significant variances in results, VOSviewer assists in pinpointing potential future research directions. Node total link strength (TLS) and pairwise normalized strengths (0–1) were computed by scaling geometric-mean co-occurrences to the maximum. The bibliometric maps generated from keyword co-occurrence analysis can reveal underlying structures where connections are present and suggest new avenues for research where they are absent. Co-occurring keywords highlight areas of scientific interest and echo the constraints set by the query syntax. The outputs from VOSviewer are bibliometric maps, which depict co-occurring keywords as nodes, interconnected in uniquely coloured subnetworks. Therefore, results presented graphically as networks reveal patterns of influence, diffusion, and conceptual evolution of the analysed query results.

The query method, being both widely used and straightforward, was employed in the Scopus database search conducted for this study. This method's scope is constrained by the volume of content indexed in the chosen database and by the specific scientific discipline attributed to the document. Another limitation across all queries was the language of publication. English, having the most substantial representation among indexed publications, was selected due to its prevalence. The chosen number of keyword co-occurrences shapes the results' graphical representation and the clarity of the bibliometric map. Therefore, a minimum threshold of 5 keyword co-occurrences was set for the bibliometric map derived from Q1. To enhance the readability, this study presents only one such map of indexed keyword co-occurrences from Q1.

In the map visualization, items of greater relevance are highlighted more prominently than those of lesser significance. Each co-occurring keyword is allocated to a single cluster. Within the bibliometric map, VOSviewer employs colours to signify the cluster to which a node belongs. In the map presented in this study, all co-occurring keywords are color-coded based on their cluster affiliation. The keyword co-occurrence analysis and the resultant maps offer a glimpse into a field's intellectual framework. Recognizing specific patterns becomes feasible when using VOSviewer, as this software crafts maps that visualize the intellectual architecture of the examined domain. The interpretation of these findings sets the stage for the subsequent section.

PLS/SEM Specification and Estimation. A directional model was specified in which OC affects MS primarily via leadership (OC - L - MS), with a weak direct path OC to MS to test partial mediation. Standardized path coefficients (β), bootstrap standard errors (SE), t-values, two-tailed p-values, and 95% confidence intervals were reported using nonparametric bootstrapping ($\geq 5,000$ resamples). Measurement quality was assessed via composite reliability (CR/ ω), convergent validity (AVE), and discriminant validity (HTMT). Global fit was evaluated with SRMR. The graphical representation is provided in Figure 2; numerical estimates are summarized in Table 2.

3. Research results

VOSviewer software (version 1.6.20) was used to explore the interrelationship between organisational culture and management style in the sustainable development context. The resulting bibliometric maps reveal the terminology employed in prior studies and indicate the main streams of research related to the examined problem (Figure 1). Figure 3 is based on an analysis of 846 scientific publications classified under query Q1, as reported in Table 1.

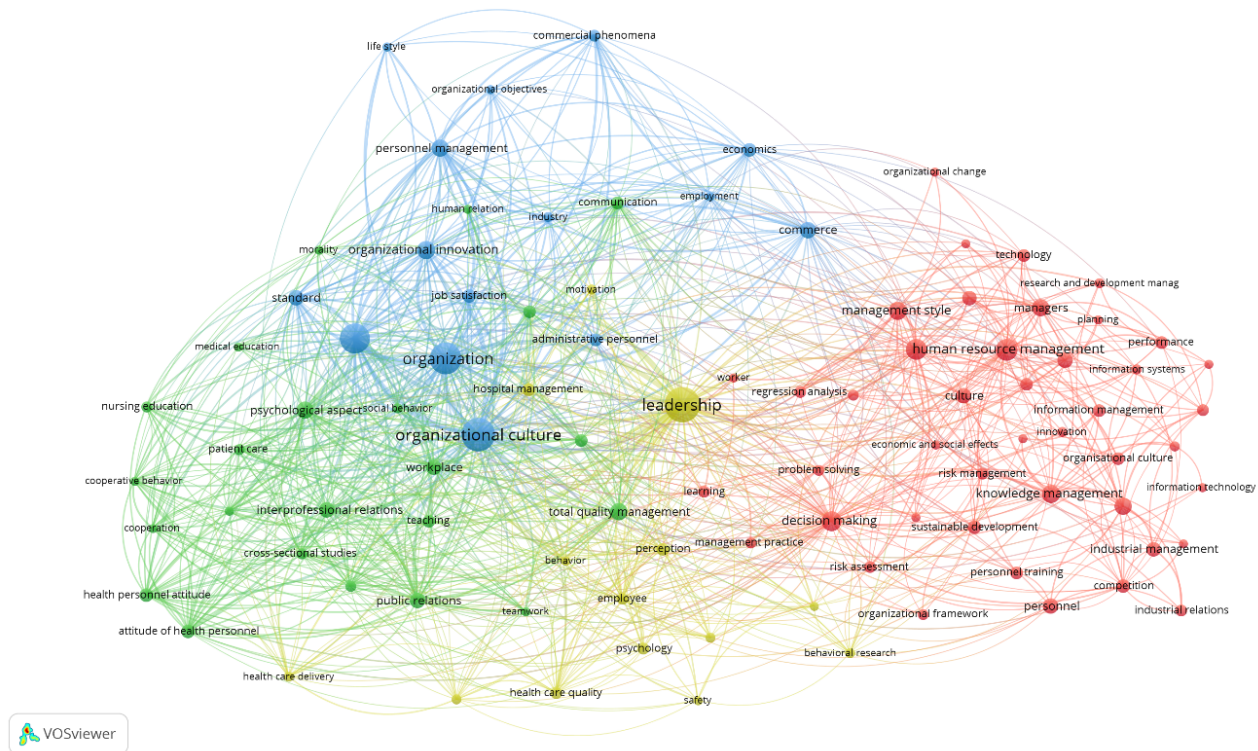


Figure 3. Results of procedure of the relationships between OC and MS exploration.

Source: Authors elaboration in VOSviewer (1.6.20 version).

This bibliometric map was generated by VOSviewer and is detailed in Table 2 as a list of keywords. Both Figure 3 and Table 2 feature-colored clusters identified by the bibliometric software, which aggregate co-occurring keywords that highlight key terms in the relationships between OC and MS. These colored clusters represent subnetworks composed of keywords frequently occurring together, indicative of specific areas for further exploration. The similarity between Figure 1 and Figure 3 lies in their representation of the relationship between OC and MS. However, the bibliometric map (Figure 3) portrays more complex dependencies. The red cluster primarily represents MS (with one node directly representing this term), while the blue cluster is associated with OC (with the main node being "organizational culture"). These two subnetworks are partially interconnected and supplemented by terms represented by the identified keywords gathered in yellow and green clusters. Differences in node size within Figure 3 indicate varying levels of importance, further elucidated by the density map.

The keywords identified within the red cluster in Figure 3 exhibit a higher degree of concentration, in contrast to keywords in the other clusters, which appear scattered and often overlap due to their relevance to employee management. The relationships between these keywords and their spatial positioning within the bibliometric map are of significant importance. Consequently, the yellow cluster is associated with leadership, behavior, psychological aspects of work, and mental health in organizational settings. On the other hand, the green cluster is primarily linked to physical health care and working conditions within business entities, relations and specialized education. The combination of these two clusters provides a comprehensive perspective on employee well-being. Some individual keywords, belonging to both of these clusters, are intertwined within various subnetworks, particularly as they describe specific contexts, such as hospital management. Serving as a bridge between these identified domains is leadership, which not only serves as one of the central nodes but also facilitates numerous connections (edges) from all areas. Table 2 presents all keyword labels identified in Figure 3. The number of links in each cluster corresponds to the total link strength and the number of occurrences.

Table 2. The keywords identified in exploration of relationship between OC and MS.

Keyword	Cluster	Links	Total link strength	Occurrences
competition	1 (red)	20	34	10
construction industry		21	32	9
culture		27	40	13
decision making		62	107	23
economic and social effects		12	12	5
empirical analysis		13	15	5
human resource management		38	81	26
industrial management		19	30	12
industrial relations		12	20	8
information management		21	29	9
information systems		19	25	6
information technology		14	16	5
innovation		22	27	6
knowledge management		40	75	19
leadership style		35	48	12
learning		36	46	8
management		50	101	24
management practice		15	18	7
management science		15	18	5
management style		46	73	18
managers		36	65	16
manufacture		15	19	5
marketing		13	16	5
occupational risks		28	38	7
organisational culture		22	29	9
organizational change		7	10	5
organizational framework		20	23	7
organizational learning		16	20	5
performance		20	28	9
personnel		32	40	13
personnel training		25	30	9
planning		16	20	5
problem solving		38	43	7
project management		27	46	14
regression analysis		25	31	8
research and development management		18	25	6
risk assessment		31	39	8
risk management		21	29	8
societies and institutions		30	60	16
strategic planning		20	31	8
sustainable development		25	31	10
technology		33	46	9
transformational leadership		17	23	6
worker		27	34	5
attitude of health personnel	2 (green)	31	97	10
communication		37	67	9
cooperation		28	57	5
cooperative behaviour		28	57	5

cross-sectional studies	34	55	7
education	31	49	9
efficiency, organizational	34	62	7
health personnel attitude	31	97	10
human relation	25	37	5
interpersonal communication	42	80	9
interprofessional relations	44	127	13
medical education	17	27	5
morality	35	47	5
nursing education	24	55	7
nursing staff	30	59	5
patient care	35	66	7
psychological aspect	46	158	17
public relations	51	132	14
social behavior	29	43	6
teaching	34	61	9
teamwork	37	52	5
total quality management	52	94	17
workplace	45	94	13
administrative personnel	28	62	9
commerce	38	92	15
commercial phenomena	23	67	8
economics	32	67	10
employment	24	34	5
industry	27	44	6
job satisfaction	40	87	10
life style	16	33	5
organization	71	401	55
organization and management	61	350	49
organizational culture	69	405	60
organizational innovation	52	148	19
organizational objectives	16	35	5
personnel management	41	131	17
standard	47	120	14
accident prevention	19	25	5
behavior	27	44	5
behavioral research	21	25	6
employee	39	57	8
health care delivery	23	46	6
health care organization	24	33	6
health care quality	26	47	8
hospital management	33	57	9
information processing	25	39	6
leadership	85	374	67
motivation	33	50	6
perception	41	59	9
psychology	32	45	8
safety	22	29	5

Source: Authors elaboration based on the Q1 results analysis in VOSviewer (version 1.6.20).

The keywords presented in Table 2 reflect the historical research topics published in the Scopus database. An analysis of these keywords enables the identification of research subjects that have been previously and currently pursued (Figure 4). The former are situated at the periphery of the graph. The overlay analysis presented in Figure 4, covering the time span from 2004 to 2014, demonstrates that the investigation of the relationship between OC and MS continues to be a subject of scientific exploration. This timeframe was selected due to intensive growth in the publication number covering relations between OC and MS.

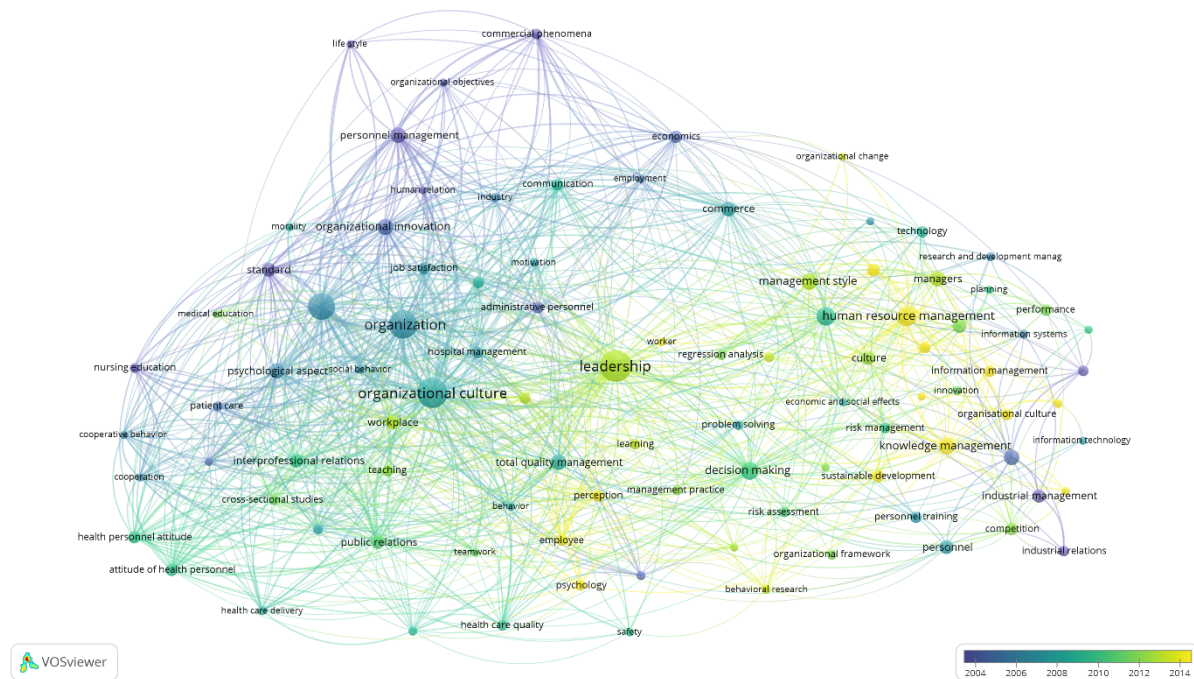


Figure 4. Overlay bibliometric map of relationships between OC and MS exploration.

Source: Authors elaboration in VOSviewer (version 1.6.20).

Figure 4 indicates the presence of leadership or its significance in the relationship between OC and MS. It is evident that leadership plays both a central and mediating role, integrating OC and MS. Among the identified keywords on the right side of Figure 4, a pivotal one is "human resource management" associated with MS.

Among the obtained results, a considerable degree of synonymity was observed, for example, between terms such as "management style" and "leadership style" in Figure 5. The obtained research findings confirm the existence of associations between OC and MS in the context of organizational performance and employee "job satisfaction". This study demonstrates the significant role that managers play, both in terms of their formal and informal leadership, which emerges within the organization. Importantly, the bibliometric structure demonstrates that the OC–MS interface is centrally embedded within leadership, human resource management, and organizational performance clusters. This indicates that the relationship is structurally anchored in mainstream management research rather than positioned at the periphery of the field.

VOS mapping shows the strongest normalized association for OC–Leadership (1.00), with moderate associations for OC–MS (0.44) and Leadership–MS (0.43), consistent with a leadership-mediated interface. The cluster structure and temporal overlay (2004–2014) are presented in Figures 3–5, and node-level TLS with link statistics appears in Table 2.

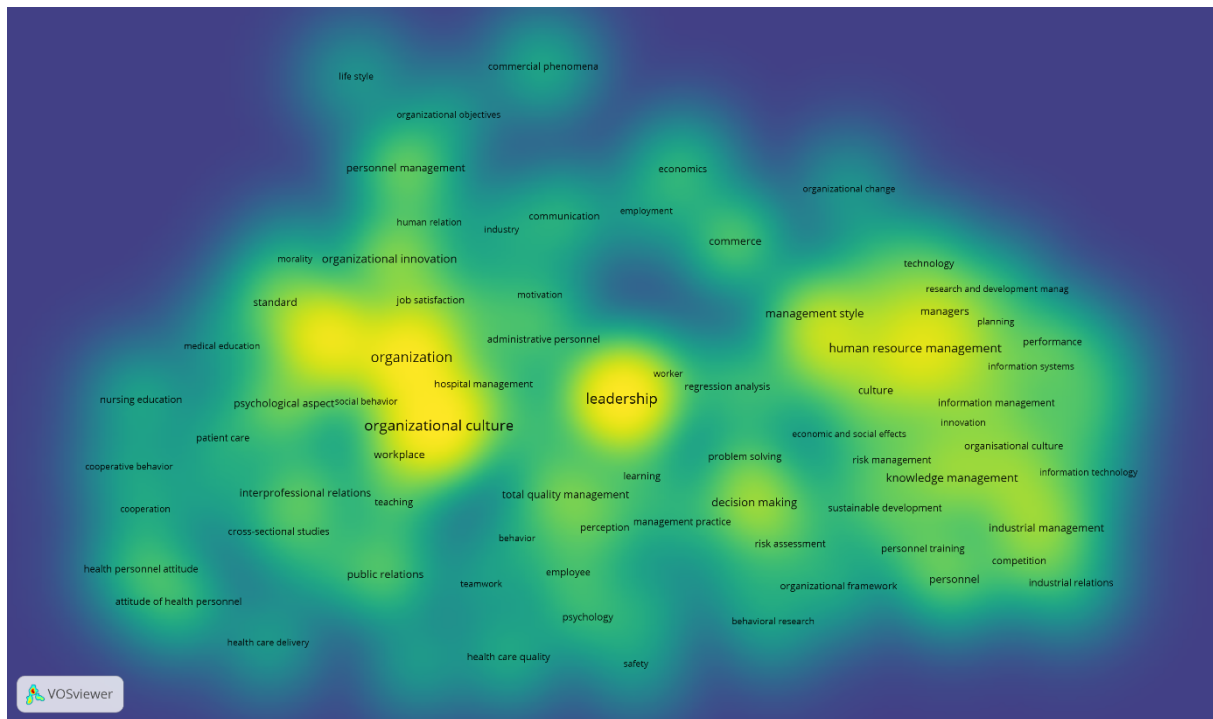


Figure 5. Keywords density map of relationships between OC and MS exploration.

Source: Authors elaboration in VOSviewer (version 1.6.20).

Guided by these patterns, a testable structural model is specified in Figure 6: OC - Leadership - MS, with a weak direct path OC - MS (dashed) to examine partial mediation. The proposed structural model provides a theoretically grounded and empirically testable specification. Future research should estimate this model on primary data using bootstrapped inference to validate mediation effects and assess robustness across contexts. The coefficients shown in Figure 6 are schematic and illustrate the expected directional structure; empirical values must be derived from primary data estimation

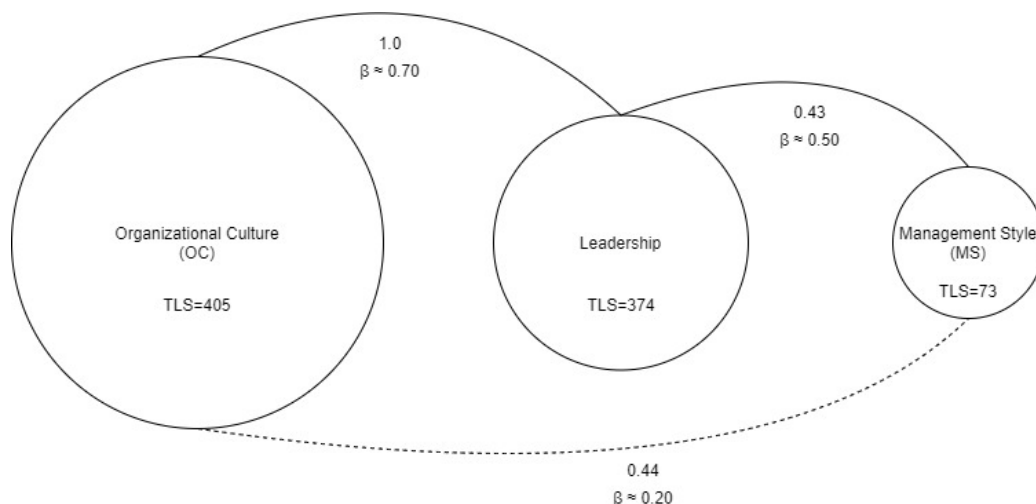


Figure 6. Structural model schematic (PLS/SEM; dashed OC → MS).

Source: Own elaboration.

4. Discussion

The outcomes of this study stem directly from the structure of the queries delineated in Table 1. These queries were confined to specific scientific domains, namely economics and management decision-making. Another limiting factor is the keyword imaging procedures, which affect their representation on bibliometric maps, given a threshold of a minimum of five co-occurrences. The

study deliberately focuses on structural concept identification rather than narrative comparison with individual prior studies. The objective was to reconstruct the conceptual architecture of the OC–MS relationship within the SD context, rather than to exhaustively contrast results with all previous contributions.

The dual VOS–PLS/SEM approach provides structural and directional insight but remains limited by the bibliometric nature of the evidence base. External validity should be examined with survey-based or multi-source datasets that estimate the proposed model using bootstrap inference and robustness checks, including alternative specifications, sub-samples, and longitudinal designs. This research was bounded by specified scientific areas identified in the queries (Table 1), such as environmental science, social sciences, business, management and accounting, economics, econometrics and finance, and decision sciences.

The data suggest that the relationship between OC and MS plays a crucial role in influencing employee well-being, working conditions, and job satisfaction. This inference is evident in the green and yellow clusters. Furthermore, the red cluster underscores this relationship's significance within the sphere of sustainable development, emphasizing employee-centric factors.

Current organizational research corroborates that employees are likely to depart if they perceive a misalignment between OC and MS, resulting in a clash with their intrinsic values. Prior studies indicate that other factors are essential for employee engagement, including soft skills and human-centric values and behaviours such as camaraderie, collaboration, and the absence of rivalry (though not competition) (Gleave, 2019). These factors contribute to an employee's sense of identity and association with an organization, adding layers to the intricate relationship between OC and MS.

The challenges in realizing sustainable development within organizations or ensuring cohesion among a set of goals are not rooted in the external business environment but in the attitudes and beliefs embedded in OC and MS. The OC–MS dynamic is in flux, undergoing gradual yet intricate transformations over time. Leadership acts as a stabilizing force within this context, but this function hinges on managerial proficiency.

While this research unfolded within the sustainable development framework, it underscores the nascent stage of probing the impact of the OC–MS relationship on predominantly socio-economic dimensions. The collective nature of OC suggests that these dimensions are combined rather than individual, driving changes within organizations. Given that this study was framed within sustainable development, the prominence of the socio-economic element is expected.

Organizational evolution is invariably linked to the maturation of employee consciousness, prompting shifts within the organization. Consequently, certain organizations grapple with challenges in recruitment, member retention, and alignment with the socio-environmental tenets of sustainable development. The present analysis elucidates the relationships between OC and MS within the framework of sustainable development. A literature review was conducted to amalgamate findings from various studies indexed in Scopus and to identify research domains where the interplay between OC and MS is prominent.

Conclusions

The results underscore the strategic relevance of the OC–MS interface within sustainable development frameworks. Stable configurations of OC and MS constitute foundational alignment mechanisms that enable coherent strategy execution and long-term organizational resilience. When cultural norms and managerial behaviours converge, organizations reduce internal friction and enhance implementation capacity. Leadership functions as the mediating mechanism through which collective values are operationalised into managerial practice.

These elements are particularly important in environmental strategies, where alignment between OC and MS, complemented by judicious managerial intervention, catalyses strategic pivots. The findings highlight the growing importance of qualitative aspects of work, especially among younger workforce cohorts. New entrants to organizations seek a clear developmental vision and harmony

between OC and MS, which can be instrumental in fostering their well-being and satisfaction. A discernible trend in the Scopus-indexed literature highlights the centrality of leadership and its associated terminologies within business entities.

From a managerial and practical standpoint, the interrelation of OC and MS in sustainable development emerges as a key area of concern (Kozar and Warwas, 2025). Executing an environmental strategy necessitates leadership capable of translating the theoretical underpinnings of sustainable development into actionable procedures and directives. Managers need to prioritise not only work conditions that promote physical health but also the psychological well-being of their staff.

This manuscript offers both scholars and practitioners insights that can support more effective progress towards sustainable development, reflecting heightened awareness of well-being and mindfulness within organizational settings. Managers are encouraged to foster a deeper understanding among employees of the strategy and the synergy between OC and MS.

A further managerial implication of this research relates to its potential as a tool for juxtaposing organizational intentions within a specific firm. Although OC and MS remain theoretical constructs, understanding their essence is imperative for implementing strategic transformations. The findings can also be harnessed to construct a business ecosystem of collaborative entities that recognise the salience of OC–MS dynamics. Additionally, the complementarity of OC and MS may serve as a starting point for job transformation and shifts towards green jobs. This study is intended to speak to a broad academic audience by outlining novel research trajectories. A prospective avenue for future work is the extension of this study, positioning OC and MS as foundational pillars for enhancing implementation outcomes.

The interrelationship between OC and MS is most plausibly enacted through leadership. Mapping the field with VOS and formalising directionality with PLS/SEM situates leadership as the transmission belt through which cultural values are converted into managerial routines that matter for ESG performance. The proposed framework offers a replicable basis for empirical validation and a pragmatic roadmap for sustainable execution.

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Reference

5. Assoratgoon, W., & Kantabutra, S. (2023). Toward a sustainability organizational culture model. *Journal of Cleaner Production*, 400(March), Article 136666. <https://doi.org/10.1016/j.jclepro.2023.136666>.
6. Bititci, U. S., Mendibil, K., Nudurupati, S., Turner, T., & Garengo, P. (2004). The interplay between performance measurement, organizational culture and management styles. *Measuring Business Excellence*, 8(3), 28–41. <https://doi.org/10.1108/13683040410555591>.
7. Bowers, M. R., Hall, J. R., & Srinivasan, M. M. (2017). Organizational culture and leadership style: The missing combination for selecting the right leader for effective crisis management. *Business Horizons*, 60(4), 551–563. <https://doi.org/10.1016/j.bushor.2017.04.001>.
8. Dewi, N. N., & Wibowo, R. (2020). The effect of leadership style, organizational culture and

- motivation on employee performance. *Management Science Letters*, 10(9), 2037–2044. <https://doi.org/10.5267/j.msl.2020.2.008>.
9. Ford, R., Newman, S., & Ford, L. (2023). Giving to get loyalty: How organizations signal their loyalty to employees. *Organizational Dynamics*, 52(1), Article 100956. <https://doi.org/10.1016/j.orgdyn.2022.100956>.
 10. Geyskens, I., Krishnan, R., Steenkamp, J. B. E. M., & Cunha, P. V. (2009). A review and evaluation of meta-analysis practices in management research. *Journal of Management*, 35(2), 393–419. <https://doi.org/10.1177/0149206308328501>.
 11. Gleave, R. (2019). More than a collaboration—What sort of organization should Cochrane be? Using organizational metaphors to explore the work of Cochrane. *Journal of Evaluation in Clinical Practice*, 25(5), 729–738. <https://doi.org/10.1111/jep.13214>.
 12. Kaarst-Brown, M. L., & Robey, D. (1999). More on myth, magic and metaphor: Cultural insights into the management of information technology in organizations. *Information Technology & People*, 12(2), 192–218. <https://doi.org/10.1108/09593849910267251>.
 13. Kang, J. H., Solomon, G. T., & Choi, D. Y. (2015). CEOs' Leadership Styles and Managers' Innovative Behaviour: Investigation of Intervening Effects in an Entrepreneurial Context. *Journal of Management Studies*, 52(4), 531–554. <https://doi.org/10.1111/joms.12125>.
 14. Kaur Bagga, S., Gera, S., & Haque, S. N. (2023). The mediating role of organizational culture: Transformational leadership and change management in virtual teams. *Asia Pacific Management Review*, 28(2), 120–131. <https://doi.org/10.1016/j.apmr.2022.07.003>.
 15. Kozar, L. J., & Paduszyńska, M. (2024). FinTech and sustainable development: study focused on identifying green research areas. *Procedia Computer Science*, 246, 1762–1769. <https://doi.org/10.1016/j.procs.2024.09.676>.
 16. Kozar, L. J., & Warwas, I. (2025). Green Finance and Digital Transformation: A Bibliometric Analysis of Research Trends. *Procedia Computer Science*, 270, 4353–4362. <https://doi.org/10.1016/j.procs.2025.09.560>.
 17. Lyons, S. T., Duxbury, L. E., & Higgins, C. A. (2006). A comparison of the values and commitment of private sector, public sector, and parapublic sector employees. *Public Administration Review*, 66(4), 605–618. <https://doi.org/10.1111/j.1540-6210.2006.00620.x>.
 18. Mwangi, G. K., Olayo, J. O., & Simuyu, A. N. (2015). Employee Skills, Management Style and Organizational Culture in Implementation of Strategic Plans in Middle Level Colleges in Thika Sub-County, Kenya. *International Journal of Business and Management*, 10(6), 199–207. <https://doi.org/10.5539/ijbm.v10n6p199>.
 19. Ogbonna, E., & Harris, L. C. (2000). Leadership style, organizational culture and performance: Empirical evidence from UK companies. *International Journal of Human Resource Management*, 11(4), 766–788. <https://doi.org/10.1080/09585190050075114>.
 20. Pagán-Castaño, E., Maseda-Moreno, A., & Santos-Rojo, C. (2020). Wellbeing in work environments. *Journal of Business Research*, 115, 469–474.
 21. Rezeki, F. (2023). The Influence of Transformational Leadership Style, Organizational Culture and Organizational Communication on Employee Job Satisfaction. *Asian Journal of Management Entrepreneurship and Social Sci*, 03(1), 698–714.
 22. Ryan, J. J. (2002). Work values and organizational citizenship behaviors: Values that work for employees and organizations. *Journal of Business and Psychology*, 17(1), 123–132. <https://doi.org/10.1023/A:1016246103190>.
 23. Sulich, A., & Soloducho-Pelc, L. (2024). Strategic management and business ecosystem scientific relations—key areas review. *International Journal of Innovation Studies*, 8(3), 287–296. <https://doi.org/10.1016/j.ijis.2024.04.005>.
 24. Sulich, A., & Sołoducho-Pelc, L. (2025). Sustainable development in production companies: integrating environmental strategy and green management style. *Discover Sustainability*, 6, 1–16. <https://doi.org/10.1007/s43621-025-01152-6>.

25. Sulich, A., Sołoducho-Pelc, L., & Ferasso, M. (2021). Management Styles and Decision-Making: Pro-Ecological Strategy Approach. *Sustainability*, 13(4), Article 1604. <https://doi.org/10.3390/su13041604>.
26. Sulich, A., Zema, T., & Kulhanek, L. (2023). Towards a Secure Future: A Bibliometric Analysis of the Relations Between Cybersecurity and Sustainable Development. *Procedia Computer Science*, 225, 1448–1457. <https://doi.org/10.1016/j.procs.2023.10.133>.
27. Yue, C. A., Men, L. R., & Ferguson, M. A. (2021). Examining the Effects of Internal Communication and Emotional Culture on Employees' Organizational Identification. *International Journal of Business Communication*, 58(2), 169–195.

Cognitive-Affective Trust Towards International E-Commerce Platforms: A Study of Polish Young Consumers

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Abstract

This study explores the cognitive-affective foundations of trust in international e-commerce among 218 young adult Polish consumers under 35 years of age. Data was collected through a computer-assisted web interview (CAWI). Three composite indices were developed to capture cognitive trust (COG_INDEX), affective trust (AFF_INDEX), and overall trust (TRUST_SCORE). Descriptive statistics, quadrant segmentation, and hierarchical regression analysis were applied to examine the relative weight of cognitive and affective factors. The results show that cognitive trust explains nearly half of the variance in overall trust, while affective factors add only marginal predictive value. Quadrant analysis further revealed that frequent purchasing clustered among respondents with high cognitive trust, whereas affective cues mainly played a supportive role. These findings confirm a sequencing model of trust formation, where rational assurances provide the baseline and emotional features reinforce engagement and loyalty. The study was limited by a small and non-random sample size, while the focus on young adults in Poland restricts its generalisability.

Key words

young consumers, e-commerce, trust, cross-border shopping.

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Introduction

In recent times, e-commerce platforms have become increasingly entrenched in global retail, reshaping how people connect with brands, make purchases, and experience shopping. International platforms have expanded access to products and services across borders, which, in many cases, has reshaped long-standing retail patterns (Han et al., 2023). At the same time, the growth of this model raises an important issue of trust. Trust in a platform is still a prerequisite for consumer participation and long-term loyalty (Chiang et al., 2018). When there is a lack of such confidence, consumers tend to withhold personal data or abandon online transactions, making trust a recurring theme in both scholarly debate and everyday business practice.

Trust in the e-commerce domain is generally understood as a multidimensional construct that combines cognitive and affective elements (Punyatoya, 2019). Cognitive trust reflects a rational

evaluation of a platform's reliability, competence, and security, expressed for instance through transparent pricing, clear privacy policies, or positive prior experiences. Affective trust, on the other hand, develops from emotional attachment and favourable impressions generated by visual design, interactive features, and marketing communication (Fang et al., 2016). Although both dimensions are widely acknowledged, their importance among younger, digitally native consumers remain fairly uncaptured and may evolve with changing expectations and technological innovation (McIntosh et al., 2021).

In a wider global context, cross-border e-commerce stands out as one of the most prominent segments of online retail. Estimates place its value at about USD 1.14 trillion in 2024 and USD 1.21 trillion in 2025, representing roughly 18.8 to 20 per cent of all global online sales (Capital One Shopping, 2025). Among firms that already operate internationally, cross-border transactions account for around 28 per cent of total online sales (Avalara, 2024). Projections suggest continued expansion at a compound annual growth rate (CAGR) of 15.44 per cent through 2034 (Precedence Research, 2025), yet domestic shopping still dominates, with approximately 80 per cent of purchases occurring within national markets. A closer look at recent reports reveals marked regional differences. In the Asia-Pacific region, 80 per cent of consumers anticipate further international growth, and in China 99 per cent report comfort with cross-border purchases (Airwallex, 2025). Taken together, these figures arguably show the rising importance of cross-border e-commerce while also indicating the continued dominance of domestic preferences in shaping online consumption patterns.

International e-commerce platforms such as Amazon, Alibaba, eBay, and Zalando have become key actors in global online retail. They aggregate products from a wide range of vendors, allowing consumers to compare offers, prices, and reviews on an international scale (Mou et al., 2020). For younger generations, who are technologically adept and receptive to cross-border shopping, these platforms combine convenience with a broad assortment and attractive pricing. At the same time, international transactions heighten perceived risks surrounding product authenticity, delivery reliability, and the enforcement of consumer rights (Anastasiadou et al., 2019). Building on this point, platforms allocate substantial resources to trust-building measures, including security certifications, transparent policies, and localised user experiences (Maniam et al., 2012). Çevik and Koç (2022) show that these mechanisms involve third-party security seals, clear communication of procedures, and high-quality website design with region-specific features to distinguish reliable providers from dishonest ones and strengthen customer trust. By extension, Zheng et al. (2025) argue that platforms should adopt comprehensive trust strategies combining advanced security measures, transparent policies, secure payment systems, and localised customer support to address the distinctive challenges of international transactions.

Research indicates varying age-related horizons of trust in the online sphere. Studies suggest that younger users, usually more comfortable with digital technologies, are more open to online shopping than older adults, who may be more hesitant due to limited experience with digital tools (McIntosh et al., 2021). Surprisingly, however, even though young people use the Internet far more often, they do not seem to fully make use of more advanced online services, such as e-commerce features or e-government platforms (Serrano-Cinca et al., 2018). Young consumers are therefore an exceptionally appealing social group that is worth paying attention to in the context of online shopping behaviour and the trust associated with it. However, to date, it has been exceedingly difficult to find scientific studies that comprehensively address the trust levels of young consumers in the sphere of e-commerce and that are not meta-analyses or review articles. For example, a study by Bylok (2022), although it concerns the trust of young consumers in e-commerce, does not take into account platform internationality and the duality of the construct of trust, which can be divided into cognitive and affective trust. This division is commonly found in studies on trust (including in the context of e-commerce) and accurately reflects the comprehensiveness of this subject (Pahrudin et al., 2025; Foroutan et al., 2022; Punyatoya, 2019). There are also studies such as that by Kizák et al. (2024), which concern the behaviour of young e-consumers of the Visegrad Group, but without addressing

the context of their trust. ElSayad and Mamdouh (2024), on the other hand, focused exclusively on aspects related to trust in AI in online stores among young shoppers. It can therefore be concluded that there is a research gap in that no study has yet been conducted on young e-consumers that would address their trust in e-commerce, taking into account the duality of the concept of digital trust and cross-border shopping.

How these investments translate into young consumers' factual trust, and which platform features are most decisive for this group, remains a question worth investigating. With international e-commerce expanding rapidly and young consumers gaining greater purchasing power, there is a growing need to identify not only what shapes the very trust in the online sphere, but also which factors hold the most relevance for this demographic. Building on this concern, the present study addresses two key questions: What determinants shape young consumers' propensity to trust international e-commerce platforms? Which category of determinants – cognitive or affective – exerts a stronger influence on that trust?

Accordingly, this paper aims to identify and measure the influence of cognitive and affective factors on consumer trust in international e-commerce platforms and to compare their relative strength. By doing so, it seeks to enrich theoretical discussions of consumer trust (with particular focus on the younger adult generations) and provide a more practical foundation for businesses operating online. Research hypotheses will be presented in the course of reasoning based on a literature review.

The paper is structured as follows: Section 1 reviews the literature on cognitive and affective perspectives of digital trust in an international context, and on this basis the research hypotheses are drawn. Section 2 outlines the methodology. Section 3 presents the results. Section 4 discusses the findings. Final section of this paper closes with the conclusions, limitations and possible directions for future research

1. Literature review

1.1 *The importance of trust in digital commerce*

Trust is a multifaceted concept whose meaning varies across academic traditions. In social psychology it is often viewed as an expectation embedded in human behaviour and personality (Paliszkievicz, 2013). Economics conceptualizes it as a form of social capital that supports the functioning of markets and exchange (Nessel, 2022). Management studies interpret trust as the trustor's belief in the trustee's competence and goodwill, which in turn facilitates stable and effective business relationships (Blomqvist, 1997). In online contexts, trust gains even more importance as it underpins consumer confidence on e-commerce platforms. Launer et al. (2022) capture this shift by defining digital trust as "the general belief that technology, people and processes act or are aligned in ways that will fulfil people's digital expectations, such as a sense of confidence, security or control to support the creation of a secure digital environment."

Within e-commerce, trust acts as a key determinant of consumer behaviour and as an enabler of successful transactions (Bylok et al., 2019; Pietrzak & Takala, 2021). Confidence in online vendors was recognized early as essential for the success of e-commerce firms (Liu & Tang, 2018). Hendricks and Mwapwele (2024) argue that trust remains indispensable for e-commerce firms' adoption, as a confidence deficit discourages consumers from engaging in online shopping. It is also widely accepted that trust provides the foundation for stable customer relationships and loyalty (Foroutan et al., 2022). Younger consumers, such as Millennials and Generation Z, show distinct patterns of online trust formation, where optimism, innovativeness and discomfort influence perceived trust and usefulness, which in turn predict purchase intention (ElSayad & Mamdouh, 2024). Bylok (2022) further observes that positive experiences during earlier online interactions increase the likelihood of future transactions, and that trust attributes exert a particularly strong influence on the purchasing decisions of younger consumers.

The importance of trust in digital commerce can also be linked to its role in reducing perceived uncertainty and risk. Providing transparent information about product quality and its guarantees, as well as vendor credibility, are particularly important for both students and young adults, who treat these factors as primary trust signals (Kocot et al., 2025). Online transactions, by their nature, lack the direct interaction between buyer and seller that traditionally provides reassurance. This absence amplifies perceived risks such as financial loss, data breaches and doubts about product quality. Trust serves as a mitigating force to these concerns, offering consumers a sense of security in an environment often associated with uncertainty. Apprehensions about identity theft, fraud and privacy violations remain widespread, yet well-designed security measures can moderate these anxieties (Netshirando et al., 2024). Foroutan et al. (2022) also highlight that the inability to physically examine products intensifies perceived risk, thereby increasing the importance of trust in online purchasing decisions.

Trust reaches beyond risk reduction into the establishment and maintenance of enduring business relationships. Without a baseline of confidence, the formation and sustainability of contracts or long-term partnerships between buyers and sellers become difficult to achieve (Silitonga et al., 2020). Trust supports productive exchanges, enabling transactions to unfold smoothly and reliably, which is crucial for the long-term viability of online ventures (Bui Thanh, 2023). It also influences not only first-time interactions with a platform but the development of loyalty, repeat purchases and other behaviours that define the ongoing success of e-commerce companies (Aslam et al., 2020). Expectations and emotional responses towards service providers also appear to mediate this relationship, with trust acting as a bridge that converts first-time buyers into returning customers and thereby shaping retention and profitability (Wang et al., 2019).

The rapid growth of the e-commerce sector, accelerated by the COVID-19 pandemic (Hadasik & Kubiczek, 2022; Pollák et al., 2021), has increased the urgency of these issues. As consumers move more of their habits online (Markovič et al., 2022), they face growing threats such as phishing, fraud, and misinformation. Against this backdrop, maintaining consumer confidence is a pressing challenge (Şcheau et al., 2016). Companies arguably need to invest continuously in trust-building practices so that consumers feel secure and confident in their online interactions, which may also improve the overall shopping experience (Meskaran & Ismail, 2012). Strzelecki (2019) echoes this point, finding that security certificates function as basic trust signals in cross-border commerce, with shops lacking them at risk of losing customer confidence. Jeon et al. (2021) add that trust transfer significantly shapes consumers' repeat purchase intention. In this way, trust operates as a dynamic mechanism underpinning both immediate transactions and ongoing loyalty.

Trust also helps to address the information asymmetry that characterizes many online transactions. In traditional retail settings, consumers can directly inspect goods, whereas in digital commerce vendors typically hold more information about the products they offer. This imbalance can produce dissatisfaction and uncertainty (Hadasik, 2024; Pandey et al., 2024). By assuring consumers that a vendor's intentions align with their interests, trust narrows this gap and encourages more confident purchasing decisions.

1.2 Cognitive and affective factors affecting digital trust

Recent research increasingly distinguishes between two complementary dimensions of trust in digital commerce: cognitive trust and affective trust. Cognitive trust rests on reasoned evaluations of a platform's competence, reliability and honesty (Mayer et al., 1995). It involves a deliberate appraisal of observable attributes, with consumers judging the trustworthiness of an e-commerce provider by considering its operational transparency, consistency in fulfilling promises and perceived ability to meet commitments. This dimension of trust is essentially performance-based and largely objective, relying on rational processes to determine whether the other party in a transaction can be relied upon (Mayer et al., 1995). For younger online shoppers, satisfaction emerges as a key mechanism bridging trust, shopping experience, and word-of-mouth intentions. In this context, elements such as personalized service and transparent data protection appear to reinforce the indirect influence of trust

on repurchase behaviour, even when consumers perceive transactions as relatively high-risk (Amado-Mateus et al., 2025). In the e-commerce context, Wang et al. (2023) describe cognitive trust as consumers' belief in the reliability, competence and trustworthiness of online platforms, especially regarding transaction processes, privacy and service delivery. Punyatoya (2018) likewise notes that cognitive trust reflects perceived website quality, privacy and security policies and prior experience with the retailer. Strzelecki (2020) adds that website performance decisively shapes consumer behaviour in cross-border e-commerce: slow load times reduce conversion rates, while faster response times enhance confidence and willingness to complete transactions.

Where cognitive trust relies on rational evaluation, affective trust grows from emotional bonds and interpersonal connections. It reflects the attachment and empathy that consumers develop toward an online vendor, often shaped by the perceived sincerity of its interactions and the overall emotional experience it provides (McAllister, 1995). Evidence from studies on younger consumer groups indicates that affective trust is strongly influenced by social cues and technological infrastructure, which together drive their engagement with e-commerce platforms (Gupta et al., 2023). Sha (2021) observes that affective trust in online settings emerges from the emotional connection a customer feels toward a platform, shaped by the quality of prior interactions and by how closely the platform's values align with the consumer's personal beliefs and preferences. This emotional dimension is less tangible and more subjective than cognitive trust, yet it arguably plays a decisive role in sustaining long-term engagement and loyalty. Strengthening affective trust involves personalized communication, responsive customer service and visible demonstrations of shared values or social responsibility. These practices help to build an emotional bond between consumer and vendor. Corporate social responsibility initiatives that align with consumer values can, for instance, enhance trust and engagement by signalling a company's commitment to ethical practices and community well-being (Macca et al., 2024). Shah and Jan (2021) complements that personalized and customer-oriented communication, combined with empathy and social responsibility, cultivates stronger emotional connections and deepens affective trust.

The integration of cognitive and affective trust can be further understood through the lens of the Cognitive-Affective-Behaviour (CAB) theory, which posits that human behaviour is shaped by the dynamic interplay of cognitive processes, emotional responses, and behavioural tendencies (Mischel & Shoda, 1995). According to this theory, individuals assess situations based on both rational evaluations (cognitive trust) and emotional connections (affective trust), with each influencing how they perceive risk, form relationships, and make decisions in digital environments. This framework helps explain why both trust dimensions are essential for building robust consumer relationships online, as they reflect the dual nature of human decision-making, rooted in both logic and emotion (Uttenthal, 2024). The CAB theory thus provides a theoretical foundation for understanding how cognitive and affective trust jointly shape consumer behaviour in e-commerce contexts.

Cognitive and affective trust interact rather than operate in isolation, hence influencing consumer decision-making in intricate yet synergistic ways. Cognitive trust anchors the initial engagement by assuring consumers of a platform's reliability, while affective trust strengthens the emotional connection that fosters loyalty and long-term relationships (Punyatoya, 2019; Foroutan et al., 2022). Fang et al. (2016), as well as Shang et al. (2023) show that both dimensions influence online behaviour, particularly with regard to website design and user experience. Together these two dimensions offer a framework for understanding the full spectrum of consumer decision-making, from initial interest to post-purchase satisfaction (Punyatoya, 2019). Cognitive trust reduces perceived risks by signalling that the platform is dependable and capable of meeting expectations. Affective trust strengthens the emotional engagement that drives loyalty and sustains long-term customer relationships. This dual character arguably equips businesses to address both the rational and emotional sides of consumption, generating stronger and more enduring connections (Nghia et al., 2020).

Balancing these dimensions also provides a broader strategic advantage. Cognitive and affective trust together help reduce uncertainty, increase customer retention and allow firms to adapt more

effectively to the changing patterns of digital consumer behaviour (Fang et al., 2016; Jeon et al., 2021). A closer look at these findings suggests that e-commerce practitioners may build rational trust through transparency and reliable services while simultaneously fostering emotional connections that reinforce retention and satisfaction.

1.3 Trust in international e-commerce platforms

International e-commerce platforms have developed into global marketplaces connecting consumers and sellers across national borders. Amazon, Alibaba and eBay exemplify this expansion, which accelerated in the aftermath of the COVID-19 pandemic as online shopping became more firmly established (Pollák et al., 2021). In this context, the concepts of trust and digital literacy converge. Individuals who are more experienced and confident in online environments, often younger and digitally active consumers, tend to report higher satisfaction and show a stronger propensity for future repurchases (Rybak, 2018). Cross-border e-commerce, understood as the international sale of goods in the digital domain, remains one of the fastest growing segments of online retail and allows consumers to access products from a wide range of global markets (Aichner & Shaltoni, 2018).

Trust operates as a cornerstone in what kind of approaches do consumers undertake to interact with these platforms. In international contexts it entails confidence in a platform's capacity to handle complex logistics, protect payments and personal data, and comply with regulatory frameworks that are frequently less familiar than domestic laws (Xu et al., 2024). Compared with national markets, this form of trust ought to bridge broader contextual gaps involving legal jurisdiction uncertainty, cultural differences and the difficulty of evaluating the credibility of foreign sellers (Witek-Hajduk & Grudecka, 2024). In practice, consumers rely on a constellation of cues such as international reputation, third-party certifications, localized customer service and clear information about customs, taxes and delivery. Liu (2024) notes that trust in international e-commerce is both multidimensional and more fragile because information asymmetry and perceived risks are typically greater than in domestic commerce.

Several determinants guide how consumers assess the trustworthiness of international platforms. Concerns about product quality, safety and reliability are especially prominent. Goods originating from the European Union, for example, are often perceived as safer and more dependable, which enhances consumer confidence (Aichner & Shaltoni, 2018). Country of origin (COO) has emerged as a particularly salient cue. Transparent communication about a product's COO can improve perceptions of quality and safety and, in turn, reinforce trust in the platform itself (Bhattacharya et al., 2023). This transparency supports consumer rights and strengthens confidence, which has a direct influence on purchase intentions (Strzelecki & Rizun, 2022). Nevertheless, despite its prominence in marketing practice, the influence of COO on cognitive and affective trust remains insufficiently studied, which signals a useful direction for further research.

Cultural context also shapes how trust develops and is maintained on international platforms. Consumers from different cultural backgrounds bring distinct frames of reference to online purchasing that reflect enduring social values. Hofstede (1984) observed that individuals from collectivist cultures tend to emphasize social proof and peer recommendations, whereas those from more individualistic cultures place greater importance on autonomy and personal choice (Rosillo-Díaz et al., 2020). This divergence affects perceptions of trust, risk and value. Jiang and Jones (2014) emphasize that cultural perceptions directly influence international shopping behaviour. Hallikainen and Laukkanen (2018) similarly argue that cultural background is instrumental in shaping a consumer's willingness to trust online platforms. Among younger consumers, social proof, technology readiness and cultural norms appear to interact with cognitive and affective trust mechanisms, pointing to areas where platforms (i.e., e-vendors) might make investments to build stronger trust (Gupta et al., 2023).

Individual attitudes toward online shopping further influence the formation of and development of trust. These attitudes are shaped by prior experiences, marketing communication and social

influence (Zhang & Benyoucef, 2016). Perceived risks such as data security, product authenticity and the reliability of third-party service providers also weigh heavily in the formation of confidence (Glover & Benbasat, 2010). Information asymmetry between consumers and vendors adds another layer of difficulty. When consumers feel inadequately informed about a product, particularly in the online domain, a lack of transparency and sense of uncertainty can erode their trust in the platform (Hadasik, 2024).

These studies suggest that trust is central to the success of international e-commerce. Addressing both cognitive and affective dimensions of trust while taking into account cultural and technological diversity can reduce perceived risks, foster loyalty and support sustained growth in global markets.

1.4. Hypotheses formation

The following subsection moves directly to hypothesis formulation, building on the previously established premises regarding the role of trust and its dual (cognitive-affective) nature in online commerce sphere. On this theoretical basis, the expected relationships between trust dimensions and young consumers' shopping behaviours on foreign and domestic platforms are outlined.

The first hypothesis concerns platform choice and shopping frequency. Prior work shows that young consumers often use international platforms such as AliExpress, Amazon, and Temu (Witek-Hajduk and Grudecka, 2024). Frequent use, however, does not align with higher trust. The same study reports lower trust in international platforms than in Polish ones, and Foroutan et al. (2022) note that consumers place stronger trust in platforms supported by domestic presence and regulatory oversight. This contrast between engagement and confidence underpins the proposed hypotheses, which read as follows:

- H1a. Young consumers use international shopping platforms more frequently than those originating from Poland.
- H1b. Young consumers place less trust in international shopping platforms than those originating from Poland.

Affective trust appears more fundamental than cognitive trust for young consumers in online purchases. While cognitive trust relies on competence and reliability, younger buyers are strongly influenced by emotional cues, social signals, and personalized experiences. Prior studies support this emphasis: affective trust significantly shapes behavioural intentions (Punyatoya, 2019), drives purchase intentions more effectively than cognitive trust among younger users (Wang et al., 2023), and aligns with young consumers' preference for emotional connection (Bartosik-Purgat & Rakowska, 2024). Notably, online shopping enjoyment, reflecting an affective aspect of online behaviour, is the strongest predictor of young consumers' involvement (Gautam & Sharma, 2020). Therefore, the study proposes the following wording of hypothesis H2:

- H2. Affective trust plays a more fundamental role for young consumers when purchasing online.

Whereas H2 emphasizes the purchasing relevance of affective mechanisms, H3 focuses on how cognitive trust shapes overall trust. Trust involves a willingness to accept vulnerability based on expected performance, which in digital commerce relates to beliefs about reliability, information integrity, and confidentiality. Research shows that cognitive trust exerts independent effects: Foroutan et al. (2022) find it significantly predicts satisfaction and loyalty even when affective trust is controlled; Wang et al. (2023) confirm that rational assessments of reliability and security independently shape consumer outcomes; and Witek-Hajduk and Grudecka (2024) highlight the importance of competence, payment security, and information accuracy for purchase intentions. Thus, the study proposes:

- H3. Higher levels of young consumers' cognitive trust in international e-commerce are associated with stronger overall trust, independently of affective trust.

Building on prior evidence linking trust to behavioural outcomes, the next hypothesis argues that the joint presence of high cognitive and affective trust is a strong predictor of shopping intensity. Research shows that on the one hand cognitive trust fosters reliability expectations and on the other:

affective trust strengthens emotional attachment. That both forms jointly promote loyalty and repeat purchasing (Foroutan et al., 2022; Suyanto et al., 2025). Consumers who experience both rational assurance and emotional comfort are therefore the most likely to engage in frequent shopping. In view of this, the next hypothesis reads as follows:

- H4. Young consumers with high cognitive and high affective trust constitute the largest share of high-frequency shoppers.

Finally, H5 specifies an expectation about which set of antecedents exerts a stronger effect on overall trust. While affective trust is important for purchase intention, overall trust in international e-commerce depends more on cognitive cues due to heightened risk and the need for reliable safeguards. Empirical research shows that security-related beliefs, such as integrity and confidentiality, strongly influence trusting beliefs. Punyatoya (2019) finds that cognitive trust has the biggest influence on behavioural intentions, even when affective trust is controlled. Witek-Hajduk and Grudecka (2024) show that cognitive antecedents (e.g. platform quality, payment security, information transparency, and legal protection) exert stronger effects on trust and purchase intentions than emotional factors. Foroutan et al. (2022) confirm that website quality, security policies, and reputation (cognitive antecedents) predict trust more strongly than emotional factors, especially in uncertain contexts. Therefore, the study proposes:

- H5. Cognitive antecedents have a stronger effect on overall trust than affective features.

2. Methodology

2.1. *Techniques and instruments used in the study*

The research employed a quantitative approach and applied the Computer-Assisted Web Interviewing (CAWI) technique. The data were obtained between 23 and 29 May 2025. The target group consisted of young adult consumers residing in Poland who had purchased goods from international e-commerce platforms within the preceding twelve months.

A purposive, criterion-based sampling strategy was applied to ensure that all respondents met clearly defined inclusion criteria: (1) being between 18 and 34 years of age, (2) living in Poland at the time of data collection, and (3) having completed at least one purchase from a foreign online retailer in the last year. Recruitment was conducted via online channels oriented toward young adults, with an explicit screening question at the start of the survey to exclude individuals who did not fulfil these criteria. Survey links were distributed to individuals meeting specific criteria, selected based on their relevance to the research context, with screening questions used to ensure eligibility. This procedure ensured that respondents were selected for their recent, relevant cross-border shopping experience rather than mere ease of access, yielding a purposive sample of experienced young online shoppers in Poland.

The questionnaire, provided as a supplementary file, was structured to move from background variables toward more specific constructs and was informed by established measures of online trust and e-commerce behaviour (e.g., Punyatoya, 2019; Pietrzak & Takala, 2021). Alongside demographic information such as gender, age, education, household size, place of residence and self-assessed financial situation, the survey included segmented items to explore how respondents interact with international e-commerce platforms and how such interactions influence their cognitive-affective trust. Respondents were asked to report their shopping preferences, including the frequency and nature of purchases made on international platforms, which served to establish patterns of cross-border consumption. This was followed by items assessing general trust (i.e., overall sense of security in online shopping, confidence in payment systems, trust in sellers and perceived legal protection), which were adapted from existing scales of online trust in e-commerce contexts (Kumar et al., 2020; Bianchi & Andrews, 2012; Soleimani, 2022).

Cognitive trust was explored through questions about platform security (including security certificates and privacy policies), transparency of pricing, clarity and usability of website interfaces, trust in the platform's country of origin and positive prior experiences with online vendors, drawing

on prior operationalizations of cognitive-based trust in digital environments (Tambunan et al., 2018; Rane & Meshram, 2012; Chiang et al., 2018; Falahat et al., 2019; Engriani & Novaris, 2020; Lo et al., 2013; Piroth et al., 2020; Bhattacharya et al., 2023; Bylok et al., 2019). Affective trust, in turn, was captured through items probing emotional responses to platform aesthetics, the attractiveness of product imagery, reactions to advertising content, perceived price attractiveness as distinct from price transparency, and the influence of social and interactive features such as live chat, customer reviews, recommendations from friends or family, and perceptions of community or pro-environmental engagement by the platform. Interpersonal influence, encompassing both electronic (eWOM) and traditional verbal feedback, plays a crucial role in shaping impulsive buying behaviour (Zheng et al., 2025). Gaining insights into sellers' opinions broadens consumers' knowledge, influencing their reasoning and decision-making processes (Obiedat, 2013). As a result, this factor contributes to both the affective and cognitive components of trust in e-commerce. Items pertaining affective trust were adapted from studies on affective trust and emotional responses to online retail interfaces (Blagoeva et al., 2023; Aichner & Shaltoni, 2017; Yin & Han, 2021; Hsieh et al., 2014; Bartók, 2018). To provide a broader context, the questionnaire also examined respondents' evaluations of the overall quality of international e-commerce market operations, including the perceived reliability and efficiency of these platforms.

The allocation of individual questionnaire items to broader analytical categories, including general trust, cognitive and affective trust factors and perceived quality of market operations, was guided by an extensive review of relevant literature and established measurement scales. This approach ensured that each area of inquiry was theoretically grounded, and that the multidimensional nature of e-consumer trust was captured in a conceptually consistent way.

2.2. Developed measures

Based on the items related to cognitive and affective trust, the respective composite indices were constructed by calculating the arithmetic mean of relevant items, i.e. the Cognitive Index (COG_INDEX) and Affective Index (AFF_INDEX). Additionally, the Overall Trust Score (TRUST_SCORE) was derived from general trust items.

Each index drew on the following groups of items:

- COG_INDEX – included visible security certificates, privacy policy clarity, transparency of content and pricing, ease of navigation, trust in country of origin, and prior positive experiences (questionnaire items Q15a-Q15g).
- AFF_INDEX – comprised attractive design, product galleries, positive advertising emotions, emotionally attractive pricing, interactive and social features, community/ecological engagement, and recommendations (questionnaire items Q16a-Q16h).
- TRUST_SCORE – captured attitude towards online shopping, as well as overall trust in online shops, sellers, legal protection, and online payments (questionnaire items Q14a-Q14e).

Table 1 presents the basic descriptive statistics for these three composite indices.

Table 1. Descriptive statistics and internal consistency of the cognitive, affective and overall trust indices (N=187)*.

Variables	COG_INDEX (7 items)	AFF_INDEX (8 items)	TRUST_SCORE (5 items)
Mean **	7.22	6.12	7.10
Standard deviation	1.54	1.89	1.56
Skewness	-1.12 (moderate left-skewness)	-0.44 (slight left-skewness)	-0.80 (slight left-skewness)
Kurtosis	+3.15 (highly leptokurtic)	+0.56 (mildly leptokurtic)	+1.4 (moderately leptokurtic)
Cronbach's alpha	0.86	0.88	0.83

Note: * All indices were calculated for the group of 187 respondents who indicated purchasing goods from international online platforms; ** For all the above indices, an 11-point (0-10) rating scale was used, whereby: for COG_INDEX and AFF_INDEX "0" means "does not increase my trust at all" and "10" means "completely increases my trust," while for TRUST_SCORE "0" means "strongly disagree" and 10 means "strongly agree."

Source: own elaboration

The internal consistency and reliability of these indices were confirmed using Cronbach's alpha, with values indicating high reliability: $\alpha = 0.86$ for COG_INDEX, $\alpha = 0.88$ for AFF_INDEX, and $\alpha = 0.83$ for TRUST_SCORE. Descriptive statistics indicate relatively high mean values across all three indices, with cognitive trust ($M = 7.22$, $SD = 1.54$) and overall trust ($M = 7.10$, $SD = 1.56$) slightly exceeding affective trust ($M = 6.12$, $SD = 1.89$). Distributions show moderate to slight left-skewness, suggesting a general tendency of respondents to assign higher ratings. Kurtosis values point to varying degrees of concentration around the mean, ranging from highly leptokurtic in the cognitive index to more moderate levels in the affective and overall trust indices. Figure 1 shows a comparison of histograms of COG_INDEX and AFF_INDEX.

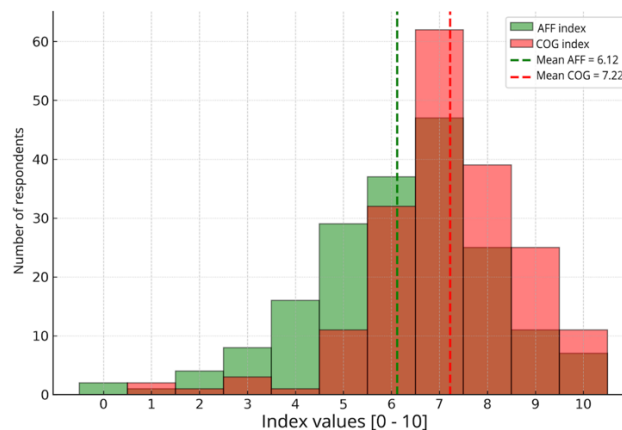


Figure 1. Histograms of the Cognitive Index (COG_INDEX) and the Affective Index (AFF_INDEX). Source: own elaboration.

A direct comparison of the indices (see Figure 1) showed that cognitive trust was generally higher and less varying than affective trust. Both indices, however, were shifted toward higher values, reflecting an overall positive disposition toward international e-commerce among young Polish consumers.

2.3. Sample characteristics

The final research sample consisted of 218 valid responses. This sample size meets the recommended threshold for quantitative survey studies, as suggested by Kock (2018), who indicates that 100–200 cases are sufficient for statistical validity. A similar number of participants was used in recent studies on digital behaviour (e.g., Ziemba et al., 2025). Therefore, the sample can be considered robust and suitable for drawing inferences about young, digitally active consumers in Poland. Following the APA Dictionary of Psychology (VandenBos, 2020), the study included participants who were adults but had not yet reached 35 years of age, thereby aligning the sample with this developmental stage.

The sample comprised young adult consumers, predominantly aged 18–24 years (89.9%), with a slight majority of female respondents (53.2%). Most participants had completed secondary education (91.3%) and resided in urban areas. The majority reported a good or very good financial situation, and most lived in households of three or four people. Detailed characteristics of respondents are illustrated in Table 2.

Descriptive statistics were used to summarize respondent characteristics and distribution of trust indices. Hierarchical quadrant analysis was applied to segment respondents based on their cognitive and affective trust scores, and to explore the relationship between these dimensions and online shopping intensity. Hierarchical regression analyses were subsequently performed to assess the relative predictive strength of cognitive and affective factors on overall trust toward international e-commerce platforms. All statistical analyses were conducted using IBM SPSS Statistics v29.0, and significance was assessed at the 0.05 level.

Table 2. Sample characteristics (N = 218).

Variable	Category	N	%	Variable	Category	N	%
Gender	Woman	116	53.2	Place of residence	City up to 200,000 inhabitants	90	41.3
	Man	101	46.3		City over 200,000 inhabitants	62	28.4
	Non-binary	1	0.5		1–2 persons	77	35.3
Age	18–24	196	89.9	Household size	3–4 persons	106	48.6
	25–34	22	10.1		5 persons or more	35	16.1
Education	Secondary	199	91.3		Poor or no response	6	2.7
	Higher	19	8.7	Self-assessed financial situation	Average	27	12.4
Place of residence	Village	36	16.5		Good	129	59.2
	Town up to 50,000 inhabitants	30	13.8		Very good	56	25.7

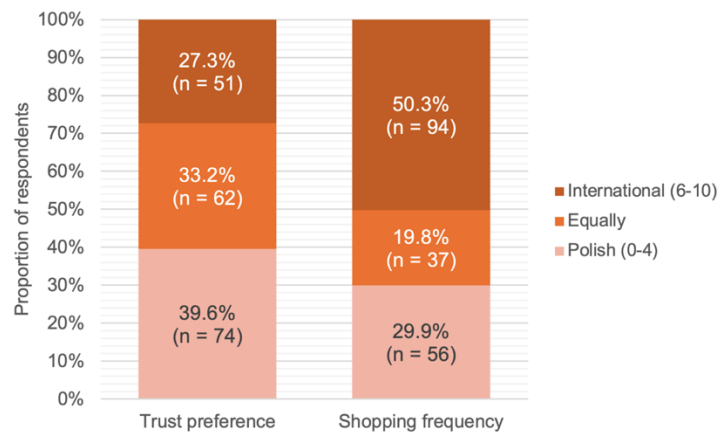
Source: own elaboration.

3. Research results

3.1. Online shopping preferences

All participants met the inclusion criterion of having experience with international online shopping during the previous year. This activity, however, did not form a daily routine. None of the respondents reported shopping every day and only 9% reported doing so several times per week. Most respondents stated that they had purchased from international e-commerce platforms (N = 187; 86.2%), while a smaller group had not engaged in cross-border online shopping (N = 31; 13.8%). This distribution indicates that the sample reflects a population of digitally active consumers familiar with global marketplaces. Consequently, the subsequent analyses are based on the 187 respondents who reported making purchases on international e-commerce platforms.

Respondents were further asked to indicate whether they purchase more frequently on Polish or international platforms, as well as to specify which type of platform they consider more trustworthy (Fig. 2).

**Figure 2.** Side-by-side comparison between trust preference and shopping frequency for international and Polish e-commerce platforms among younger adults.

Source: own elaboration.

In terms of purchasing behaviour, half of the respondents reported shopping more often on international platforms (50.3%), while only around thirty per cent reported a preference for Polish platforms. Trust, however, follows a different pattern: 39.6% expressed greater confidence in Polish platforms, roughly one third reported equal trust in both types, and just over 27% declared higher trust in international platforms. This discrepancy suggests that international platforms attract a larger

share of transactions despite relatively lower declared trust. Hence, both H1a and H1b hypotheses are confirmed.

3.2. Determinants of trust in international e-commerce platforms

Respondents were asked to evaluate a series of factors influencing their trust in international e-commerce platforms on a 0–10 scale. Table 3 presents the mean ratings, standard deviations, and the share of high scores (8–10) for all cognitive and affective trust factors included in the study, with cognitive factors highlighted in blue and affective factors in red.

Table 3. Mean ratings of cognitive and affective trust factors.

Factor	Mean	Std. dev.	% 8-10	Factor	Mean	Std. dev.	% 8-10
Positive experiences with the platform	8.55	1.65	78.1	Trust in the platform's country of origin	6.45	2.49	36.4
Favourable reviews from other users	7.8	1.8	61.0	Visible security certificates	6.37	2.35	33.7
Clear and understandable pricing	7.74	1.95	58.8	Attractive pricing	5.98	2.64	31.6
User-friendly website navigation	7.47	2.15	54.0	Positive emotional response to advertising	5.89	2.72	30.5
Transparent and comprehensible content	7.45	1.85	55.1	Social features, e.g., chat and reviews	5.86	2.68	28.9
Attractive and aesthetically pleasing website design	6.87	2.27	44.4	Engagement in social and environmental initiatives	5.7	2.64	25.1
Appealing product image galleries	6.6	2.49	45.5	Interactive features, e.g., AR or lotteries	4.27	2.96	15.0
Clear privacy policy	6.53	2.1	33.7				

Note. Affective factors have been marked with colour red; cognitive factors have been marked with colour blue. Sorted by highest mean values.

Source: own elaboration.

Table 2 differentiates cognitive factors (blue) from affective factors (red), making clear how the two domains diverge in their importance for trust formation. Organized in descending order from the highest to the lowest mean values, the table places the strongest ratings and largest share of top scores in the upper section, which is dominated by blue rows. Previous positive experiences with the platform (mean = 8.55, SD = 1.65; 78.1% scoring 8-10) ranks first, while favourable reviews from other users (mean = 7.80; 61%) stands out as the only affective factor among the top items. Other blue-coded indicators, including clear and understandable pricing (7.74), user-friendly navigation (7.47) and transparent content (7.45), also cluster that exceeds a mean rating of seven and suggest that reliability, transparency and accumulated experience underpin trust more strongly than any other category.

Red-coded affective factors form a middle-to-lower band. Aesthetic design (mean = 6.87) and product galleries (6.60) show moderate salience but far fewer high ratings (about 44-45%), while emotional responses to advertising (5.89), attractive pricing in emotional terms (5.98), social or interactive features (5.86) and engagement in social or environmental initiatives (5.70) register lower still. Interactive or gamified features such as lotteries or augmented reality rank last (mean = 4.27; 15% scoring 8-10), underlining their marginal relevance.

Four of the five top positions are cognitive, pointing to a hierarchy in which performance- and information-oriented cues outweigh design aesthetics or emotional engagement in shaping trust. Hence, the H2 hypothesis has to be rejected.

3.3. Quadrant analysis of cognitive-affective trust

To better understand the interplay between the cognitive (COG) and affective (AFF) dimensions of trust, a hierarchical quadrant analysis was performed. The sample was split using the median values of COG_INDEX (7.29) and AFF_INDEX (6.25), resulting in four distinct quadrants (Figure 3).

The analysis identified four distinct segments. The largest and most active group combined high cognitive and high affective scores ($n = 67$), representing the most engaged and trusting users who purchase regularly on international platforms. Another segment showed high cognitive but low affective scores ($n = 33$), indicating that strong cognitive trust may develop even without affective reinforcement. A third group, with both low cognitive and low affective scores ($n = 57$), revealed minimal trust and limited engagement in online shopping. Finally, the last segment with high affective but low cognitive scores ($n = 30$) suggests that, e.g., positive emotions and aesthetics rarely compensate for weak cognitive trust in this context.

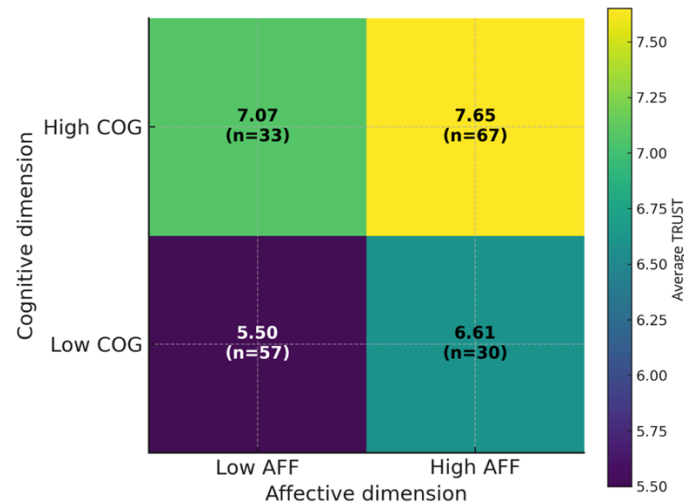


Figure 3. Hierarchical quadrant analysis between the cognitive (COG) and affective (AFF) trust dimensions.

Source: own elaboration.

Respondents with low scores on both dimensions (Low COG + Low AFF) displayed the lowest overall trust levels (mean = 5.50), confirming that the absence of both rational and emotional enablers is associated with disengagement from international platforms. Moving from Low to High COG while holding AFF constant at its lower level produced a 1.6-point increase in TRUST (5.50 $\rightarrow$ 7.07), indicating that cognitive trust is the stronger determinant. A similar shift along the affective axis (Low $\rightarrow$ High AFF, with low COG) produced a smaller, but still positive, effect (+1.1 points).

The highest trust levels were observed in the High COG + High AFF quadrant (mean = 7.65), where rational assurances and affective appeal reinforce each other. This group comprised 36% of respondents, representing the most trustful and engaged consumers. Notably, adding affective trust on top of already high cognitive trust produced a further 0.6-point increase in TRUST, suggesting a complementary effect of emotions once cognitive preconditions are met. Thus, hypothesis H3 is confirmed.

3.4. Trust segments and online shopping intensity

The quadrant segmentation was further analysed in relation to self-reported purchase frequency (Figure 4). The color-coded scatterplots show that frequent purchasing clustered almost entirely among respondents with high cognitive scores, regardless of their affective levels. Affective factors appeared to have a secondary, supportive function, moving respondents from low to moderate engagement (annual to monthly shopping), yet only a small minority achieved the highest frequency (weekly purchases, 6 respondents in total).

The High COG + High AFF segment contained the largest concentration of high-frequency shoppers and thus represents the most commercially valuable group. In contrast, the Low COG + Low AFF segment ($n = 57$) showed minimal trust and near-complete disengagement from cross-border e-commerce. This pattern indicates that strengthening cognitive trust factors such as

transparency, security and reliability should take priority, while affective elements can be used to nudge users toward higher engagement. Notably, frequent international online shopping was found almost exclusively in the High COG + High AFF segment, suggesting that affective trust reinforces trust-based behaviours but cannot replace cognitive trust, which remains the principal driver. Therefore, the H4 hypothesis is confirmed.

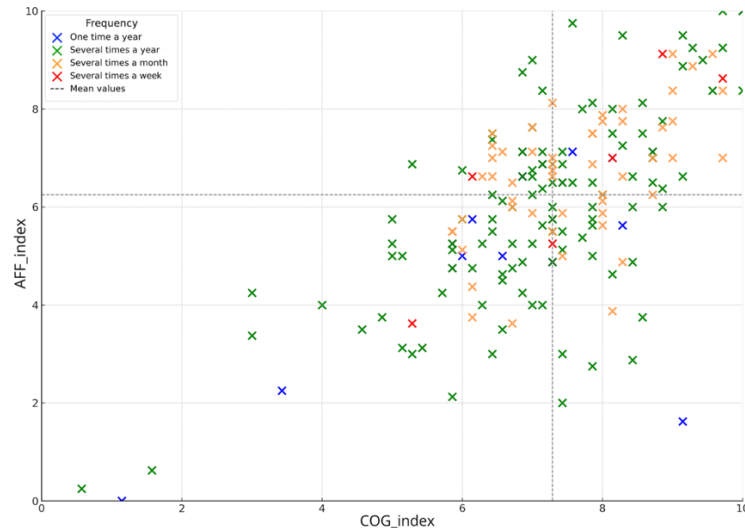


Figure 4. Self-reported purchase frequency in international e-commerce platforms vs. level of cognitive and affective trust.

Source: own elaboration.

3.5. Hierarchical regression analysis: predictors of overall trust

To assess the relative influence of cognitive and affective antecedents on overall trust, a hierarchical regression analysis was conducted (Table 4). Entering COG_INDEX first (Model 1) explained 46.5% of the variance in the overall trust score ($R^2 = 0.465$). Adding AFF_INDEX in the second step produced only a marginal, borderline-significant increase ($\Delta R^2 = 0.011$, $p = 0.056$), bringing the total to 47.5%. This suggests that cognitive factors alone capture nearly half of the variability in trust levels, with affective cues adding only a small additional share.

Table 4. Hierarchical regression results.

	Sequence (predictors)	R^2 (step 1)	R^2 (step 2)	ΔR^2	F-change	p
TRUST~	COG $\rightarrow$ +AFF	0.465	0.475	+0.011	3.689	0.056
TRUST~	AFF $\rightarrow$ +COG	0.283	0.475	+0.192	67.523	< 0.001

Source: own elaboration.

The reversed sequence yielded a contrasting picture. Entering AFF_INDEX first explained just 28.3% of the variance, but adding COG_INDEX increased explained variance by nearly 19 percentage points ($\Delta R^2 = 0.192$, $F = 67.5$, $p < 0.001$). Standardized coefficients in the full model (Table 5) confirmed that cognitive trust was roughly four times stronger as a predictor ($\beta = 0.59$, $p < 0.001$) than affective trust ($\beta = 0.14$, $p \approx 0.056$), whose effect remained only marginally significant at $\alpha = 0.10$.

Table 5. Standardized beta coefficients for predictors.

Predictor	β	p
COG_z	+0.59	<0.001
AFF_z	+0.14	0.056

Intercept ≈ 0 .

Source: own elaboration.

The model accounted for about 48% of the variance in trust scores. These results suggest that rational, information-based cues such as transparency, security assurances and website usability drive trust most strongly, while affective features such as design and emotional appeal offer only a modest supplementary contribution. In view of this, hypothesis H5 is confirmed.

3.6. Summary of hypothesis verification

Table 6 provides a cumulative overview of the verification outcomes for the proposed hypotheses. Additional insights derived from the analysis, along with the confirmation or refutation of the research hypotheses, are presented in the following Discussion section.

Table 6. Hypotheses' verification – an overview

Hypothesis		Result
H1a	Young consumers use international shopping platforms more frequently than those originating from Poland.	Confirmed ✓
H1b	Young consumers place less trust in international shopping platforms than those originating from Poland.	Confirmed ✓
H2	Affective trust factors play a more fundamental role for young consumers when purchasing online.	Rejected X
H3	Higher levels of young consumers' cognitive trust in international e-commerce are associated with their stronger overall trust, independently of affective trust.	Confirmed ✓
H4	Young consumers with high cognitive and high affective trust represent the largest proportion of high-frequency shoppers.	Confirmed ✓
H5	Cognitive antecedents have a stronger effect on overall trust than affective features.	Confirmed ✓

Source: own elaboration.

4. Discussion

This study reveals a consistent pattern in how young consumers approach trust in international e-commerce. Their evaluations concentrate first on cognitive indicators, which corresponds with a growing literature that frames online trust as a predominantly rational process, where perceived risk is reduced through cognitive evaluation and performance-based appraisal (Handoyo, 2024). In other words, for younger consumers the starting point of trust formation is not the website aesthetics but its ability to signal competence, reliability and procedural transparency. Earlier work on cognitive trust as a threshold condition in digital environments (Singh et al., 2024) ties with the empirical results presented above.

At the same time, the data also show that, while cognitive aspects are more decisive, affective features should not be overlooked, particularly for young consumers. Aesthetics, design and emotional engagement act as amplifiers, extending the reach of cognitive trust rather than replacing it. This dynamic mirrors findings that affective trust typically complements and reinforces the cognitive dimension rather than operating as an independent driver (Sha, 2021). The findings support a layered model in which participation is enabled by a rational basis of security and transparency, whereas affective elements deepen engagement after these basic conditions are met (Singh et al., 2024; McAllister, 1995).

The quadrant-based segmentation provides a clear illustration of this layered model. Respondents who combined high cognitive and high affective evaluations represent, with no surprise, are the most active and engaged cohort. This pattern may be aligned with studies showing that engagement rises sharply when both dimensions of trust are satisfied (Gill et al., 2024; Xiao et al., 2025). Conversely, low cognitive trust was associated with minimal purchasing regardless of the platform's appearance, reflecting prior evidence that emotional marketing alone cannot compensate for deficiencies in product quality or service reliability (Zhou & Tong, 2022). Of particular note is the elevated status of favourable reviews - the only affective cue that reached the top tier. Some studies (e.g., Stouthuysen et al., 2018) suggest that customer reviews even function as a cognitive factor in shaping trust in e-commerce. This suggests that social proof functions as a hybrid mechanism bridging rational

evaluation and emotional response, consistent with Peña-García et al. (2024), who demonstrate that reviews mediate between cognitive assessment and emotional resonance in online settings.

Equally noteworthy is the gap between reported trust and actual behaviour. While respondents expressed more confidence in domestic platforms, they reported more frequent shopping on international ones. This paradox is consistent with meta-analytical findings by Handoyo (2024), as well as Alzaidi and Agag (2022), that stated trust often fails to translate directly into behaviour. Other studies also point out higher trust ratings for domestic vendors but greater cross-border purchase frequency among young consumers (Singh et al., 2024; Xiaoyan & Pertheban, 2023). The most plausible explanation lies in the transactional advantages of international platforms, such as larger assortments, competitive prices and wider availability, which appear to lower the trust threshold required to complete a purchase. This interpretation aligns with evidence that once competence and reliability signals reach an acceptable level, consumers proceed with cross-border transactions even when their overall trust remains lower than for domestic alternatives (Gill et al., 2024).

It is also important to bear in mind the differences between younger and older e-shoppers in terms of their level and formation of digital trust. Younger generations, which tend to be more comfortable using digital platforms, are more likely to engage in online shopping compared to older people, who often display greater reluctance stemming from less practice with technology (McIntosh et al., 2021). In older consumers, also, brand loyalty is driven more by affect than cognition when satisfaction is present (Kaur et al., 2018). Satisfaction strengthens the link between affect and loyalty, while disconfirmation shows no impact. Moreover, Zhang et al. (2024) in their study examined trust in metaverse shopping across age groups and revealed that affective trust dominates among “digital natives” group (younger shoppers), while cognitive trust is more influential for “digital immigrants” group (older buyers).

This study addresses a significant gap in the existing research on trust formation among young consumers in international e-commerce. Prior research has long distinguished cognitive and affective trust in e-commerce and adjacent digital settings (Punyatoya, 2019; Pahrudin et al., 2025; Zhang et al., 2024). What remains underdeveloped is evidence on how this dual structure of trust operates specifically among young e-consumers in contemporary online retail, particularly when cross-border shopping and platform internationality are part of the purchase environment. As a result, the literature offers strong conceptual tools but limited age-targeted, context-complete empirical tests of digital trust in youth-driven e-commerce behaviour. In addition, by highlighting the role of social proof as a bridge between rational and emotional aspects, the paper expands current theoretical perspectives that often examine these dimensions independently.

Taken together, these findings point toward a sequencing model of trust formation rather than two competing dimensions. Cognitive assurances such as transparency, security and verifiable reliability provide the entry point, and only then do affective cues such as aesthetics, brand personality or community engagement deepen loyalty and encourage repeat behaviour. By weaving these results with recent studies and meta-analyses, the present research moves beyond simple confirmation of earlier work and clarifies the conditions under which young consumers cross the threshold from caution to active participation. It shows how social proof, hybrid signals and emotional attachments interact with rational evaluation, producing a multi-layered process that underpins trust in international e-commerce.

Conclusions

This study provides systematic evidence that young consumers’ trust in international e-commerce platforms is anchored primarily in cognitive rather than affective assessments. Security assurances, transparency of information and favourable prior experiences emerge as the most salient and consistently endorsed signals of reliability. These cues shape a rational foundation that enables consumers to overcome the perceived risks of cross-border transactions. Affective aspects such as aesthetics, design and emotional impressions operate as complementary rather than substitutive

elements: they can enrich user experience and deepen loyalty but do not create trust in isolation. In other words, emotions and appearance support but do not replace evidence of competence and reliability.

The quadrant-based classification further clarifies this hierarchy. Respondents who combined high cognitive and high affective evaluations formed the most engaged group, reporting more frequent and confident purchasing. Low cognitive trust coincided with minimal shopping activity regardless of platform aesthetics, underscoring that emotional appeal cannot compensate for weak cognitive assurances. Among all affective cues, favourable reviews stood out as the only upper-tier item, suggesting that social proof bridges rational evaluation and emotional response and functions as a hybrid trust signal.

These findings imply a sequencing model of trust formation. Cognitive assurances (transparent pricing, security certificates, clear data policies and reliable navigation) constitute the baseline for participation. Once this baseline is in place, affective cues such as design aesthetics, community initiatives or emotionally resonant content can reinforce confidence, extend engagement and support loyalty. For managers of international e-commerce platforms, the implication is to first invest in security, transparency and reliability, and only then layer on affective or experiential features that deepen attachment.

The results also suggest that trust should be monitored as a differentiated resource, not as a single attitude. Different trust profiles imply different managerial priorities: users with strong cognitive but weak affective trust may respond better to responsive support and tailored communication, while those with low cognitive trust likely disengage regardless of emotional cues. Platform strategies should be designed per segment rather than for an assumed “average” young consumer, as trust profiles reveal distinct pathways toward commitment.

The contrast between domestic and international platforms further indicates that cross-border trust depends on the clarity of procedures. Young consumers appear willing to purchase internationally, but only when the rules of the transaction are easy to interpret. Operational clarity in areas such as delivery tracking or dispute handling does not merely reduce uncertainty; it signals how the platform behaves when expectations are tested.

Finally, the prominence of trust in predicting shopping frequency points to a managerial opportunity to treat trust as a measurable performance indicator. Rather than viewing it as a soft perception, trust can be tracked through behavioural metrics such as repeat visits, cart completion and complaint resolution time. When trust is treated as a measurable lever rather than a belief, managers gain visibility into which actions genuinely move behaviour.

Several limitations qualify these conclusions. First, the allocation of items to the cognitive and affective constructs was based on theoretical reasoning and expert judgement rather than empirical validation, which introduces a degree of subjectivity. Future research should apply exploratory and confirmatory factor analyses to test whether the observed structure aligns with theoretical expectations and to refine measurement for use in more complex models such as SEM.

Second, the focus on young adults in Poland constrains generalizability. Cross-border shopping in this setting may heighten sensitivity to transparency and legal clarity, which could strengthen the emphasis on cognitive cues. The relatively high education levels and urban residence of respondents may also tilt evaluations toward information quality. Comparative studies across age groups and cultural settings would clarify whether the same hierarchy of determinants holds elsewhere.

Third, the cross-sectional design captures trust at one point in time. Longitudinal studies could test whether affective factors become more salient as familiarity with platforms increases or as brand–consumer relationships deepen. Country-of-origin effects, although included, were not examined in depth; future work could separate their cognitive and affective pathways and examine how they interact with social proof. Also, incorporating behavioural data from platforms would provide a stronger basis for validating the observed link between trust profiles and purchase frequency.

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Reference

1. Aichner, T., & Shaltoni, A. M. (2018). Marketing of specialised products and services to consumers with disabilities: exploring the role of advertising, country-of-origin, and e-commerce. *The International Review of Retail Distribution and Consumer Research*, 28(2), 115–136. <https://doi.org/10.1080/09593969.2017.1364658>.
2. Airwallex. (2025). *International eCommerce: Key insights into the global market (2025)*. <https://www.airwallex.com/blog/international-e-commerce>.
3. Alzaidi, M. S., & Agag, G. (2022). The role of trust and privacy concerns in using social media for e-retail services: The moderating role of COVID-19. *Journal of Retailing and Consumer Services*, 68, Article number 103042. <https://doi.org/10.1016/j.jretconser.2022.103042>.
4. Amado-Mateus, M., Guzmán-Rincón, A., & Ortega-Almonacid, F. D. (2025). Online repurchase intention among Colombian university students: A TPB-based model using structural equation modeling. *Digital Business*, 5(2), Article number 100146. <https://doi.org/10.1016/j.digbus.2025.100146>.
5. Anastasiadou, E., Lindh, C., & Vasse, T. (2019). Are consumers international? A study of CSR, cross-border shopping, commitment and purchase intent among online consumers. *Journal of Global Marketing*, 32(4), 239–254. <https://doi.org/10.1080/08911762.2018.1528652>.
6. Aslam, W., Hussain, A., Farhat, K., & Arif, I. (2020). Underlying factors influencing consumers' trust and loyalty in E-commerce. *Business Perspectives and Research*, 8(2), 186–204. <https://doi.org/10.1177/2278533719887451>.
7. Avalara. (2024). *The state of global cross-border e-commerce report 2023-24*. <https://www.avalara.com/dam/avalara/public/documents/pdf/state-of-global-cross-border-e-commerce-report-2023-2024.pdf>
8. Bartók, O. (2018). The use of CSR in E-commerce as a way to compete. *Journal of Competitiveness*, 10(4), 5–20. <https://doi.org/10.7441/joc.2018.04.01>
9. Bartosik-Purgat, M., & Rakowska, W. (2024). Gender in acceptance of augmented reality in e-commerce: An international perspective. *International Entrepreneurship Review*, 10(4), 113–127. <https://doi.org/10.15678/ier.2024.1004.08>.
10. Bhattacharya, S., Sharma, R. P., & Gupta, A. (2023). Does e-retailer's country of origin influence consumer privacy, trust and purchase intention? *The Journal of Consumer Marketing*, 40(2), 248–259. <https://doi.org/10.1108/jcm-04-2021-4611>.
11. Bianchi, C., & Andrews, L. (2012). Risk, trust, and consumer online purchasing behaviour: a Chilean perspective. *International Marketing Review*, 29(3), 253–275. <https://doi.org/10.1108/02651331211229750>.

12. Blagoeva, K. T., Mijoska, M., & Pulevska-Ivanovska, L. (2023). The impact of website design on consumer decision making – evidence from North Macedonia. *WSB Journal of Business and Finance*, 57(1), 78–87. <https://doi.org/10.2478/wsbjbf-2023-0009>.
13. Blomqvist, K. (1997). The many faces of trust. *Scandinavian Journal of Management*, 13(3), 271–286. [https://doi.org/10.1016/s0956-5221\(97\)84644-1](https://doi.org/10.1016/s0956-5221(97)84644-1).
14. Bylok, F. (2022). Examining the impact of trust on the e-commerce purchase intentions of young consumers in Poland. *Journal of Internet Commerce*, 21(3), 364–391. <https://doi.org/10.1080/15332861.2021.1978194>.
15. Bylok, F., Pabian, A., Zawada, M., & Kućęba, R. (2019). Consumer trust online as a determinant of E-commerce development: A case of Poland. *Proceedings of the 2019 10th International Conference on E-Business, Management and Economics* (pp. 142–145). Beijing, China: Association for Computing Machinery. <https://doi.org/10.1145/3345035.3345050>.
16. Bui Thanh, K. (2023). Increasing online business productivity through customer electronic loyalty: the role of online trust and hedonic value. *International Journal of Public Sector Performance Management*, 12(1/2), 252–274. <https://doi.org/10.1504/ijpspm.2023.132250>.
17. Capital One Shopping. (2025). *Cross-Border Online Shopping Statistics*. <https://capitaloneshopping.com/research/cross-border-online-shopping-statistics/>.
18. Çevik, F., & Koç, T. (2022). How to break the market power of digital pioneers: Design principles for building trust in e-commerce. *Alphanumeric Journal*, 10(2), 167–184. <https://doi.org/10.17093/alphanumeric.1133328>.
19. Chiang, I. P., Lin, Y. C., & Huang, C. H. (2018). Measuring the Effects of Online-to-Offline Marketing. *Contemporary Management Research*, 14(3), 167–189. <https://doi.org/10.7903/cmr.18462>.
20. ElSayad, G., & Mamdouh, H. (2024). Are young adult consumers ready to be intelligent shoppers? The importance of perceived trust and the usefulness of AI-powered retail platforms in shaping purchase intention. *Young Consumers*, 25(6), 969–989. <https://doi.org/10.1108/yc-02-2024-1991>.
21. Engriani, Y., & Novaris, A. (2020). The effect of perceived benefit, electronic word of mouth and perceived web quality on online shopping attitude in Shopee with trust as an intervening variable. *Proceedings of the 4th Padang International Conference on Education, Economics, Business and Accounting (PICEEBA-2 2019)*, pp. 978–987. <https://doi.org/10.2991/aebmr.k.200305.167>.
22. Falahat, M., Lee, Y.-Y., Foo, Y.-C., & Chia, C.-E. (2019). A model for consumer trust in e-commerce. *Asian Academy of Management Journal*, 24(S2), 93–109. <https://doi.org/10.21315/aamj2019.24.s2.7>.
23. Fang, J., George, B., Shao, Y., & Wen, C. (2016). Affective and cognitive factors influencing repeat buying in e-commerce. *Electronic Commerce Research and Applications*, 19, 44–55. <https://doi.org/10.1016/j.elerap.2016.08.001>.
24. Foroutan, R. A., Sarokolaei, M. G., & Rezaeian, J. (2022). Online customer behavior: An analysis of the effects of cognitive and affective trust. *Current Chinese Science*, 2(6), 434–449. <https://doi.org/10.2174/2210298102666220829121101>.
25. Gautam, V., & Sharma, V. (2020). Online young consumer shopping self-efficacy: An Indian exploration. *Asia Pacific Journal of Information Systems*, 30(3), 532–546. <https://doi.org/10.14329/apjis.2020.30.3.532>.
26. Gill, H., Vreeker-Williamson, E., Hing, L. S., Cassidy, S. A., & Boies, K. (2024). Effects of cognition-based and affect-based trust attitudes on trust intentions. *Journal of Business and Psychology*, 39(6), 1355–1374. <https://doi.org/10.1007/s10869-024-09986-z>.
27. Glover, S., & Benbasat, I. (2010). A Comprehensive Model of Perceived Risk of E-Commerce Transactions. *International Journal of Electronic Commerce*, 15(2), 47–78. <https://doi.org/10.2753/JEC1086-4415150202>.

28. Gupta, A., Kumar, A., & Melese, E. (2023). Young consumer engagement at the bottom of pyramid: applying S-O-R framework in e-commerce context. *Young Consumers*, 24(6), 786–806. <https://doi.org/10.1108/yc-06-2022-1542>.
29. Hadasik, B. (2024). *Reduction of information asymmetry in e-commerce: the web scraping approach*. Katowice: Publishing House of the University of Economics in Katowice.
30. Hadasik, B., & Kubiczek, J. (2022). E-commerce market environment formed by the COVID-19 pandemic – a strategic analysis. *Forum Scientiae Oeconomia*, 10(3), 25–52. https://doi.org/10.23762/FSO_VOL10_NO3_2.
31. Hallikainen, H., & Laukkanen, T. (2018). National culture and consumer trust in e-commerce. *International Journal of Information Management*, 38(1), 97–106. <https://doi.org/10.1016/j.ijinfomgt.2017.07.002>.
32. Han, L., Ma, Y., Addo, P. C., Liao, M., & Fang, J. (2023). The role of platform quality on consumer purchase intention in the context of cross-border E-commerce: The evidence from Africa. *Behavioral Sciences*, 13(5), Article number 385. <https://doi.org/10.3390/bs13050385>.
33. Handoyo, S. (2024). Purchasing in the digital age: A meta-analytical perspective on trust, risk, security, and e-WOM in e-commerce. *Heliyon*, 10(8), Article number e29714. <https://doi.org/10.1016/j.heliyon.2024.e29714>.
34. Hendricks, S., & Mwapwele, S. D. (2024). A systematic literature review on the factors influencing e-commerce adoption in developing countries. *Data and Information Management*, 8(1), Article number 100045. <https://doi.org/10.1016/j.dim.2023.100045>.
35. Hofstede G. (1984). *Culture's consequences: International differences in work related values*. London & Beverly Hills, CA: Sage Publishing.
36. Hsieh, J.-K., Hsieh, Y.-C., Chiu, H.-C., & Yang, Y.-R. (2014). Customer response to web site atmospherics: Task-relevant cues, situational involvement and PAD. *Journal of Interactive Marketing*, 28(3), 225–236. <https://doi.org/10.1016/j.intmar.2014.03.001>.
37. Jeon, H. G., Kim, C., Lee, J., & Lee, K. C. (2021). Understanding E-commerce consumers' repeat purchase intention: The role of trust transfer and the moderating effect of neuroticism. *Frontiers in Psychology*, 12, Article number 690039. <https://doi.org/10.3389/fpsyg.2021.690039>.
38. Jiang, P., & Jones, D. B. (2014). An exploratory study of factors affecting consumer international online shopping behavior. *International Journal of E-business Research*, 10(2), 45–60. <https://doi.org/10.4018/ijebr.2014040103>.
39. Kaur, D., Mustika, M. D., & Sjabadhyini, B. (2018). Affect or cognition: which is more influencing older adult consumers' loyalty? *Heliyon*, 4(4), Article number e00610. <https://doi.org/10.1016/j.heliyon.2018.e00610>.
40. Kizák, M., Tomášová, M., & Belíčková, P. (2024). Perception of e-commerce by young adults in Visegrad Group countries. *Journal of Management and Business: Research and Practice*, 16(1), 1–12. <https://doi.org/10.54933/jmbrp-2024-16-1-1>.
41. Kock, N. (2018). Minimum Sample Size Estimation in PLS-SEM: An Application in Tourism and Hospitality Research. In F. Ali, S. M. Rasoolimanesh, C. Cobanoglu (Eds.), *Applying Partial Least Squares in Tourism and Hospitality Research*. Emerald Publishing. pp. 1–16. <https://doi.org/10.1108/978-1-78756-699-620181001>.
42. Kocot, M., Kwasek, A., & Depta, A. (2025). Wybrane uwarunkowania zachowań zakupowych e-konsumentów na przykładzie studentów. *Wiadomości Statystyczne. The Polish Statistician*, 70(3), 44–56. <https://doi.org/10.59139/ws.2025.03.4>.
43. Kumar, P. K., Kumar, S., & Kumar, B. (2020). Usability and security issues in the implementation of E-commerce website. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 6(3), 249–257. <https://doi.org/10.32628/cseit206356>.
44. Launer, M., Çetin, F., & Paliszkievicz, J. (2022). Digital trust in the workplace: Testing a new instrument on a multicultural sample. *Forum Scientiae Oeconomia*, 10(1), 30–47. https://doi.org/10.23762/FSO_VOL10_NO1_2.

45. Liu, J. (2024). Research on the Influencing Factors of Cross-Border E-commerce Consumers. *Frontiers in Business, Economics and Management*, 13(1), 84–86. <https://doi.org/10.54097/7aj8fs61>.
46. Liu, Y., & Tang, X. (2018). The effects of online trust-building mechanisms on trust and repurchase intentions: An empirical study on eBay. *Information Technology & People*, 31(3), 666–687. <https://doi.org/10.1108/itp-10-2016-0242>.
47. Lo, S.-K., Chou, Y.-J., & Teng, C.-I. (2013). Source effect of advertised reference price influences on transaction value in online shopping environments. *Electronic Commerce Research*, 13(4), 411–421. <https://doi.org/10.1007/s10660-013-9129-9>.
48. Macca, L. S., Ballerini, J., Santoro, G., & Dabić, M. (2024). Consumer engagement through corporate social responsibility communication on social media: Evidence from Facebook and Instagram Bank Accounts. *Journal of Business Research*, 172, Article number 114433. <https://doi.org/10.1016/j.jbusres.2023.114433>.
49. Maniam, B., Naranjo, L., & Subramaniam, G. (2012). E-commerce best practices: How to achieve an environment of trust and security. *International Journal of Innovation, Management and Technology*, 3(4), 396–401.
50. Markovič, P., Pollák, F., Vavrek, R., & Kostiuk, Y. (2022). Impact of Coronavirus pandemic on changes in e-consumer behaviour: Empirical analysis of Slovak e-commerce market. *Ekonomický Časopis*, 70(4), 368–389. <https://doi.org/10.31577/ekoncas.2022.04.04>.
51. Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20(3), 709–734. <https://doi.org/10.2307/258792>.
52. Meskaran, F., & Ismail, Z. (2012). Customers' trust in e-commerce: In collective culture setting. *2012 International Conference on Information Retrieval & Knowledge Management* (pp. 182–186). Kuala Lumpur, Malaysia: IEEE. <https://doi.org/10.1109/infrkm.2012.6205032>.
53. McAllister, D. J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1), 24–59. <https://doi.org/10.2307/256727>.
54. McIntosh, J., Du, X., Wu, Z., Truong, G., Ly, Q., How, R., Viswanathan, S., & Kanij, T. (2021). Evaluating age bias in E-commerce. *2021 IEEE/ACM 13th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)*. Madrid, Spain: IEEE. <https://doi.org/10.1109/chase52884.2021.00012>.
55. Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review*, 102(2), 246–268. <https://doi.org/10.1037/0033-295x.102.2.246>.
56. Mou, J., Cohen, J., Dou, Y., & Zhang, B. (2020). International buyers' repurchase intentions in a Chinese cross-border e-commerce platform: A valence framework perspective. *Internet Research*, 30(2), 403–437. <https://doi.org/10.1108/intr-06-2018-0259>.
57. Nessel, S. (2022). Political structures and trust in markets: A comparative examination of consumer trust in 28 EU member states and the effects of consumer policy on trust. *Journal of Sociology*, 58(4), 462–480. <https://doi.org/10.1177/14407833211001932>.
58. Netshirando, V., Kadyamatimba, A., & Munyoka, W. (2024). Effects of cyber-security and trust issues on consumers' intention to use E-commerce systems in rural South Africa. *International Journal of Research in Business and Social Science*, 13(7), 538–549. <https://doi.org/10.20525/ijrbs.v13i7.3535>.
59. Nghia, H. T., Olsen, S. O., & Trang, N. T. M. (2020). Shopping value, trust, and online shopping well-being: a duality approach. *Marketing Intelligence & Planning*, 38(5), 545–558. <https://doi.org/10.1108/mip-08-2019-0411>.
60. Obiedat, R. (2013). Impact of online consumer reviews on buying intention of consumers in UK: Need for cognition as the moderating role. *International Journal of Advanced Corporate Learning*, 6(2), 16–21. <https://doi.org/10.3991/ijac.v6i2.2910>.

61. Paliszkiwicz, J. (2013). *Zaufanie w zarządzaniu* [in Polish]. Warsaw: Wydawnictwo Naukowe PWN.
62. Pahrudin, P., Caraka, R. E., Liu, L.-W., Ugiana Gio, P., Anita Yunikawati, N., & Pardamean, B. (2025). Exploring features and products in E-commerce on consumers behavior using cognitive affective. *IEEE Access*, 13, 63774–63791. <https://doi.org/10.1109/access.2025.3553192>.
63. Pandey, S., Mittal, S., & Chawla, D. (2024). Tackling consumer information asymmetry and perceived uncertainty for luxury re-commerce through seller signals. *Journal of Retailing and Consumer Services*, 79, Article number 103736. <https://doi.org/10.1016/j.jretconser.2024.103736>.
64. Peña-García, N., Losada-Otálora, M., Auza, D. P., & Cruz, M. P. (2024). Reviews, trust, and customer experience in online marketplaces: the case of Mercado Libre Colombia. *Frontiers in Communication*, 9, Article number e1460321. <https://doi.org/10.3389/fcomm.2024.1460321>.
65. Pietrzak, P., & Takala, J. (2021). Digital trust – a systematic literature review. *Forum Scientiae Oeconomia*, 9(3), 59–71. https://doi.org/10.23762/FSO_VOL9_NO3_4.
66. Piroth, P., Ritter, M. S., & Rueger-Muck, E. (2020). Online grocery shopping adoption: do personality traits matter? *British Food Journal*, 122(3), 957–975. <https://doi.org/10.1108/bfj-08-2019-0631>.
67. Pollák, F., Konečný, M., & Ščeuľovs, D. (2021). Innovations in the management of E-commerce: Analysis of customer interactions during the COVID-19 pandemic. *Sustainability*, 13(14), 7986. <https://doi.org/10.3390/su13147986>.
68. Precedence Research. (2025). *Cross Border E-commerce Market Size and Forecast 2025 to 2034*. <https://www.precedenceresearch.com/cross-border-e-commerce-market>.
69. Punyatoya, P. (2019). Effects of cognitive and affective trust on online customer behavior. *Marketing Intelligence & Planning*, 37(1), 80–96. <https://doi.org/10.1108/mip-02-2018-0058>.
70. Rane, P. B., & Meshram, B. B. (2012). Application-level and database security for E-commerce application. *International Journal of Computer Applications*, 41(18), 1–5. <https://doi.org/10.5120/5638-7896>.
71. Rosillo-Díaz, E., Blanco-Encomienda, F. J., & Crespo-Almendros, E. (2020). A cross-cultural analysis of perceived product quality, perceived risk and purchase intention in e-commerce platforms. *Journal of Enterprise Information Management*, 33(1), 139–160. <https://doi.org/10.1108/jeim-06-2019-0150>.
72. Rybak, A. (2018). Consumer trust in E-commerce: The case of Poland. *Folia Oeconomica Stetinensia*, 18(2), 59–71. <https://doi.org/10.2478/fofi-2018-0019>.
73. Șcheau, C., Arsene, A., & Dinca, G. (2016). Phishing and e-commerce: an information security management problem. *Journal of Defence Resources Management*, 7(1), 129–140.
74. Serrano-Cinca, C., Muñoz-Soro, J. F., & Brusca, I. (2018). A multivariate study of internet use and the digital divide: Internet use and digital divide. *Social Science Quarterly*, 99(4), 1409–1425. <https://doi.org/10.1111/ssqu.12504>.
75. Sha, W. (2021). A validation of affective trust construct in B2C e-commerce. *Issues in Information Systems*, 22(3), 296–306. https://doi.org/10.48009/3_iis_2021_317-327.
76. Shah, M. U., & Jan, M. F. (2021). Connecting Corporate Social Responsibility (CSR) to Customer Loyalty: A mediation analysis in hoteling industry of Pakistan. *SAGE Open*, 11(4). <https://doi.org/10.1177/21582440211067233>.
77. Shang, Q., Ma, H., Wang, C., & Gao, L. (2023). Effects of background fitting of e-commerce live streaming on consumers' purchase intentions: A cognitive-affective perspective. *Psychology Research and Behavior Management*, 16, 149–168. <https://doi.org/10.2147/PRBM.S393492>.
78. Silitonga, K. A. A., Ikhsan, R. B., & Fakhrorazi, A. (2020). Drivers of buyer retention in e-commerce: The role of transaction characteristics and trust. *Management Science Letters*, 10, 3485–3494. <https://doi.org/10.5267/j.msl.2020.6.046>.

79. Singh, N., Misra, R., Quan, W., Radic, A., Lee, S.-M., & Han, H. (2024). An analysis of consumer's trusting beliefs towards the use of e-commerce platforms. *Humanities & Social Sciences Communications*, 11(1), Article number 899. <https://doi.org/10.1057/s41599-024-03395-6>.
80. Soleimani, M. (2022). Buyers' trust and mistrust in e-commerce platforms: a synthesizing literature review. *Information Systems and E-Business Management*, 20(1), 57–78. <https://doi.org/10.1007/s10257-021-00545-0>.
81. Stouthuysen, K., Teunis, I., Reusen, E., & Slabbinck, H. (2018). Initial trust and intentions to buy: The effect of vendor-specific guarantees, customer reviews and the role of online shopping experience. *Electronic Commerce Research and Applications*, 27, 23–38. <https://doi.org/10.1016/j.elerap.2017.11.002>.
82. Strzelecki, A. (2019). Key features of E-Tailer shops in adaptation to cross-border E-commerce in the EU. *Sustainability*, 11(6), 1589. <https://doi.org/10.3390/su11061589>
83. Strzelecki, A. (2020). Content delivery networks in cross-border e-commerce. *International Journal of Advanced Computer Science and Applications*, 11(4), 19–27. <https://doi.org/10.14569/ijacsa.2020.0110404>.
84. Strzelecki, A., & Rizun, M. (2022). Consumers' change in trust and security after a personal data breach in online shopping. *Sustainability*, 14(10), Article number 5866. <https://doi.org/10.3390/su14105866>.
85. Suyanto, B., Egalita, N., Sugihartati, R., Mas'udah, S., Savira, P. S., Anridho, C., & Syamsiyah, N. (2025). Young urban people's impulsive online shopping behavior and its financial literacy. *Cogent Social Sciences*, 11(1), Article number 2443553. <https://doi.org/10.1080/23311886.2024.2443553>.
86. Tambunan, B., Sihombing, H., Doloksaribu, A., & Muda, I. (2018). The effect of security transactions, ease of use, and the risk perception of interest online buying on the e-commerce Tokopedia site (Study on Tokopedia.id site users in Medan city). *IOP Conference Series: Materials Science and Engineering*, 420, Article number 012118. <https://doi.org/10.1088/1757-899X/420/1/012118>.
87. Uttenthal, M. (2024). A conceptual analysis of trust. *Social Sciences Information*, 63(3), 392–410. <https://doi.org/10.1177/05390184241270835>.
88. VandenBos, G. R. (2020). *APA Dictionary of Psychology*. American Psychological Association (2nd Edition). Washington, DC.
89. Wang, M.-Y., Zhang, P.-Z., Zhou, C.-Y., & Lai, N.-Y. (2019). Effect of emotion, expectation, and privacy on purchase intention in WeChat health product consumption: The mediating role of trust. *International Journal of Environmental Research and Public Health*, 16(20), Article number 3861. <https://doi.org/10.3390/ijerph16203861>.
90. Wang, J., Shahzad, F., & Ashraf, S. F. (2023). Elements of information ecosystems stimulating the online consumer behavior: A mediating role of cognitive and affective trust. *Telematics and Informatics*, 80, Article number 101970. <https://doi.org/10.1016/j.tele.2023.101970>.
91. Witek-Hajduk, M. K., & Grudecka, A. (2024). Cross-border e-shopping on e-commerce B2C multi-sided digital platforms: Antecedents and moderating role of country of location. *Entrepreneurial Business and Economics Review*, 12(4), 135–156. <https://doi.org/10.15678/eber.2024.120408>.
92. Xiao, W., Huang, B., Fang, H., Li, Y., Chen, W., & Ye, T. (2025). The influence of cognitive and affective trust on the utilization of family doctor services: A Chinese cross-sectional survey based on McAllister's theory. *Patient Preference and Adherence*, 19, 1463–1473. <https://doi.org/10.2147/PPA.S504605>.
93. Xiaoyan, Z., & Pertheban, T. R. (2023). Exploring the factors affecting consumer trust in cross-border E-commerce: A comparative study. *Academic Journal of Business & Management*, 5(19), 51–57. <https://doi.org/10.25236/ajbm.2023.051909>.

94. Xu, Y., He, D., & Fan, M. (2024). Antecedent research on cross-border E-commerce consumer purchase decision-making: The moderating role of platform-recommended advertisement characteristics. *Heliyon*, 10(18), Article number e37627. <https://doi.org/10.1016/j.heliyon.2024.e37627>.
95. Yin, C., & Han, J. (2021). Dynamic pricing model of E-commerce platforms based on deep reinforcement learning. *Computer Modeling in Engineering & Sciences*, 127(1), 291–307. <https://doi.org/10.32604/cmescs.2021.014347>.
96. Zhang, K. Z. K., & Benyoucef, M. (2016). Consumer behavior in social commerce: A literature review. *Decision Support Systems*, 86, 95–108. <https://doi.org/10.1016/j.dss.2016.04.001>.
97. Zhang, L., Anjum, M. A., & Wang, Y. (2024). The impact of trust-building mechanisms on purchase intention towards metaverse shopping: The moderating role of age. *International Journal of Human-Computer Interaction*, 40(12), 3185–3203. <https://doi.org/10.1080/10447318.2023.2184594>.
98. Zheng M., Chu, C., & Cao, C. (2025). Building bridges of trust: the role of payment, certification, logistics, and herd mentality in cross-border e-commerce. *Asia Pacific Journal of Marketing and Logistics*. In press. <https://doi.org/10.1108/APJML-04-2025-0652>.
99. Zhou, R., & Tong, L. (2022). A study on the influencing factors of consumers' purchase intention during livestreaming e-commerce: The mediating effect of emotion. *Frontiers in Psychology*, 13, e903023. <https://doi.org/10.3389/fpsyg.2022.903023>.
100. Ziemia, E. W., Grabara, D., Renik, K., & Maruszewska, E. W. (2025). Behavioral intention and use of ChatGPT among accounting and finance students: A two-year comparative study. In M. Hernes, J. Wątróbski, A. Rot (Eds.), *Emerging Challenges in Intelligent Management Information Systems*. Springer Nature Switzerland: Cham. pp. 64–76. https://doi.org/10.1007/978-3-031-78465-1_6.

Investing in Families: Housing as Pro-Natalist Fiscal Policy in Low-Fertility Economies

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Abstract

Fertility rates in many high- and upper-middle-income economies have fallen to historically low levels, especially in East Asia, Central and Eastern Europe, and the Gulf. Countries such as Poland, the United Arab Emirates, Hong Kong, and Singapore now record birth rates far below the replacement level of 2.1 children per woman, with demographic ageing, shrinking workforces, and pressure on pay-as-you-go pension and health systems becoming central macroeconomic challenges. This study primarily seeks to address a specific research question: whether, and under what conditions, such housing support can be justified as pro-natalist fiscal policy rather than a purely redistributive transfer. Adopting a human-capital and public-finance perspective, the article treats each additional child as a future taxpayer whose lifetime net fiscal contribution creates a positive “fiscal externality” of fertility. The methodology employs stylised lifecycle fiscal calculations calibrated to Poland, using publicly available data from the World Bank, OECD, Eurostat, and the National Bank of Poland to compare the present value of lifetime tax contributions with the upfront cost of family housing. This research proposes a fiscally grounded response: near-free or free housing for families that raise three or more children, delivered through a phased scheme. The results suggest that, under conservative assumptions and a 3% real discount rate, the present value of an average future adult's lifetime taxes can exceed the cost of providing a modest family apartment, supporting the investment framing of the policy. The theoretical contribution lies in reframing pro-natalist housing support as a long-horizon public investment with measurable fiscal returns, bridging the literatures on low fertility, housing affordability and generational accounting. For policymakers, the research paper identifies practical design principles, including eligibility targeting, phased vesting, and place-based pilots, which can help translate the fiscal logic into implementable programmes in low-fertility economies.

Key words

low fertility, family policy, housing policy, fiscal externality, pro-natalist policy, human capital investment.

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Introduction

Low fertility has become a structural challenge for many high-income and upper-middle-income economies. In East Asia, Central and Eastern Europe, and the Gulf, birth rates have fallen well below the replacement level of approximately 2.1 children per woman (United Nations, 2023; Eurostat, 2024b). The consequences include demographic ageing, a reduction in cohorts entering the labour market, increasing old-age dependency ratios, and escalating pressure on pay-as-you-go pension and healthcare systems. At the same time, the political feasibility of large-scale immigration as a demographic “solution” is increasingly contested. The question of how to support childbearing among citizens and residents who would like to have more children has therefore become a central issue in public policy. The primary objective of this study is to answer the research question of

whether, and under what conditions, such housing support can be justified as pro-natalist fiscal policy rather than a purely redistributive transfer.

The material conditions under which young adults form households have also changed markedly. In many low-fertility settings, especially in dense metropolitan areas, housing affordability and security have emerged as major constraints on family formation (Dettling & Kearney, 2014). High purchase prices, rising rents, and the need for large down payments delay entry into owner-occupation and make it harder for couples to plan for more than one child. Surveys and empirical studies in European, East Asian, and Gulf contexts increasingly identify housing as one of the most important barriers to earlier marriage and higher fertility (Dettling & Kearney, 2014; Yi & Zhang, 2010; Mulder & Billari, 2010; Vignoli et al., 2013), alongside labour-market insecurity and the cost of childcare. For many young couples, the issue is not a lack of preference for children, but a lack of confidence that they can provide stable housing for a larger family.

From the perspective of public finance, however, children are not only a private good whose costs fall primarily on parents. In ageing welfare states, each additional child is also a future taxpayer whose labour-market participation and consumption will help to finance pensions, healthcare and other public services. This creates what the literature describes as a fiscal externality of fertility (Sinn, 1997): parents bear most of the direct and indirect costs of raising children, while the state and older generations capture a large part of the long-run fiscal benefits. When this externality is ignored, the public sector may underinvest in measures that support childbearing, even when such measures would be fiscally attractive when evaluated over the life cycle of future taxpayers.

This article brings these strands together and explores whether housing policy can be deliberately designed to internalise part of this fiscal externality. It examines the idea that free or heavily subsidised housing for families that raise three or more children might be treated not as a purely redistributive social transfer, but as a form of pro-natalist fiscal investment. In particular, it asks under what demographic and budgetary conditions such a policy could be justified as generating a positive expected long-run fiscal return for the state once the lifetime net tax contributions of additional children are taken into account. The analysis draws on the existing literature on low fertility, housing affordability, and the fiscal impact of childbearing, and combines this with a simple investment-style framework. Using stylised calculations calibrated to a European case (Poland) and informed by conditions in high-cost metropolitan housing markets in East Asia and the Gulf, the article sketches how the expected lifetime net tax contributions of additional children can be compared with the upfront cost of providing family housing. It then outlines a possible design for a phased housing-for-fertility scheme, in which support is linked to the birth and successful upbringing of third and subsequent children rather than provided unconditionally.

The contribution is threefold. First, the research paper proposes an explicit public-finance framing of pro-natalist housing policy, treating support for larger families as a potential investment with measurable long-run fiscal returns. Secondly, it links debates on demographic decline to concrete design questions in housing and urban policy, highlighting the importance of location, eligibility, phasing, and conditionality. Thirdly, it identifies a set of research questions for economists and policy scholars, including the estimation of lifetime net fiscal contributions in different institutional settings, the measurement of fertility responses to housing interventions, and the general-equilibrium effects of large-scale schemes on housing markets and public budgets. Recent contributions confirm that these issues have intensified. Doepke et al. (2022) document a “new era” in fertility economics shaped by structural economic change, while Maestas et al. (2023) provide updated evidence on the macroeconomic costs of population ageing, and Fila and Pytliková (2023) offer new quasi-experimental evidence linking housing subsidies to fertility outcomes. Despite this extensive body of work, no existing study provides an integrated framework that evaluates targeted housing support explicitly as a long-term fiscal investment linked to higher-order births. It is this gap that the present article seeks to address.

The remainder of this article proceeds through a review of the relevant background and literature on low fertility, housing constraints and the fiscal externality of childbearing, followed by the methodology and conceptual framework for thinking about housing as pro-natalist fiscal policy, stylised fiscal calculations illustrating the conditions under which free or near-free family housing might yield positive net returns, a discussion of key elements of policy design and implementation, and concluding reflections on broader fiscal, social, and political implications together with an agenda for empirical evaluation.

1. Literature review

1.1. *Low fertility and macroeconomic risks*

The sustained decline of fertility below replacement level has been widely analysed in demographic and economic literature. In many high- and upper-middle-income societies, the transition from large families to small families has gone beyond the “two-child norm” into what some authors describe as ultra-low fertility, with total fertility rates well below 1.5 (Kohler et al., 2002). According to the United Nations (2023), global fertility has declined from approximately 5 children per woman in 1950 to 2.3 in 2021, with particularly steep declines observed in East Asia, Southern Europe and Central and Eastern Europe. South Korea recorded a total fertility rate of just 0.78 in 2022, while Poland’s rate stood at 1.29, both far below the replacement level of approximately 2.1 children per woman (Eurostat, 2024b).

This shift has three macroeconomic consequences that are now familiar but increasingly acute: population ageing, slower labour-force growth and rising old-age dependency ratios. From a growth perspective, smaller cohorts entering the labour market imply a lower potential growth rate, unless compensated by rapid productivity gains or large immigration flows (Bloom et al., 2010). The seminal work of Lee and Mason (2011) on National Transfer Accounts demonstrates how demographic change fundamentally reshapes the economic lifecycle, with ageing societies facing mounting fiscal pressures from the growing gap between consumption and labour income among older cohorts.

For public finances, pay-as-you-go pension and health systems become more difficult to sustain as the ratio of contributors to beneficiaries declines. The OECD (2023) projects that pension expenditure as a share of GDP will rise substantially in most member countries over the coming decades, with old-age dependency ratios in some European countries expected to exceed 50% by 2050. Intergenerational transfer systems that were designed for relatively youthful populations are thus placed under structural strain (Auerbach & Kotlikoff, 1999). In addition, demographic decline may undermine domestic demand, weaken housing markets in some regions and change the spatial pattern of economic activity (Maestas et al., 2023).

A large literature has examined policy responses to low fertility, including parental leave, childcare subsidies, tax reliefs, cash transfers and family-friendly labour-market regulations (Gauthier, 2007; Thévenon & Gauthier, 2011). While some of these interventions have measurable positive effects on fertility, they are often modest and context dependent (Luci-Greulich & Thévenon, 2013). McDonald (2006) argues that fertility decline is driven by a combination of high opportunity costs of childbearing, particularly for women, and institutional failures to adapt to changing gender roles. The comprehensive review by Doepke et al. (2022) emphasises that understanding fertility behaviour requires attention to the interactions among economic incentives, cultural norms, and institutional constraints.

Moreover, many policies have been designed primarily with gender equality or work-family reconciliation in mind, rather than with explicit attention to their long-run macro-fiscal implications (Thévenon, 2011). Adserà (2004) demonstrates that labour market institutions significantly affect fertility rates, with high unemployment and employment instability reducing childbearing, while flexible work arrangements tend to support it. This leaves space for complementary approaches that foreground the links between fertility, public finances and long-horizon investment decisions.

1.2. Housing affordability, family formation and fertility

In parallel, research on housing markets has shown that access to affordable, secure housing is a key determinant of household formation and family decisions (Mulder, 2006; Mulder & Billari, 2010). In high-cost urban environments, young adults frequently face a combination of high purchase prices, large down payment requirements, and tight rental markets. Entry into owner-occupation is delayed and, in some cases, permanently out of reach, particularly for lower- and middle-income households without parental support (Öst, 2012). The phenomenon of “generation rent” has been documented across multiple countries, with homeownership rates among young adults declining substantially since the early 2000s (McKee et al., 2017).

A growing empirical literature suggests that these constraints have direct implications for fertility. Studies from European cities, East Asian metropolitan regions and Gulf economies point to housing as one of the main barriers to earlier marriage and to larger families (Lauster & Fransson, 2006; Mulder & Billari, 2010). The foundational work of Dettling and Kearney (2014) uses US metropolitan area data to demonstrate that a \$10,000 increase in house prices is associated with a 0.5% decline in births among non-owners and an increase among owners through wealth effects. Yi and Zhang (2010) find similar negative effects of housing costs on fertility in Hong Kong, one of the world's most expensive housing markets.

High housing costs are associated with delayed union formation, postponed first births and a reduced probability of having a second or third child (Clark, 2012; Vignoli et al., 2013). Clark (2012) demonstrates that women in expensive housing markets delay family formation significantly, while Lauster and Fransson (2006) document the intricate relationship between homeownership, marriage and fertility in the Nordic context. Lovenheim and Mumford (2013) exploit housing wealth shocks to show that increased housing equity raises fertility, with effects concentrated among higher-parity births. Conversely, improved access to subsidised or public housing has, in some contexts, been linked to higher marriage rates and earlier childbearing (Feyrer et al., 2008).

The mechanisms are both financial and psychological (Vignoli et al., 2013). Housing represents a large, fixed cost in the household budget and a central element of perceived life-course security (Mulder, 2006). Without secure tenure and sufficient space, couples may feel unable to commit to having several children, even when their underlying preferences are family oriented. Comolli (2017) shows that economic uncertainty, including housing market volatility, significantly depresses fertility intentions and outcomes. Overcrowding, instability and the risk of eviction further reinforce this reluctance (Kulu & Steele, 2013). In this sense, housing policy is not neutral with respect to demographic outcomes: it helps to shape the opportunity set and risk environment in which fertility decisions are made.

Some countries already integrate housing and family policy to a limited extent. For example, priority access to public housing, preferential loan terms or tax reliefs may be granted to married couples or parents. Singapore's public housing system explicitly links flat allocation to marriage and family formation, while several European countries offer mortgage subsidies or tax benefits to families with children (Ronald, 2008; Chua, 2014). However, these instruments are often designed primarily to address affordability or equity concerns, with fertility effects treated as a secondary outcome. The literature has only begun to explore the potential of more explicitly pro-natalist housing instruments, especially those targeted at third and subsequent births (Rindfuss et al., 2010).

1.3. Children as a fiscal asset: the fiscal externality of fertility

Public economics has long recognised that fertility decisions have implications beyond the household's private sphere (Folbre, 1994). In pay-as-you-go systems, the consumption of the elderly is financed largely by the taxes and contributions of current workers. Each additional child, if they grow up to participate in the labour market, becomes a future contributor to these systems. At the same time, children also generate public costs through education, healthcare and child-related transfers.

The notion of a fiscal externality of fertility formalises this idea. The concept was developed systematically by Sinn (1997), who argued that pay-as-you-go pension systems create an implicit tax on children, because the returns to child-rearing are partly captured by the pension system rather than by parents themselves. Parents decide how many children to have based on private costs and benefits, yet their decision also affects the intergenerational transfer system by altering the size and composition of future cohorts. Cigno (1993), Cigno and Werding (2007) further developed the theoretical analysis of how public pension systems distort fertility incentives, showing that the implicit taxation of children can lead to suboptimally low fertility from a social welfare perspective.

The net fiscal contribution of an additional child can be positive or negative, depending on tax structures, benefit rules, labour-market outcomes and discount rates. In ageing, high-income societies with substantial public sectors, several studies suggest that the marginal child typically generates a positive net fiscal contribution over the life cycle, even after accounting for education and health expenditure (Lee & Miller, 2000; Wolf et al., 2011). Using National Transfer Accounts methodology, Lee and Mason (2011) estimate lifecycle fiscal profiles across multiple countries, generally finding that adults in their prime working years generate substantial fiscal surpluses that offset childhood and old-age deficits. Connolly et al. (2010) apply a similar approach to estimate the fiscal value of births resulting from assisted reproductive technologies.

When this externality is not explicitly recognised, the public sector may under-invest in policies that encourage childbearing or support families, because these policies are evaluated over short budget horizons rather than over the working lives of future taxpayers (Werding, 2014). Conversely, if governments take a longer view, it becomes meaningful to treat certain forms of family support as public investment in human capital, rather than purely as social transfers. This reframing opens the door to designing instruments whose expected long-run fiscal return can be compared with their upfront cost, much as one would evaluate infrastructure or education spending (Becker & Murphy, 1988).

The methodological approach to estimating fiscal externalities has been refined through the development of generational accounting (Auerbach et al., 1991). This framework tracks the present value of all future taxes paid and transfers received by different birth cohorts, providing a comprehensive picture of intergenerational fiscal flows. Bonin (2001) provides a thorough treatment of the methodology, while subsequent applications have been conducted for numerous countries. These studies consistently highlight the fiscal strain created by population ageing and the potential value of policies that support sustainable fertility levels.

The present research builds on this line of reasoning. It treats free or heavily subsidised family housing as one possible instrument for internalising part of the fiscal externality of fertility, by reducing a key barrier to larger families and thereby potentially increasing the number of future taxpayers.

1.4. Gaps in existing pro-natalist policy approaches

Existing pro-natalist policies in low-fertility societies tend to fall into several broad categories: direct cash transfers or tax credits per child, subsidised childcare and parental leave, subsidies for assisted reproduction, and measures to improve work-family balance (Gauthier, 2007; Thévenon, 2011). While these instruments address important constraints and have valuable equity and gender dimensions, they also exhibit some limitations from the perspective adopted here.

First, many policies are short-term and flow-based: they provide ongoing support as long as children are young, but do not change the long-run asset position of households. By contrast, housing is a stock variable: secure ownership of a dwelling can transform a family's balance sheet and perceptions of long-term security, which may be particularly relevant for decisions about third and subsequent children (Mulder, 2006). Evidence from multiple countries suggests that wealth and asset security play a distinct role in fertility decisions beyond current income (Lovenheim & Mumford, 2013; Schneider, 2015).

Secondly, relatively few pro-natalist measures explicitly integrate public-finance considerations into their design. Debates often focus on distributive fairness or on modest changes in fertility rates, without systematically comparing the present value of policy costs with the expected net fiscal contributions of additional births (Werding, 2014). Cigno and Werding (2007) argue that this represents a significant gap in policy analysis, as the fiscal sustainability of family policy depends critically on whether the children whose births it encourages will generate positive net fiscal contributions.

Thirdly, the literature on pro-natalist policy has only partially engaged with housing and urban planning as domains where demographic concerns can be addressed (Kulu & Boyle, 2009). Where housing interventions have been studied, they have typically been analysed in isolation from long-term fiscal sustainability, or treated as context-specific institutional features rather than as generalisable instruments. Notable exceptions include work on Singapore's housing-based family policies (Chua, 2014) and recent analyses of housing subsidies and fertility in European contexts (Fila & Pytliková, 2023), but systematic integration of housing and fiscal perspectives remains limited.

Fourthly, the effectiveness of existing pro-natalist policies varies substantially across contexts. Luci-Greulich and Thévenon (2013) find that while financial transfers and childcare services can raise fertility, effects depend on policy design and institutional context. Countries with comprehensive policy packages tend to achieve better outcomes than those relying on single instruments (Thévenon & Gauthier, 2011). This suggests that housing-based measures might be most effective when integrated with broader family policy frameworks rather than implemented in isolation.

Against this backdrop, there is a gap for conceptual work that integrates these three domains and evaluates housing support through the lens of long-run fiscal investment. The central research question that this article addresses is therefore: under what demographic, fiscal, and housing-market conditions can targeted housing support for families with three or more children be justified as a positive net public investment rather than a purely redistributive transfer?

2. Methodology

2.1. *An investment perspective on family policy*

Standard discussions of family and fertility policy use the language of support or compensation: transfers are justified by equity, poverty reduction or social cohesion. By contrast, the framework adopted here starts from a public finance perspective, in which children are also viewed as future contributors to public budgets (Lee & Mason, 2011). This approach builds on the foundational work of Auerbach et al. (1991) in generational accounting, which established methods for tracking the present value of all future taxes paid and transfers received by different birth cohorts. As Bonin (2001) demonstrates, such lifecycle fiscal analysis provides a rigorous framework for evaluating policies with long-term demographic consequences. In this view, a government can evaluate certain family policies in the same way as it evaluates other long-horizon expenditures, such as education or infrastructure: by comparing the expected discounted stream of benefits with the upfront cost.

Let C denote the per-family fiscal cost of providing a free (or heavily subsidised) dwelling, and let F denote the expected net fiscal contribution of one additional child over their lifetime, defined as the present value of taxes and social contributions paid minus all lifetime public expenditures received, including education, healthcare, child-related transfers, and eventual pension entitlements. Let ΔN denote the expected increase in the number of children per family induced by the housing policy, relative to a situation without the policy. In highly simplified terms, the policy can be viewed as fiscally attractive if $F \cdot \Delta N \geq C$, once appropriate discounting and risk adjustments are taken into account.

This condition abstracts from wider general-equilibrium effects and from non-fiscal benefits (such as social cohesion), but it captures the basic investment logic: the state spends an amount C today in order to increase the number of future taxpayers, whose net contributions are summarised by F . In practice, neither F nor ΔN is directly observed. They depend on tax structures, labour-market outcomes, educational attainment, migration, and behavioural responses to policy. The economic

theory of fertility decisions (Becker & Barro, 1988) provides a foundation for understanding how families respond to changes in the opportunity cost of childbearing, including those mediated through housing constraints. Nonetheless, the framework highlights that the fiscal evaluation of pronatalist policies is, in principle, no different from the evaluation of other long-run public investments: what matters is the sign and magnitude of the expected net present value.

2.2. *Linking housing support to marginal births*

For a housing-for-fertility scheme to be interpreted as an investment rather than a general subsidy to existing fertility, it must be designed so that it affects marginal births, that is, births that would not have occurred in the absence of the policy, or that would have been postponed to an extent that materially alters the demographic profile. The empirical literature supports the existence of such marginal effects: Dettling and Kearney (2014) demonstrate that housing costs significantly influence fertility decisions, while Lovenheim and Mumford (2013) show that housing wealth shocks affect fertility, with effects concentrated among higher-parity births, precisely the margin most relevant to this analysis. In the stylised expression above, ΔN represents these marginal births.

Housing enters the framework as a specific lever that alters the budget and risk constraints of young households. As Mulder (2006), Mulder and Billari (2010) have established, housing represents a central element of perceived life-course security, and access to secure, adequate housing is a key determinant of family formation decisions. Vignoli et al. (2013) demonstrate that the mechanisms are both financial and psychological: housing costs represent a large, fixed burden in household budgets, while Comolli (2017) shows that economic uncertainty, including housing market volatility, significantly depresses fertility intentions and outcomes. A free or heavily subsidised dwelling reduces a large, fixed cost and creates a stable environment in which having multiple children becomes more feasible. The policy thus aims to raise ΔN not by providing a small benefit to all families, but by offering a large, indivisible asset conditional on achieving a certain family size.

This logic implies that the design of the scheme must: target households at a stage in the life course where fertility decisions are still open; tie the full benefit to the achievement of a specified family size (here, three or more children); and ensure that the support is not easily captured by households whose fertility decisions would have been the same without the policy. In other words, the closer the scheme comes to affecting genuinely marginal births, the more meaningful it becomes to compare $F \cdot \Delta N \geq C$.

2.3. *Third and higher-order births as a policy target*

Focusing on families with three or more children is consistent with both demographic and fiscal considerations. In many low-fertility societies, the majority of adults still express a preference for at least two children, but actual completed fertility often falls short of this ideal. This phenomenon, characterised by Kohler et al. (2002) as part of the emergence of “lowest-low fertility,” reflects how structural constraints prevent couples from achieving their desired family size. The “gap” frequently lies at the level of the third child and beyond, as McDonald (2006) argues that institutional failures to adapt to changing gender roles particularly affect higher-parity births. From a policy perspective, this suggests that third and higher-order births are a natural target for instruments intended to raise fertility towards replacement levels.

In the framework above, this can be interpreted as concentrating resources on households for which the marginal response ΔN is likely to be largest at the third child. A family that is already strongly committed to having two children may be more sensitive to a large reduction in housing-related risk when deciding whether to have a third. By contrast, policies that spread limited resources thinly across all births may generate smaller changes in marginal fertility behaviour, even if they are attractive on other grounds.

The housing scheme considered here, therefore, conditions full support on the successful birth and upbringing of at least three children, while earlier stages (for example, the first and second child) may trigger partial or phased benefits. This structure is intended to align the policy more closely with the marginal fertility margin that is most relevant in very low-fertility contexts.

2.4. Time horizon, uncertainty and risk-sharing

Any attempt to evaluate a housing-for-fertility scheme as a public investment must confront issues of time horizon and uncertainty. The stream of fiscal contributions represented by F stretches over several decades and depends on factors that are only partially under policy control, such as macroeconomic conditions, technological change and migration patterns. Moreover, not all children will remain in the country, participate fully in the labour market or have continuous careers.

In this sense, the state is not simply “purchasing” a deterministic stream of future tax revenues. Rather, it is sharing demographic and labour-market risk with families. The provision of a dwelling today can be viewed as an advance on the expected fiscal benefits of future cohorts, recognising that some of those cohorts may underperform relative to expectations while others may exceed them.

The conceptual framework presented here does not resolve these uncertainties, but it does make them explicit. It suggests that any serious appraisal of pro-natalist housing policy should: use realistic, data-based ranges for F (expected net fiscal contribution) and for the expected duration of working life; treat the estimated net present value as a range rather than a point estimate; and compare the resulting fiscal risk profile with that of other long-run public investments.

This perspective underscores that even if the precise value of $F \cdot \Delta N$ is difficult to pin down, it is still analytically meaningful to ask whether, under plausible assumptions, the policy lies in a region where expected fiscal returns are positive.

2.5. Positioning within the broader policy mix

Finally, the framework does not imply that housing-based instruments should replace other forms of family policy. Rather, it positions them as one component of a broader pro-natalist policy mix that may include childcare provision, parental leave, tax credits and measures to support work-family balance. The distinctive contribution of housing support in this mix is that it operates through a large, long-lived asset which directly addresses a central barrier to larger families in many low-fertility settings. This conceptual framework guides the construction of the stylised fiscal calculations that follow and organises the subsequent discussion of policy design and implementation.

2.6. Data sources and calculation methodology

The stylised fiscal calculations use the standard generational-accounting/lifetime-tax approach employed in applied work (Connolly et al., 2010). This methodology, first developed by Auerbach et al. (1991) and subsequently refined in numerous applications (Auerbach & Kotlikoff, 1999; Bonin, 2001), estimates annual tax revenue per person from aggregate data, multiplies by an expected working life to obtain lifetime (undiscounted) taxes, and computes the present value (PV) of future taxes using a conventional real discount rate. The PV is then compared with an estimate of the one-off housing cost (the price of an apartment suitable for a larger family). While generational accounting has evolved to incorporate age-specific profiles and detailed institutional features, the simplified approach adopted here prioritises transparency and replicability, consistent with the objective of illustrating orders of magnitude rather than providing definitive country-specific forecasts.

All baseline inputs are taken from high-quality official sources (latest available series): Aggregate tax-to-GDP ratio (Narodowy Bank Polski, 2024): 36.6% (OECD, 2024). This is used as a simple proxy for average annual tax revenue per capita (tax receipts/GDP $\times$ GDP per capita). GDP per capita (current US\$), Narodowy Bank Polski (2024): US\$25,022.7 (World Bank, 2024). Expected duration of working life (years): EU average 37.2 years (Eurostat, 2024); for a conservative Poland calibration, using 33.4 years (Eurostat figures emphasise that some member states, and women in particular, have shorter expected working lives; we treat 33.4 as a conservative lower bound and 37.2 as an upper bound). Housing cost (illustrative family apartment): NBP/market data indicate average transaction prices on Poland’s seven largest urban markets at roughly PLN 13,400 per m² (Q1 2024) and lower national averages; for a conservative national calibration, PLN 11,800/m² is used (a plausible national average) and a family apartment of 60 m² (yielding PLN 708,000). Regional/metro prices (e.g., Warsaw, Tri-city, Kraków) are higher and are noted below. Currency and conversion: where source

data are in USD, conversion uses contemporaneous average exchange information (NBP/market series used when needed).

Results are shown both undiscounted and discounted at a 3% real (present value), with sensitivity to the choice of discount rate reported in the text. The choice of a 3% real discount rate follows standard practice in long-horizon fiscal sustainability analysis and generational accounting applications (Auerbach & Kotlikoff, 1999; Moore et al., 2004), though the appropriate social discount rate remains debated in public economics.

The annual tax revenue per person used in this calculation is not intended to be a cohort-specific micro-estimate of lifetime taxes, but a transparent, easily replicable baseline derived from aggregate public-finance data. The purpose is to illustrate orders of magnitude rather than to provide a full generational accounting exercise. To summarise: the baseline assumptions held fixed throughout the analysis are the tax-to-GDP ratio (36.6%), GDP per capita (US\$25,022.7), and the family apartment cost (60 m² at PLN 11,800/m²). The parameters treated as sensitivity considerations, and varied in the discussion, are the real discount rate (baseline 3%, with discussion of 1–2% and 4% alternatives), the expected duration of working life (33.4 years as the conservative baseline, 37.2 years as the upper bound), and regional housing price variation (national average versus metropolitan prices).

3. Research results

Following the methodology established by Lee and Miller (2000) and Wolf et al. (2011) for estimating the fiscal externalities of fertility, a simple, transparent accounting exercise is applied to the specific question of housing-based pro-natalist policy. The exercise is deliberately stylised and illustrative, intended to show orders of magnitude and the sensitivity of the investment argument to standard parameter choices rather than to produce a definitive policy cost-benefit analysis for any single jurisdiction.

The first stage of the calculation estimates annual tax revenue per person. Annual tax revenue per capita is computed as the product of the tax-to-GDP ratio and GDP per capita. Using the inputs above: GDP per capita (Narodowy Bank Polski, 2024) = US\$25,022.7; Tax-to-GDP (Narodowy Bank Polski, 2024) = 36.6%. Thus: Annual tax (USD) = $25,022.7 \times 0.366 = \text{US\$}9,158.31$ (approx). Converting to PLN using the contemporaneous average (NBP series used above) gives $\approx \text{PLN } 37,560$ per year (rounded).

The second stage multiplies annual tax receipts by expected years in work to obtain undiscounted lifetime taxes. Using the conservative Poland proxy of 33.4 years, this yields undiscounted lifetime taxes of approximately PLN 1,254,506. Using the EU average of 37.2 years, the corresponding figure is approximately PLN 1,397,234 (PLN 37,560 multiplied by 33.4 yields approximately 1.254 million PLN; PLN 37,560 multiplied by 37.2 yields approximately 1.397 million PLN).

The third stage converts the future stream of annual tax receipts into a present value using the standard annuity formula, in which the present value equals the annual payment multiplied by the factor $[1 - (1 + r)^{-n}]$ divided by r , where A denotes annual tax (PLN 37,560), r denotes the real discount rate (0.03), and n denotes working years. At a 3% real discount rate, the present value over 33.4 years is approximately PLN 785,513, and over 37.2 years approximately PLN 835,075. These present values are conservative because they treat the person's taxes as a flat annuity; a full lifecycle model would use age-profiled earnings and tax schedules.

The fourth stage compares these present values with the housing cost. Using the family-apartment cost described above, the cost of a 60 m² apartment at PLN 11,800 per m² amounts to PLN 708,000.

Comparing the present value of lifetime taxes with the apartment cost, the conservative estimate (33.4 years) yields a ratio of 785,513 to 708,000, or approximately 1.11, indicating that the present value of lifetime taxes exceeds the one-off housing cost by approximately 11%. The EU-average estimate (37.2 years) yields a ratio of 835,075 to 708,000, or approximately 1.18, exceeding the housing cost by approximately 18%. If one uses the undiscounted lifetime tax figure (1.25–1.40 M PLN), the

ratio is substantially larger (roughly 1.77-1.97), but undiscounted sums exaggerate long-run value; the discounted PV is the conventional public-finance comparator.

Under these stylised, conservative inputs, the present value of an average future adult's lifetime tax contributions in Poland (discounted at 3%) is on the same order as, and under plausible calibrations slightly greater than, the upfront public cost of providing a 60 m² apartment at a modest national price. It should be emphasised that this result is illustrative and exploratory; it rests on aggregate data and simplified assumptions, and should not be interpreted as a definitive cost-benefit finding. This finding aligns with the broader literature on fiscal externalities of fertility: Lee and Mason (2011) demonstrate that adults in their prime working years typically generate substantial fiscal surpluses that offset childhood and old-age deficits, while Wolf et al. (2011) find positive net fiscal contributions from childbearing in high-income settings. The results also echo Connolly et al.'s (2010) analysis of assisted reproduction technologies, which similarly concluded that the fiscal value of births can exceed the public costs of supporting them. This supports the core investment framing of the policy: housing support for families with three or more children can be plausibly presented as an investment with a positive fiscal return on orders of magnitude, not merely as a pure transfer.

Table 1. Stylised fiscal comparison: lifetime tax contributions and housing costs (Poland).

Item	Value (baseline)	Source
GDP per capita (current USD)	25,022.7	World Bank
Tax-to-GDP ratio (%)	36.6	OECD
Annual tax per capita (PLN, approx.)	37,560	The author's calculation
Expected working life (years)	33.4	Eurostat
Undiscounted lifetime tax contributions (PLN)	1,254,506	The author's calculation
Present value of lifetime taxes (3% real, PLN)	785,513	The author's calculation
Cost of family apartment (60 m ² , PLN)	708,000	National Bank of Poland

Notes: Values are baseline estimates. PLN = Polish zloty. Lifetime taxes discounted at a 3% real rate.

Source: Developed by the author.

Raising the discount rate to 4% reduces the PV substantially; lowering it to 1-2% increases the PV. Long-run discounting is therefore a quantitatively important assumption. Sensitivity to the choice of discount rate and housing price assumptions is discussed qualitatively, as these parameters materially affect the present value of future tax contributions.

In high-cost cities (Hong Kong, central Singapore, prime Warsaw neighbourhoods), a family home suitable for three children can cost multiples of the national price. Yi and Zhang (2010) document how Hong Kong's extreme housing costs have contributed to its ultra-low fertility, while Clark (2012) shows that women in expensive housing markets significantly delay family formation. For example, the NBP/administered urban sample gives Q1 2024 averages of $\approx$ PLN 13,400/m² in the seven largest markets; a 60 m² apartment at that metro price would be $\approx$ PLN 804,000, reducing the PV/price ratio. For true high-cost global cities (Hong Kong; central Singapore), the gap between PV of lifetime taxes and the housing cost will generally be larger (i.e., the fiscal case is weaker) unless the accommodation provided is targeted (smaller size in city centre + larger family housing in suburbs) or programme design exploits land/volume economies or phased vesting.

4. Discussion

From a public finance perspective, the objective is to target households whose fertility decisions are most likely to respond to a substantial reduction in housing-related constraints. Eligibility criteria, therefore, need to balance inclusiveness with fiscal efficiency. One approach is to restrict eligibility to households that are legally married or in a formally recognised long-term partnership, reflecting empirical evidence linking stable unions to higher completed fertility. Lauster and Fransson (2006) document the intricate relationship between homeownership, marriage, and fertility, while Kulu and Steele (2013) show how housing transitions and childbearing decisions are interrelated over the family life course. In addition, limiting eligibility to first-time homeowners can help ensure that public resources are directed toward households for whom housing represents a binding constraint rather

than an additional asset, consistent with Öst's (2012) finding that housing and family formation decisions are made simultaneously. Residency requirements and legal status criteria may further be used to align eligibility with the objective of expanding the domestic tax base.

Crucially, full eligibility should be conditional on the successful birth and upbringing of a specified number of children, here defined as three or more. Conditioning benefits on realised family outcomes helps to distinguish between households whose fertility behaviour changes in response to the policy and those whose behaviour would have been unchanged. From a fiscal perspective, such conditionality is essential to ensure that public expenditure is linked to the generation of future contributors rather than distributed as a general subsidy.

Given the long-time horizon and uncertainty associated with fertility outcomes, a phased vesting structure plays a key role in managing fiscal risk. This approach draws on the logic articulated by Werding (2014), who emphasises that the fiscal sustainability of family policy depends on aligning public expenditure with actual demographic outcomes. Rather than providing full housing support upfront, benefits can be allocated incrementally as families progress through successive birth thresholds. Under such a scheme, households may initially receive access to subsidised rental housing or preferential lease terms upon marriage or the birth of a first child. Additional support, such as partial equity participation, reduced purchase prices, or enhanced subsidies, may follow the birth of a second child. Full ownership or the maximum level of subsidy would be granted only once the household has reached the third-child threshold and satisfied minimum residency and caregiving conditions. This approach aligns public expenditure more closely with realised demographic outcomes and reduces the risk of providing large, irreversible transfers to households that do not ultimately contribute to higher fertility. It also allows policymakers to spread fiscal costs over time, which may improve political and budgetary feasibility.

The delivery of housing support can take several institutional forms, each with distinct advantages and trade-offs. One option is direct state provision, whereby public authorities finance, build, and allocate housing units. Singapore's public housing system, as documented by Chua (2014), provides a prominent example of this approach, explicitly linking flat allocation to marriage and family formation. This model allows for tight control over eligibility, pricing, and location but requires substantial administrative capacity and upfront public investment.

Alternatively, public-private partnerships may be used to leverage private-sector expertise and capital. Under such arrangements, developers may be incentivised through land grants, long-term contracts, or guaranteed demand in exchange for providing housing at regulated prices to eligible families. In some contexts, cooperation with non-profit or faith-based organisations may also play a role, particularly where such institutions have experience in community-based housing provision.

Regardless of the delivery model, integration with local land-use planning and infrastructure provision is critical. Housing for larger families must be accompanied by adequate access to schools, healthcare, transport, and childcare facilities. Without such integration, the potential fertility effects of housing support may be undermined by congestion, long commutes, or insufficient public services.

Given the novelty and scale of a housing-for-fertility scheme, phased implementation through place-based pilot programmes is advisable. Pilot projects allow policymakers to test behavioural responses, administrative processes, and fiscal impacts before committing to nationwide expansion. Regions suitable for pilot implementation may include areas experiencing population decline, underutilised housing stock, or weaker labour-market attachment, as well as suburban or satellite zones connected to major metropolitan centres. Selection criteria should reflect both demographic objectives and cost considerations, including land availability and construction costs. From a research perspective, pilot programmes offer valuable opportunities for evaluation. By comparing fertility outcomes, housing stability, and fiscal indicators across treated and untreated regions, policymakers and researchers can assess the scheme's marginal impact. Longitudinal data collection is particularly important, as the fiscal effects of additional births materialise only over extended horizons.

Housing-based pro-natalist instruments should be understood as complements, not substitutes, to existing family policies. Child benefits, parental leave, childcare subsidies, and work-family reconciliation measures address constraints that housing policy alone cannot resolve. Conversely, housing support operates through a distinct channel by altering households' long-term asset positions and perceptions of security. The broader literature on family policy effectiveness (Gauthier, 2007; Luci-Greulich & Thévenon, 2013) suggests that combinations of policies addressing multiple constraints, childcare, parental leave, housing, and income support, tend to be more effective than isolated interventions, though the optimal mix varies by institutional and cultural context.

Policy coherence requires careful coordination between these instruments. For example, housing support that strongly encourages larger families may increase demand for childcare and education services, necessitating parallel investment in those areas. At the same time, overlapping benefits must be designed to avoid high fiscal costs or unintended incentives. The impact of labour market institutions on fertility decisions (Adserà, 2004) underscores the importance of considering how housing policy interacts with employment flexibility, job security, and work-family reconciliation measures. In this sense, the housing-for-fertility framework outlined here provides a lens through which broader family policy portfolios can be assessed: not only in terms of short-run affordability and equity, but also in their contribution to long-run demographic and fiscal sustainability.

The stylised calculations in Section 3 demonstrate that, under conservative and transparent assumptions, the fiscal case for targeted housing support is not implausible: the present value of lifetime tax contributions can match or modestly exceed the upfront housing cost. This matters because it shows that the fiscal externality framework developed by Sinn (1997) and extended by Cigno and Werding (2007) can be meaningfully applied to a specific, tangible policy channel, housing, rather than remaining at the level of abstract intergenerational accounting. The results extend the existing literature by connecting the fiscal externality argument to the specific margin of third and higher-order births, where housing constraints are most binding and policy leverage is most plausible. The purpose is to clarify the main channels through which such a scheme may succeed or fail, the trade-offs it creates, and the principal risks that must be addressed for the framework to be credible in policy and research terms.

The central claim of this article is not that housing support “pays for itself” mechanically, but that under plausible conditions it can be analysed as a long-horizon investment with a positive expected fiscal return. This framing builds on Sinn's (1997) foundational analysis of how pay-as-you-go pension systems create implicit taxation of children, and on subsequent work by Cigno and Werding (2007) showing how public pension systems distort fertility incentives. Whether that claim holds depends on several interacting parameters: the magnitude of the fertility response (especially at third and higher-order births), the lifetime net fiscal contributions of children who remain in the domestic economy, and the fiscal cost of the housing unit after accounting for financing arrangements, land costs, and administrative overhead.

Three considerations are particularly important. First, the budget horizon matters. Conventional public-budget processes emphasise annual or medium-term costs, whereas the fiscal benefits of additional births materialise over decades. This mismatch tends to bias assessment against policies with long payoff horizons. Second, risk and uncertainty must be treated explicitly. Outcomes depend on future labour-market participation, earnings trajectories, and demographic behaviour; an investment framing remains credible only if presented as an expected-value statement with sensitivity analysis rather than as a guaranteed return. Third, the definition of “net fiscal contribution” is crucial. A rigorous evaluation requires accounting not only for future taxes, but also for the associated public costs of education, healthcare, family benefits and eventual pension entitlements. Stylised calculations can illustrate magnitudes, but a full fiscal appraisal ultimately requires cohort-based modelling.

A further issue concerns fiscal capacity and opportunity cost. Even if the investment argument is plausible, governments may still prefer alternative instruments with comparable returns (e.g., early childhood education, labour force participation policies, productivity-enhancing infrastructure). As

Becker and Murphy (1988) argue in their analysis of family-state interactions, the optimal policy mix depends on comparative returns across different investment channels. The appropriate comparison is therefore not between housing-for-fertility and “doing nothing”, but between housing-for-fertility and the marginal return on other long-horizon public expenditures. The investment framing becomes most compelling where housing is a first-order constraint on completed fertility, as documented by Mulder and Billari (2010) across multiple country contexts, and where existing pro-family instruments have delivered limited marginal gains. A housing policy targeted at families with three or more children raises immediate distributional questions. By design, such a scheme directs a large, indivisible benefit to a subset of households. This can be defended on efficiency grounds if the targeted group is the margin where fertility responses are most elastic and where the external fiscal benefit is largest, a logic consistent with Folbre’s (1994) argument that children function as public goods whose benefits extend beyond the family. However, distributional concerns can affect political legitimacy and compliance, and may also influence the policy’s behavioural impact. Several equity tensions are foreseeable. First, childless households or smaller families may perceive the scheme as unfair, particularly in contexts where housing affordability is also a major issue for singles and couples without children. Second, the scheme can create differential access between income groups if eligibility requires marriage, stable residency, or administrative documentation that is easier to satisfy for some groups than others. Third, spatial inequity may arise if affordable delivery requires siting housing in peripheral areas with weaker services or labour-market access.

A policy that transfers housing assets to large families will inevitably face political economy challenges. Housing is highly salient, distributional stakes are visible, and beneficiaries are identifiable. These features can generate both support and resistance, depending on how the scheme interacts with existing social cleavages and housing market conditions.

The most important political-economy issue is the distinction between investment and welfare framing. If the scheme is perceived primarily as a redistribution programme, support may weaken during fiscal tightening and controversies over targeting. If it is credibly framed as an investment in long-run fiscal sustainability and demographic renewal, it may attract broader support, including from constituencies concerned about pensions, labour shortages, or national continuity. Research on the political economy of family policy (Gauthier, 2007; Luci-Greulich & Thévenon, 2013) suggests that pro-natalist measures gain broader political support when they are framed in terms of long-term fiscal sustainability and economic competitiveness rather than as narrow welfare transfers. Maintaining credibility requires institutional design that demonstrates discipline: phased vesting, enforceable residency requirements, and measurable evaluation.

A large-scale housing subsidy affects not only beneficiaries but also the broader housing market. The most immediate risk is capitalisation into prices: if housing supply is inelastic, subsidies can raise market prices, transferring benefits to landowners and developers rather than to families (Hilber & Turner, 2014; Hilber, 2017). In such a case, the fiscal cost increases while the fertility response may weaken, undermining the investment logic. Empirical evidence from mortgage subsidy programmes in the United States (Sommer & Sullivan, 2018) and the United Kingdom (Carozzi et al., 2020) demonstrates that a substantial portion of housing subsidies can be capitalised into higher prices, with the magnitude depending on local supply elasticities and regulatory constraints.

This general-equilibrium concern implies that housing-for-fertility schemes should be paired with measures that improve effective supply, through construction capacity, land-use planning, infrastructure expansion, or development of satellite communities. Delivery through direct provision or regulated-price units may also reduce capitalisation compared to pure demand-side subsidies (Floetotto et al., 2016). However, these measures require careful coordination with urban planning and transport policy, particularly in metropolitan regions. Hilber (2017) provides a comprehensive synthesis of the mechanisms by which housing policies affect prices, emphasising the critical role of land-use regulation and supply constraints in determining policy incidence.

A second general-equilibrium effect concerns labour supply and location decisions. If housing is provided in peripheral areas, households may face longer commutes and different labour-market opportunities, a consideration that Adserà (2004) identifies as crucial for understanding how labour market institutions affect fertility rates. Conversely, stable housing may reduce stress and improve labour-market attachment by increasing residential stability, consistent with Schneider's (2015) findings that wealth and asset security play a distinct role in fertility decisions beyond current income. The direction of this effect is context-dependent and should be treated as an empirical question rather than assumed.

Third, there may be interactions with internal and international migration. In some contexts, a generous housing benefit could attract in-migration to eligible regions, altering local labour markets and housing demand. Where policy objectives are tied to expanding the domestic tax base, the scheme's eligibility and residency rules must be aligned with the intended beneficiary population. General equilibrium models of housing policy (Sommer & Sullivan, 2018) suggest that migration responses can substantially alter the distributional and efficiency implications of place-based housing interventions.

The conceptual framework in this article is intended to apply to low-fertility economies generally, but its practical viability is especially salient in high-cost urban environments. Hong Kong and Singapore exemplify contexts in which housing affordability and space constraints are central life-course issues, and fertility has reached extremely low levels. In such cases, the investment logic faces a stronger challenge: the per-unit cost of housing is high, and the gap between the PV of fiscal contributions and housing costs may be narrower unless programme design exploits spatial strategies (e.g., subsidised family housing in well-connected satellite areas) and strict targeting. In the Gulf, including the UAE, the context differs in two respects. First, housing policy and family policy often interact with broader questions of social contract and citizenship. Second, labour markets typically involve a large expatriate component, and the fiscal value of additional births may depend strongly on nationality status, labour-force participation, and long-run residency. These features do not invalidate the investment framing, but they emphasise that the "fiscal externality" channel is mediated by institutional design: who is eligible, who becomes a future taxpayer in the relevant sense, and how long they remain within the fiscal system.

Across these contexts, the general implication is that housing-for-fertility schemes are most plausible when designed as place-based, integrated programmes: tied to transport and service provision, linked to phased vesting and enforceable conditions, and evaluated using transparent metrics. Where these features are absent, the fiscal and demographic rationale weakens and the policy risks becoming an expensive transfer with limited behavioural impact.

Conclusions

This research paper has examined whether housing support targeted at families with three or more children can be credibly interpreted as pro-natalist fiscal policy in low-fertility economies. The central argument is that, in ageing societies, fertility generates a fiscal externality: parents bear substantial private costs of raising children, while the public sector and older cohorts capture part of the long-run fiscal benefits through future tax and contribution revenues. When policy appraisal focuses primarily on short-run budget horizons, this externality may be undervalued, and governments may under-invest in measures that would be fiscally attractive when evaluated over the lifecycle of future taxpayers. Bringing together the literatures on low fertility, housing affordability, and public finance, the article proposes a conceptual framework for assessing free or near-free housing for larger families using an investment logic. A stylised calibration for Poland suggested that, under transparent and conservative inputs, the present value of lifetime tax contributions associated with an average future adult can be of a similar order of magnitude to the upfront cost of providing a modest family apartment. This does not constitute a definitive cost-benefit evaluation. The calculations are illustrative and exploratory, and their results are conditional on the specific parameter assumptions

employed. However, it supports the claim that a targeted housing-for-fertility scheme can be analysed as a long-run investment rather than as a purely redistributive transfer, particularly when policy design is oriented toward influencing marginal third and higher-order births and when fiscal risks are managed through phased vesting and enforceable conditions.

The credibility of such a scheme depends on careful design: eligibility targeting, phased vesting linked to realised demographic outcomes, supply-side integration to limit price capitalisation, and place-based piloting prior to national rollout.

Several limitations of the present analysis should be acknowledged, each of which points directly to a research agenda for economists and policy scholars. First, the calculations presented here are stylised and do not constitute a full generational accounting exercise. A comprehensive analysis would require age-specific profiles of taxes, transfers, employment, mortality, and public service use, along with institutional details of the pension and healthcare systems, as demonstrated in the detailed country applications by Bonin (2001) and the cross-national comparisons by Lee and Mason (2011). The approach taken is consistent with the simplified lifetime-tax methodology used in applied public-finance studies, but it abstracts from many cohort-specific dynamics; future work should replace these stylised calculations with cohort-based modelling. Secondly, the results compare the present value of lifetime gross tax contributions with the upfront cost of housing. A complete fiscal evaluation would incorporate all public expenditures associated with an additional child, including education, healthcare, child-related transfers, and eventual pension entitlements. As Cigno and Werding (2007) emphasise, the fiscal sustainability of family policy depends critically on whether the children whose births it encourages will generate positive net fiscal contributions. Existing international studies, including Wolf et al. (2011), generally find positive lifetime net fiscal contributions in high-income settings, but magnitudes are sensitive to institutional features. Thirdly, the approach does not incorporate behavioural responses or general-equilibrium effects. Large-scale housing subsidies may influence housing prices, migration patterns, labour supply and fertility decisions in ways that modify the fiscal outcome, as demonstrated by Hilber and Turner (2014) and Sommer and Sullivan (2018) in their analyses of mortgage subsidies. The fertility response itself is uncertain; while Dettling and Kearney (2014) and Fila and Pytliková (2023) provide evidence that housing costs affect fertility, the magnitude of responses to specific policy interventions requires empirical identification through quasi-experimental or experimental approaches where feasible. General-equilibrium effects on housing prices, construction, labour supply and location choices are likely to be quantitatively important and should be analysed using structural or simulation models appropriate to the local context. Fourthly, comparative work across settings with different housing regimes and welfare-state designs would help clarify external validity and identify conditions under which the investment logic is most likely to hold. Finally, all present-value calculations depend on standard assumptions regarding discount rates, working-life duration, and tax baselines. These parameters should be interpreted as ranges, not precise point estimates, and sensitivity analysis is essential when applying the framework to specific countries or policy settings.

In low-fertility economies facing long-run demographic and fiscal pressures, the policy question is not whether governments can afford to invest in families, but whether they can afford not to. Housing is one of the largest fixed constraints shaping life-course decisions. Treating targeted family housing as a potential fiscal investment provides a coherent framework for evaluating one of the most direct ways states can reduce barriers to larger families while maintaining analytical discipline and empirical testability.

Even using conservative, transparent public data, a straightforward lifecycle accounting exercise suggests the present value of a future adult's tax contributions in Poland is on the same order as the one-off cost of supplying a modest family home. These results are illustrative and context-dependent; they should be treated as indicative orders of magnitude rather than as precise fiscal forecasts. Interpreting targeted family housing as a long-run fiscal investment (rather than only as

redistribution) therefore has prima facie plausibility, subject to the important caveats above and to robust cohort-level modelling and pilot evaluation.

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Reference

1. Adserà, A. (2004). Changing fertility rates in developed countries: The impact of labor market institutions. *Journal of Population Economics*, 17(1), 17–43. <https://doi.org/10.1007/s00148-003-0166-x>.
2. Auerbach, A. J., Gokhale, J., & Kotlikoff, L. J. (1991). Generational accounts: A meaningful alternative to deficit accounting. In D. Bradford (Ed.), *Tax policy and the economy*, Vol. 5 (pp. 55–110). MIT Press.
3. Auerbach, A. J., & Kotlikoff, L. J. (1999). The methodology of generational accounting. In A. J. Auerbach, L. J. Kotlikoff, & W. Leibfritz (Eds.), *Generational accounting around the world* (pp. 31–41). University of Chicago Press.
4. Becker, G. S., & Barro, R. J. (1988). A reformulation of the economic theory of fertility. *Quarterly Journal of Economics*, 103(1), 1–25. <https://doi.org/10.2307/1882640>.
5. Becker, G. S., & Murphy, K. M. (1988). The family and the state. *Journal of Law and Economics*, 31(1), 1–18. <https://doi.org/10.1086/467147>.
6. Bloom, D. E., Canning, D., & Fink, G. (2010). Implications of population ageing for economic growth. *Oxford Review of Economic Policy*, 26(4), 583–612. <https://doi.org/10.1093/oxrep/grq038>.
7. Bonin, H. (2001). *Generational accounting: Theory and application*. Springer.
8. Carozzi, F., Hilber, C. A. L., & Yu, X. (2020). *On the economic impacts of mortgage credit expansion policies: Evidence from Help to Buy* (CEP Discussion Paper No. 1681). Centre for Economic Performance, LSE.
9. Chua, B. H. (2014). Navigating between limits: The future of public housing in Singapore. *Housing Studies*, 29(4), 520–533. <https://doi.org/10.1080/02673037.2013.874548>.
10. Cigno, A. (1993). Intergenerational transfers without altruism: Family, market and state. *European Journal of Political Economy*, 9(4), 505–518. [https://doi.org/10.1016/0176-2680\(93\)90036-T](https://doi.org/10.1016/0176-2680(93)90036-T).
11. Cigno, A., & Werding, M. (2007). *Children and pensions*. MIT Press.
12. Clark, W. A. V. (2012). *Do women delay family formation in expensive housing markets?* *Demographic Research*, 27, 1–24. <https://doi.org/10.4054/DemRes.2012.27.1>.
13. Comolli, C. L. (2017). The fertility response to the Great Recession in Europe and the United States: Structural economic conditions and perceived economic uncertainty. *Demographic Research*, 36, 1549–1600. <https://doi.org/10.4054/DemRes.2017.36.51>.
14. Connolly, M. P., Hoorens, S., Chambers, G. M., & Ledger, W. L. (2010). The costs and consequences of assisted reproductive technology: An economic perspective. *Human Reproduction Update*, 16(6), 603–613. <https://doi.org/10.1093/humupd/dmq013>.
15. Dettling, L. J., & Kearney, M. S. (2014). House prices and birth rates: The impact of the real estate market on the decision to have a baby. *Journal of Public Economics*, 110, 82–100. <https://doi.org/10.1016/j.jpubeco.2013.09.009>.
16. Doepke, M., Hannusch, A., Kindermann, F., & Tertilt, M. (2022). *The economics of fertility: A new era* (NBER Working Paper No. 29948). National Bureau of Economic Research. <https://doi.org/10.3386/w29948>.

17. Eurostat. (2024a). *Duration of working life — statistics*. Publications Office of the European Union. <https://ec.europa.eu/eurostat>.
18. Eurostat. (2024b). *Population structure and ageing*. Publications Office of the European Union. <https://ec.europa.eu/eurostat>.
19. Feyrer, J., Sacerdote, B., & Stern, A. D. (2008). Will the stork return to Europe and Japan? Understanding fertility within developed nations. *Journal of Economic Perspectives*, 22(3), 3–22. <https://doi.org/10.1257/jep.22.3.3>.
20. Fila, J., & Pytliková, M. (2023). Housing subsidies and fertility: Evidence from the Czech Republic. *Journal of Housing Economics*, 61, 101944. <https://doi.org/10.1016/j.jhe.2023.101944>.
21. Floetotto, M., Kirker, M., & Stroebel, J. (2016). Government intervention in the housing market: Who wins, who loses? *Journal of Monetary Economics*, 80, 106–123. <https://doi.org/10.1016/j.jmoneco.2016.04.005>.
22. Folbre, N. (1994). Children as public goods. *American Economic Review*, 84(2), 86–90.
23. Gauthier, A. H. (2007). The impact of family policies on fertility in industrialized countries: A review of the literature. *Population Research and Policy Review*, 26(3), 323–346. <https://doi.org/10.1007/s11113-007-9033-x>.
24. Hilber, C. A. L. (2017). The economic implications of house price capitalization: A synthesis. *Real Estate Economics*, 45(2), 301–339. <https://doi.org/10.1111/1540-6229.12129>.
25. Hilber, C. A. L., & Turner, T. M. (2014). The mortgage interest deduction and its impact on homeownership decisions. *Review of Economics and Statistics*, 96(4), 618–637. https://doi.org/10.1162/REST_a_00427.
26. Kohler, H.-P., Billari, F. C., & Ortega, J. A. (2002). The emergence of lowest-low fertility in Europe during the 1990s. *Population and Development Review*, 28(4), 641–680. <https://doi.org/10.1111/j.1728-4457.2002.00641.x>.
27. Kulu, H., & Boyle, P. J. (2009). High fertility in city suburbs: Compositional or contextual effects? *European Journal of Population*, 25(2), 157–174. <https://doi.org/10.1007/s10680-008-9163-9>.
28. Kulu, H., & Steele, F. (2013). Interrelationships between childbearing and housing transitions in the family life course. *Demography*, 50(5), 1687–1714. <https://doi.org/10.1007/s13524-013-0216-2>.
29. Lauster, N., & Fransson, U. (2006). Of marriages and mortgages: The second demographic transition and the relationship between marriage and homeownership in Sweden. *Housing Studies*, 21(6), 909–927. <https://doi.org/10.1080/02673030600917826>.
30. Lee, R., & Miller, T. (2000). Immigration, social security, and broader fiscal impacts. *American Economic Review*, 90(2), 350–354. <https://doi.org/10.1257/aer.90.2.350>.
31. Lee, R. D., & Mason, A. (2011). *Population aging and the generational economy: A global perspective*. Edward Elgar Publishing.
32. Lovenheim, M. F., & Mumford, K. J. (2013). Do family wealth shocks affect fertility choices? Evidence from the housing market. *The Review of Economics and Statistics*, 95(2), 464–475. https://doi.org/10.1162/REST_a_00266.
33. Luci-Greulich, A., & Thévenon, O. (2013). The impact of family policies on fertility trends in developed countries. *European Journal of Population*, 29(4), 387–416. <https://doi.org/10.1007/s10680-013-9295-4>.
34. Maestas, N., Mullen, K. J., & Powell, D. (2023). The effect of population aging on economic growth, the labor force, and productivity. *American Economic Journal: Macroeconomics*, 15(2), 306–332. <https://doi.org/10.1257/mac.20190196>.
35. McDonald, P. (2006). Low fertility and the state: The efficacy of policy. *Population and Development Review*, 32(3), 485–510. <https://doi.org/10.1111/j.1728-4457.2006.00134.x>.
36. McKee, K., Moore, T., Soaita, A., & Crawford, J. (2017). 'Generation rent' and the fallacy of choice. *International Journal of Urban and Regional Research*, 41(2), 318–333. <https://doi.org/10.1111/1468-2427.12445>.

37. Moore, M. A., Boardman, A. E., Vining, A. R., Weimer, D. L., & Greenberg, D. H. (2004). "Just give me a number!" Practical values for the social discount rate. *Journal of Policy Analysis and Management*, 23(4), 789–812. <https://doi.org/10.1002/pam.20047>.
38. Mulder, C. H. (2006). Population and housing: A two-sided relationship. *Demographic Research*, 15, 401–412. <https://doi.org/10.4054/DemRes.2006.15.13>.
39. Mulder, C. H., & Billari, F. C. (2010). Homeownership regimes and low fertility. *Housing Studies*, 25(4), 527–541. <https://doi.org/10.1080/02673031003711469>.
40. Narodowy Bank Polski. (2024). *Information on home prices and the situation in the housing and commercial real estate market in Poland in 2024 Q1*. <https://nbp.pl/wp-content/uploads/2025/01/Information-on-home-prices-and-the-situation-in-the-housing-and-commercial-real-estate-market-in-Poland-in-2024-Q1.pdf>.
41. OECD. (2023). *Pensions at a Glance 2023*. OECD Publishing. <https://www.oecd.org/pensions>.
42. OECD. (2024). *Revenue Statistics 2024: Poland*. OECD Publishing. <https://www.oecd.org/tax>.
43. Öst, C. E. (2012). Housing and children: Simultaneous decisions? - A cohort study of young adults' housing and family formation decision. *Journal of Population Economics*, 25(1), 349–366. <https://doi.org/10.1007/s00148-010-0345-5>.
44. Rindfuss, R. R., Guilkey, D. K., Morgan, S. P., & Kravdal, Ø. (2010). Child-care availability and fertility in Norway. *Population and Development Review*, 36(4), 725–748. <https://doi.org/10.1111/j.1728-4457.2010.00355.x>.
45. Ronald, R. (2008). *The ideology of home ownership: Homeowner societies and the role of housing*. Palgrave Macmillan.
46. Schneider, D. (2015). The great recession, fertility, and uncertainty: Evidence from the United States. *Journal of Marriage and Family*, 77(5), 1144–1156. <https://doi.org/10.1111/jomf.12212>.
47. Sinn, H.-W. (1997). The value of children and immigrants in a pay-as-you-go pension system: A proposal for a partial transition to a funded system (NBER Working Paper No. 6229). National Bureau of Economic Research. <http://www.nber.org/papers/w6229.pdf>.
48. Sommer, K., & Sullivan, P. (2018). Implications of US tax policy for house prices, rents, and homeownership. *American Economic Review*, 108(2), 241–274. <https://doi.org/10.1257/aer.20141751>.
49. Thévenon, O. (2011). Family policies in OECD countries: A comparative analysis. *Population and Development Review*, 37(1), 57–87. <https://doi.org/10.1111/j.1728-4457.2011.00390.x>.
50. Thévenon, O., & Gauthier, A. H. (2011). Family policies in developed countries: A 'fertility-booster' with side-effects. *Community, Work & Family*, 14(2), 197–216. <https://doi.org/10.1080/13668803.2011.571400>.
51. United Nations (2023). *Department of Economic and Social Affairs. World Population Prospects 2022*. <https://population.un.org>.
52. Vignoli, D., Rinesi, F., & Mussino, E. (2013). A home to plan the first child? Fertility intentions and housing conditions in Italy. *Population, Space and Place*, 19(1), 60–71. <https://doi.org/10.1002/psp.1716>.
53. Werding, M. (2014). *Familien in der gesetzlichen Rentenversicherung: Das Umlageverfahren auf dem Prüfstand*. Bertelsmann Stiftung.
54. Wolf, D. A., Lee, R. D., Miller, T., Donehower, G., & Genest, A. (2011). Fiscal externalities of becoming a parent. *Population and Development Review*, 37(2), 241–266. <https://doi.org/10.1111/j.1728-4457.2011.00410.x>.
55. World Bank. (2024). *World Development Indicators: GDP per capita (current US\$) - Poland*. <https://data.worldbank.org>.
56. Yi, J., & Zhang, J. (2010). The effect of house price on fertility: Evidence from Hong Kong. *Economic Inquiry*, 48(3), 635–650. <https://doi.org/10.1111/j.1465-7295.2009.00213.x>.

Digital Leadership and Lean Manufacturing: An Analysis Using an Importance-Performance Map

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Abstract

The success of lean manufacturing practices in Industry 4.0 is highly dependent on people and technology; therefore, an appropriate leadership style is essential when pursuing the implementation of lean manufacturing. This study explores whether digital leadership has direct and indirect effects on lean manufacturing practices via the mediation of the two dimensions of thriving at work; in parallel, the degree of its importance and respective performance is evaluated. The research design was quantitative, non-experimental, cross-sectional, and explanatory and was conducted in the Mexican border export manufacturing industry using a non-probabilistic sample of 1,123 people. The statistical techniques used were partial least squares structural equation modelling [PLS-SEM] and importance–performance mapping [IPMA]. The results reveal a direct effect of digital leadership on lean manufacturing practices and an indirect effect through the learning dimension of thriving at work; the vitality dimension has no significant effect on lean manufacturing practices. The importance–performance map highlights the significant effect of digital leadership on lean manufacturing; at the indicator level, it reveals that leaders need to improve their performance by seeking out and motivating employees to experience and use new technologies.

Key words

Industry 4.0, digital leadership, thriving at work, lean manufacturing, structural model, performance importance map.

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Introduction

Manufacturers must respond quickly to market demands and operate with high quality, productivity, and low costs; thus, lean manufacturing practices are useful (Lu et al., 2018). This productive scheme is essential for companies to thrive in competitive markets (Sekhar et al., 2023), even emerging as the only method that meets most of the objectives required by companies in the line of business, due to the multiple benefits associated with the application of its techniques (Kumar et al., 2022). However, lean practices designed for high volumes and low production variety face the challenge of adapting to new requirements: low volumes and high variety; shorter response times; greater customisation; and environmental concerns. For this, management approaches supported by digital technologies, particularly Industry 4.0 (I4.0), are useful (Sartal et al., 2022).

Manufacturing companies using lean production techniques should adapt to I4.0 (Qureshi et al., 2023). I4.0 helps improve manufacturing practices and operations by employing different emerging technologies (Rahardjo et al., 2023). Moreover, manufacturing companies have changed with the use of I4.0 technologies, including cloud computing, big data analytics, robotics, and the Internet of Things (IoT) (Rahardjo et al., 2023). Although a single definition of Industry 4.0 is lacking, some studies (Buer et al., 2018) have operationalised it with the use of smart products and processes, enabling autonomous data collection and analysis, and interaction between products, processes, suppliers, and customers via the Internet. Recent studies (Maware & Parsley, 2023) indicate that Industry 4.0 technologies have positive and significant effects on lean manufacturing.

People are important in both I4.0 and lean manufacturing. Industry 4.0 is based on the adoption of technologies, but it also demands considerable changes in organisational culture, which requires the consideration of workers (Bianco et al., 2021). In parallel, the integration of people into the process is a relevant factor (Veile et al., 2019) and success in the application of lean manufacturing essentially depends on people (Tortorella et al., 2021), since they and technology integrate in a fundamental binomial to maximise performance (Qureshi et al., 2023). It is important to mention that when a company seeks to produce under lean manufacturing schemes, appropriate leadership styles are indispensable (Benkarim & Imbeau, 2021; Kumar et al., 2022). In this regard, academic literature recognises the importance of leadership in addressing the challenges of digital transformation (Ratajczak, 2022; Zeike et al., 2019). It should be noted that lean manufacturing has evolved toward a culture rooted in values, principles, and behaviours that promote continuous improvement, and in this regard, leadership 4.0 plays a fundamental role (Gatell & Avella, 2024).

Furthermore, organisations face new opportunities and challenges in managing their human capital (Agustina et al., 2020; Bartsch et al., 2021). Among the consequences of thriving at work are self-improvement, talent development, sustainable performance, and competitive management (Brown et al., 2017; Goh et al., 2021; Porath et al., 2011). In recent decades, the 'thriving at work' variable has been the subject of increasing attention (Brown et al., 2017; Liu et al., 2021). Papers published in the last five years (Rego et al., 2021) highlight the importance of discovering its antecedents, among which different leadership styles are included (Liu et al., 2021). This research makes an important contribution to the literature. First, it adds knowledge regarding the integration of lean manufacturing and Industry 4.0, a topic of growing interest in the early stages of development (Bianco et al., 2021; Rahardjo et al., 2023). Moreover, the impact of leadership on lean manufacturing initiatives has been investigated, which is a topic of knowledge with few empirical studies (Tortorella et al., 2021). With regard to thriving at work, insights into its causes and consequences are added, and in doing so it is expected that the limited proposals for specific and reliable recommendations will be enhanced (Kleine et al., 2019). Furthermore, although several studies have assessed the influence of leadership styles, such as authentic (Xu et al., 2017), servant (Walumbwa et al., 2017), and transformational (Hildenbrand et al., 2018), on thriving at work, no studies were identified that examined digital leadership as a precursor to thriving at work. It is worth mentioning that recent studies have pointed out that studies on leadership in the context of I4.0 will take time to consolidate, as those published to date have focused on technological topics (Bianco et al., 2021). In the context of

the export manufacturing industry of the northern border of Mexico, this study analysed whether digital leadership has direct and indirect effects on lean manufacturing practices through the mediation of thriving at work. In addition, it evaluates the degree of importance and performance of the latent variables and indicators. This document includes four sections: the theoretical framework of the study constructs; research methods; results; discussion and conclusions.

1. Literature review

1.1. Leadership

In the business context, a leadership style capable of managing people's talent is essential (Kaur et al., 2024; Sivathanu & Pillai, 2018). Leaders influence people's confidence, effectiveness, and commitment (Agustina et al., 2020), and by acting as role models and motivating with inspiring visions, they enhance the experience of collaborators, enabling them to feel fulfilled and vital in their tasks (Dvir et al., 2002; Koistinen & Vuori, 2024).

In the manufacturing context, the transition from mass production models to lean management systems demands significant technical and sociocultural changes, for which conducive leadership is required (Fujimoto et al., 2024; Tortorella et al., 2021). The industry 4.0 era demands the development of specific competencies in leaders (Bianco et al., 2021; Netland & Ferdows, 2016). Leadership 4.0, also known as digital leadership (Oberer & Erkollar, 2018), is essential in the era of digital transformation and technology, and is recognised as an important element for operational excellence, digital culture, and firm competitiveness (Chatterjee et al., 2023; Mihardjo et al., 2019a; Peng, 2021), given the need to optimise the use of digital technology to strengthen the firm's advantages (Sasmoko et al., 2019). In parallel, digital leadership is considered a benchmark in the knowledge society: its influence is achieved with the use of digital tools (Narbona, 2016). Its purpose is to lead the company toward digital transformation and strengthen its ability to adapt to rapid changes in the environment (Nagel, 2020). Moreover, in the I4.0 environment, the leader is oriented towards the customer, staff development, lean principles, and operational performance (Gatell & Avella, 2024). In addition, the digital leader manages the organization's dynamic capabilities to thrive in business scenarios with high and rapid rates of change (Tigre et al., 2023). This leadership style drives communication and transformation using digital media (Mihardjo et al., 2019b; Oberer & Erkollar, 2018) and has distinctive characteristics, such as creativity, deep knowledge, global vision and collaboration, and loyal participation through vision (Sasmoko et al., 2019; Zhu, 2015)

1.2. Thriving at work

Organizational interest in investigating thriving at work grew in response to its strong predictive ability on variables like work engagement, performance, satisfaction, and burnout (Goh et al., 2021). Thriving at work is a state of mind in which people learn and feel stronger in their job. (Spreitzer et al., 2005). Employees who thrive at work feel energized, empowered, and full of life because they feel a sense of personal growth and can apply their valuable knowledge and skills (Kleine et al., 2019; Niessen et al., 2011; Spreitzer et al., 2005). In parallel, thriving at work benefits workers in diverse aspects, such as health (Porath et al., 2011; Spreitzer et al., 2005; Walumbwa et al., 2017), performance, satisfaction, and well-being (Pfeffer, 2010; Porath et al., 2011; Spreitzer et al., 2012), and it decreases their propensity to feel worried, depressed, or disturbed (Keyes, 2002).

Spreitzer et al. (2005) developed the Socially Embedded Model of Thriving (SEMT), which makes two fundamental assumptions: most employees work in socially integrated contexts; and work environments in which trust, respect, and inclusive decision-making exist enhance self-determination and personal agency (Goh et al., 2021). According to this model, employees thrive at work through interaction, observation, and communication with supervisors and peers (Liu et al., 2021; Spreitzer et al., 2012).

Thriving at work is composed of two dimensions: a feeling of vitality; and a sense of learning or improving – the former represents a sense of energy and enthusiasm for work, and the latter involves the acquisition and application of knowledge and skills to build capacity and confidence. The two

dimensions reflect the experience of personal growth, and it is necessary to maintain high levels across them both for employees to thrive (Goh et al., 2021; Porath et al., 2011). Then, thriving at work involves growth in expressions of vitality (hedonic) and learning (eudemonic) as characteristics of psychological development (Saleem et al., 2020).

People are more likely to thrive under favourable working conditions (Spreitzer et al., 2005). In this regard, leadership styles that empower, support, and inspire people are essential to creating environments where people thrive. According to various studies, leaders who focus on employee development foster and enable thriving at work (Chen and Kanfer, 2006; Lin et al., 2020; Shahid et al., 2020; Walumbwa et al., 2017). In parallel, when they show high levels of determination and can create favourable contexts (with social support and availability of emotional, motivational, informational, and relational resources), they can enhance employees' drive and courage, thereby increasing their perception of thriving at work (Rego et al., 2021). Digital leaders tend to increase subordinates' feelings of competence and promote vitality (Tummers et al., 2016). Therefore, it is proposed that:

H1a. Digital leadership positively and significantly influences the learning dimension of thriving at work.

H1b. Digital leadership positively and significantly influences the vitality dimension of thriving at work.

Both dimensions of thriving at work can contribute to personal growth and development, but the perception of thriving largely depends upon the extent to which they are combined and mutually beneficial (Porath et al., 2011). Employees may be enthusiastic about their work, but over time, this enthusiasm can fade if there are no opportunities for learning and growth (Paterson et al., 2014). In addition, people do not feel fulfilled if they experience low energy levels, even if they have acquired new skills in their work (Abid et al., 2020). Therefore, it is postulated that:

H2. The learning dimension of thriving at work has a positive and significant impact on the vitality dimension of thriving at work.

1.3. Lean manufacturing (LM)

Lean manufacturing is a management philosophy focused on organizational efficiency, with a continuous search for perfection (Salvadorinho et al., 2024; Tayaksi et al., 2020). The lean philosophy emerged in Japan in the 1950s and is used to manage and optimize production processes; it emphasizes eliminating waste, improving production efficiency and effectiveness, increasing product quality, customer satisfaction, and eliminating variability in processes, which involves focusing on activities that add value to the customer and suppressing all waste in the production process (Medyński et al., 2023; Qureshi et al., 2023; Schonberger, 2007; Shah & Goldstein, 2006; Vinodh & Joy, 2012). Globally, this thinking is adopted as a strategy to promote flexibility, reliability, and productivity (Kumar et al., 2022).

Lean thinking prioritizes people as an essential factor for maintaining and strengthening continuous improvement in processes (Pagliosa et al., 2019). Within lean environment, soft practices are fundamental if the purpose is to foster long-term and continuous improvement (Qureshi et al., 2023). Note that employees can facilitate or limit the use of lean manufacturing techniques, especially when performing implementation tasks (Benkarim & Imbeau, 2022; Tortorella & Fogliatto, 2014; Wong et al., 2009).

Leadership became critically significant once it was understood that Lean goes beyond the concept of a toolbox and is best understood as a philosophy based on changing human behaviour (Bianco et al., 2021). Moreover, leadership is regarded as an indispensable driver of lean success because it contributes to creating conditions for continuous improvement and waste elimination (Gatell & Avella, 2024). Digital leadership enables the successful implementation of lean manufacturing (Aripin et al., 2023; Walker & Qian, 2020). In a case study conducted with a European automobile manufacturer, it was found such leadership enabled the successful implementation of lean

manufacturing practices, since employees were involved and committed to the company (Aripin et al., 2023). Thus, it is postulated that:

H3. Digital leadership directly, positively, and significantly impacts the use of lean manufacturing practices.

The workplace is an essential environment where people can achieve a positive identity, whether for reasons of self-admiration or to give meaning to their lives (Saleem et al., 2020). Thriving can be seen as a reaction to challenges, not only in overcoming work pressure, but also in responding to challenging situations (Bartram et al., 2023; Saleem et al., 2020; Subramanian & Suresh, 2024). Thus, vitality and energy are key resources in demanding work environments (Bartram et al., 2023). On the other hand, employee learning plays an important role in improving performance (Muhammad et al., 2022; Qureshi et al., 2023). This means that people who learn at work are more likely to be competent and acquire knowledge that helps improve the functioning of the organization (Saleem et al., 2020). Therefore, in the implementation of lean manufacturing initiatives, it is important to create positive work environments that consider not only the needs of the firm but also depart from the requirements of the people; this will involve determining how to ensure that employees are self-sufficient, have a sense of purpose, and are committed (Hines et al., 2022). Therefore, it is postulated that:

H4a. Thriving at work, through its learning dimension, positively and significantly influences the use of lean manufacturing practices.

H4b. Thriving at work through the vitality dimension positively and significantly affects the use of lean manufacturing practices.

2. Methodology

This research is quantitative, non-experimental, cross-sectional, and explanatory. The participants were employees from productive (operational) and management areas working in manufacturing companies of the maquiladora export industry in Ciudad Juarez, Chihuahua. The sample was non probabilistic and was conducted as a convenience sampling, applying the snowball technique. A survey was used as the data collection technique; an online questionnaire was submitted through an electronic link, and the fieldwork was carried out in October and November 2023. Eligible individuals to receive the electronic link were active employees in the export manufacturing industry. A total of 1,123 employees participated, and of them 50.7% were men and 48.3% were women. Regarding age, 53.6% of them were between 20 and 25 years old, and 63.2% had been with the organization for less than 2 years. Regarding education, 29.5% of the participants completed high school, followed by 22.7% with a bachelor's degree. In terms of position, 27.5% of the employees were operators, 17.6% were technicians, 10.4% were group leaders, 19.1% were engineers, 6.3% were supervisors, 2.3% were managers, and 16.8% were assistants, administrative or forklift workers. Lastly, 39.8% of participants worked in companies manufacturing parts for the automotive sector, 17.3% for the medical sector, 17.1% for the electronics sector, 3.7% for the metallurgical sector, 2% for the aerospace sector, and 20.2% for other sectors.

The scales available in the literature were adapted for each construct (Table 1).

Table 1. Operationalization of study variables.

Thriving at work			
Learning dimension		Vitality dimension	
I consider that in my work:	TWL3. I feel that I am getting better every day.	TWV1. I feel alive.	TWV4. I feel alert and awake.
TWL1. I am always learning.		TWV2. I am encouraged and energized.	
TWL2. Even as time goes by, I am still learning	TWL4. I am always moving forward.	TWV3. I feel very active.	TWV5. I look forward to each new day.
	TWL5. I have developed a lot as a person.		
Digital leadership		Lean manufacturing	
In the company where I work, leaders/supervisors use digital media (such as e-mail, WhatsApp, intranet) to:	Lid6. Encourage employees to be more open and adopt new technologies (NT) for work	At the company where I work	LM5. Employees are able to reduce the time to change from model to production.
WhatsApp, intranet) to:	Lid7. Can select the technologies that help the company the most.	LM1. Employees from different areas (such as production, quality,	
Lid1. Share the information	Lid8. Build environments where employees use new technologies (NT).		LM6. More than one

Digital leadership		Lean manufacturing	
that you need on the job.	Lid9. Select communication platforms (such as WhatsApp, e-mail) that are more favourable to the company.	maintenance) can perform different types of activities.	model is produced in a work shift.
Lid2. Share the information needed to learn and/or contribute new ideas.	Also, leaders/supervisors:	LM2. The layout of the workstations can be easily changed (e.g. the location or order of operations in an area).	LM7. Different techniques are used to improve product quality (e.g. control charts).
In parallel, leaders/supervisors:	Lid10. Encourage employees to explore new technologies so that they can bring new ideas into the workplace.	LM3. There are warning systems for moving material (e.g. cones, cards, empty shelves).	LM8. There are systems to know when the machine is failing (such as sounds, coloured lights)
Lid3. Listen to their employees.	Lid11. Seek to involve employees in a variety of activities	LM4. Only the necessary quantities are produced, not more and not less.	LM9. Material arrives when needed (minimum inventory/just in time).
Lid4. Build collaboration, trust, and participation agreements between employees.	Lid12. Know how to prepare employees to work with new technologies (NT).		
Lid5. Provide an environment that encourages decision-making among employees.	Lid13. Know what it takes to have more participatory and collaborative environments.		

Source: Self-elaboration.

Thriving at work with 10 items from the scale of Porath et al. (2011), including two dimensions: 1) Learning (TWL) and 2) Vitality (TWV); Digital leadership was assessed with 13 items from the proposal by García-Vázquez et al. (2023); and Lean manufacturing practices with 9 items from the scale of Nawanir et al. (2015). In all cases, a Likert-type scale with 5 response options ranging from "strongly disagree" to "strongly agree" was used. Partial least squares structural equation modelling (PLS-SEM) and an importance-performance matrix (IPMA) were used for inferential analysis.

3. Research results

Since only a theoretical proposal was available to measure digital leadership, the first step was to perform a test to validate its theoretical dimensions. For this purpose, an exploratory factor analysis (EFA) was used. In the EFA, a varimax rotation was employed, and the number of factors was set to three, in accordance with the factors proposed in the original scale and a Kaiser–Meyer–Olkin (KMO) index of 0.957 was obtained, reflecting a good factorial fit (Hair Jr, et al., 1999). Also, the EFA showed a chi-square value of 13,711.316 with 78 degrees of freedom, and a significance of 0.000 in Barlett's test of sphericity, evidencing its validity (Lévy Magin & Varela Mallou, 2008). The three dimensions of digital leadership were grouped into the following factors: Information (Lid1 and Lid2); Technological empowerment (Lid3, Lid4, Lid5, Lid6, Lid7, Lid8 and Lid9); and Participation and experimentation (Lid10, Lid11, Lid12 and Lid13).

Subsequently, the measurement model was assessed. The factor loadings, reliability, and convergent validity were verified. In the first criterion, it is recommended that the items exhibit loadings equal to or greater than 0.708 (Hair Jr et al., 2020). In this regard, from the original model of 32 items, six were eliminated: one from digital leadership (Lid7); four from thriving at work (TWL2, TWL3, TWV2, TWV3); and one from lean manufacturing (LM2). Table 2 shows the loadings of the remaining 26 items in the measurement model. The factor loadings are greater than 0.708 and statistically significant. Regarding convergent validity, Cronbach's alpha values, rho_a and rho_c show values between 0.700 and 0.950, and the average variance extracted (AVE) scores exceed the 0.500 threshold, as they are between 0.638 and 0.859 (Hair Jr et al., 2020).

Table 2. Measurement indicators and convergent validity.

Construct	Items	Charges	Cronbach's alpha	Composite reliability rho_a	Composite reliability rho_c	Average variance extracted (AVE)
Digital leadership-information	Lid1	0.950	0.897	0.898	0.951	0.906
	Lid2	0.954				
	Lid3	0.855				
Digital leadership-technological empowerment	Lid4	0.892	0.936	0.936	0.949	0.758
	Lid5	0.886				
	Lid6	0.890				
	Lid8	0.876				

Construct	Items	Charges	Cronbach's alpha	Composite reliability rho_a	Composite reliability rho_c	Average variance extracted (AVE)
Digital leadership-participation and experimentation	Lid9	0.821	0.917	0.917	0.942	0.801
	Lid10	0.883				
	Lid11	0.888				
	Lid12	0.902				
	Lid13	0.907				
Thriving at work - learning	Prosp1	0.919	0.918	0.918	0.948	0.859
	Prosp4	0.934				
	Prosp5	0.928				
Thriving at work-Vitality	PTV1	0.919	0.901	0.910	0.938	0.835
	PTV4	0.925				
	PTV5	0.896				
	LM1	0.739				
Lean manufacturing	LM3	0.822	0.919	0.921	0.934	0.638
	LM4	0.745				
	LM5	0.768				
	LM6	0.810				
	LM7	0.856				
	LM8	0.843				
	LM9	0.799				

Source: Own calculations.

Discriminant validity was assessed with the heterotrait–monotrait (HTMT) ratio, in which a maximum cut-off point of 0.85 (for dissimilar constructs) or 0.90 (for similar constructs) is recommended (Henseler et al., 2015). As shown in Table 3, the model has discriminant validity, given that the HTMT ratios are below the suggested cut-off points.

Table 3. Discriminant validity.

Construct	Digital leadership - technological empowerment	Digital leadership - information	Digital leadership - participation experimentation	Thriving at work - learning	Thriving at work - vitality	Lean manufacturing practices
Digital leadership – technological empowerment						
Digital leadership – information	0.786					
Digital leadership – participation and experimentation.	0.894	0.750				
Thriving at work – learning	0.780	0.747	0.786			
Thriving at work – vitality	0.777	0.672	0.755	0.813		
Lean manufacturing practices	0.769	0.765	0.752	0.770	0.652	

Source: Own calculations.

Subsequently, the structural model was reviewed and the variance inflation factor (VIF) indicators of the constructs, the size and significance of the path coefficients, and the values of f^2 , R^2 , and Q^2 were assessed. In the first case, it is recommended that the VIF values be equal to or less than 3.0 (Hair Jr et al., 2020). The results indicate that the possibility of multicollinearity is low since the VIF values are below the recommended threshold of 3.0. Specifically, the VIF value between Digital leadership and Thriving at work – learning is 1.000, between Digital leadership and Thriving at work – vitality is 2.470, and between Digital leadership and Lean manufacturing practices is 2.932. In addition, the VIF between Thriving at work – learning and Thriving at work - vitality is 2.470, between Thriving at work - learning and Lean manufacturing practices is 2.949, and between Thriving at work – vitality and Lean manufacturing practices is 2.667. The size and significance of the path coefficients are shown in Table 4. Of the six hypotheses posed, only one is rejected (H4b. Thriving at work, through

the vitality dimension, positively and significantly impacts the use of lean manufacturing practices, path = 0.050, $t = 1.566$). The remaining five hypotheses are validated.

Table 4. Hypothesis testing.

Hypothesis	Path	Values t	Result
H1a. Digital leadership positively and significantly influences the learning dimension of thriving at work.	0.771	46.667***	Validated
H1b. Digital leadership positively and significantly influences the vitality dimension of thriving at work.	0.416	11.200***	Validated
H2. The learning dimension of thriving at work has a positive and significant impact on the vitality dimension of thriving at work.	0.424	11.421***	Validated
H3. Digital leadership directly, positively, and significantly impacts the use of lean manufacturing practices.	0.552	14.900***	Validated
H4a. Thriving at work, through its learning dimension, positively and significantly influences the use of lean manufacturing practices.	0.544	14.608***	Validated
H4b. Thriving at work, through its vitality dimension, positively and significantly affects the use of lean manufacturing practices.	-0.050	1,566ns	Not validated

Notes: *** significant with an Alpha of 0.001, if $t > 3.291$, for a two-tailed test.

Source: Own calculations.

The effect size f^2 estimates the predictive ability of the model constructs: values between 0.02 and 0.14 indicate small effects; between 0.15 and 0.35, medium effects; and above 0.35, large effects (Cohen, 1988; Hair Jr et al., 2020). In this study, no significant effect was identified for Thriving at work – vitality – Lean manufacturing practices (0.002), but a small effect was identified for Thriving at work – learning – Lean manufacturing practices (0.094); medium effects of Digital leadership – Thriving at work – vitality (0.187), Thriving at work – learning – Thriving at work – vitality (0.194) and Digital leadership – Lean manufacturing practices (0.261); and a large effect of Digital leadership – Thriving at work – learning (1.470).

The R^2 coefficient is a measure of prediction and determines the extent to which it explains the model data (Seidel & Back, 2009). An R^2 equal to or greater than 0.670 is considered substantial, an R^2 of 0.350 moderate and 0.190 or less is considered weak (Henseler et al., 2009). The results show three R^2 between moderate and substantial: Thriving at work – learning (0.595), Thriving at work – vitality (0.625), and lean manufacturing practices (0.615). Moreover, with the Stone–Geisser's Q2 coefficient, the relevance and predictive quality of the model was reviewed. It is stated that there is predictive relevance when this indicator is greater than zero, values of $Q2 = 0.25$ reveal medium relevance, and when $Q2 = 0.50$ there is large relevance (Hair Jr et al., 2020). The results showed large significance in the three endogenous variables: thriving at work (learning) (0.594); thriving at work (vitality) (0.552); and lean manufacturing practices (0.539). We also evaluated the mediating role of thriving at work in its two dimensions – vitality and learning – on the relationship between digital leadership and lean manufacturing practices, identifying that this variable performed a complementary mediation (direct $\beta = 0.544$, $t = 14.608$; indirect $\beta = 0.215$, $t = 6.934$; total $\beta = 0.759$, $t = 40.738$) (Cepeda-Carrión et al., 2017). The final model is shown in Figure 1.

The results of the structural model are complemented with an importance-performance map. This map compares the effects of exogenous constructs (identified with the PLS-SEM) on an endogenous construct of interest, and performance is added as an additional dimension (Hair Jr et al., 2024; Streukens et al., 2017). The variable of interest in this study was lean manufacturing practices. The importance and performance values of the latent variables are presented in Table 5.

Table 5. Effects and performance of the latent variables.

Latent variables	Importance	Performance
Thriving at work: learning	0.306	66.285
Thriving at work: vitality	-0.050 n.s.	56.484
Digital leadership	0.759	59.792

Source: Own calculations.

The results revealed that digital leadership has the highest importance (0.759), and the lowest relevance is in thriving at work (vitality) (-0.050, with no statistically significant effect). In terms of performance, the highest level is in thriving at work the learning dimension (66.285) and the lowest in thriving at work in vitality dimension (56.484). These results show that digital leadership is the latent variable that most influences lean manufacturing practices. It should be noted that lean manufacturing practices have a performance level of 62.196.

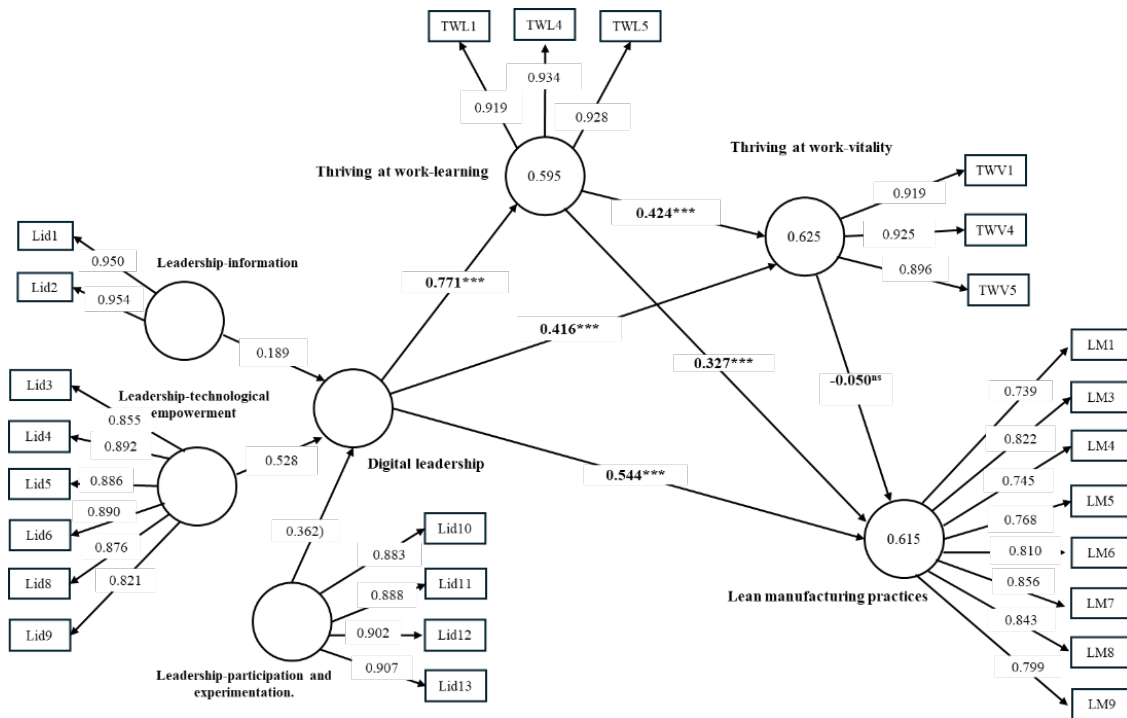


Figure 1. Final model.

Notes: *** significant with an alpha of 0.001, if $t > 3.291$, for a two-tailed test.

Source: Own calculations.

With this information, the importance-performance map was created (Figure 2). In the lower-right quadrant is located digital leadership (importance=0.759, performance=59.792), which implies that it has a high level of importance but a low level of performance. The upper-right quadrant is empty, implying that there are no predictors with both high importance and performance. The lower-left quadrant contains latent variables with low importance and performance. In this quadrant is located the thriving at work - vitality variable (with no statistically significant effect), and finally, in the upper-left quadrant is located thriving at work - learning, with a low level of importance, but a high level of performance (Figure 2).

As a final step, the same procedure was applied to build the importance-performance map (Figure 3). In the lower-right quadrant are located eight leadership items, which have high importance but exhibit low levels of performance. The items belong to the dimensions of technological empowerment (L3, L4, L5, L6, L8) and participation and experimentation (L10, L12 and L13). Within that quadrant, according to their importance and low performance, the items with the greatest opportunity for improvement are: Lid10 "Encourage employees to explore new technologies so that they can bring new ideas into the workplace" (importance=0.076, performance=56.122); Lid12 "Know how to prepare employees to work with new technologies" (importance=0.076, performance=57.146); Lid5 "Provide an environment that encourages decision-making among employees" (importance=0.077, performance=57.191); Lid13 "They know what it takes to have more participatory and collaborative environments" (importance=0.078, performance=57.703); Lid6 "Encourage employees to be more open and adopt new technologies for work (NT)" (importance=0.077, performance=58.393); Lid3 "Listen to their employees" (importance=0.074, performance=58.482); Lid8 "Build environments

where employees use new technologies (NT)" (importance=0.078, performance=58.660); and Lid4 "Build collaboration, trust, and participation agreements between employees" (importance=0.077, performance=59.216).

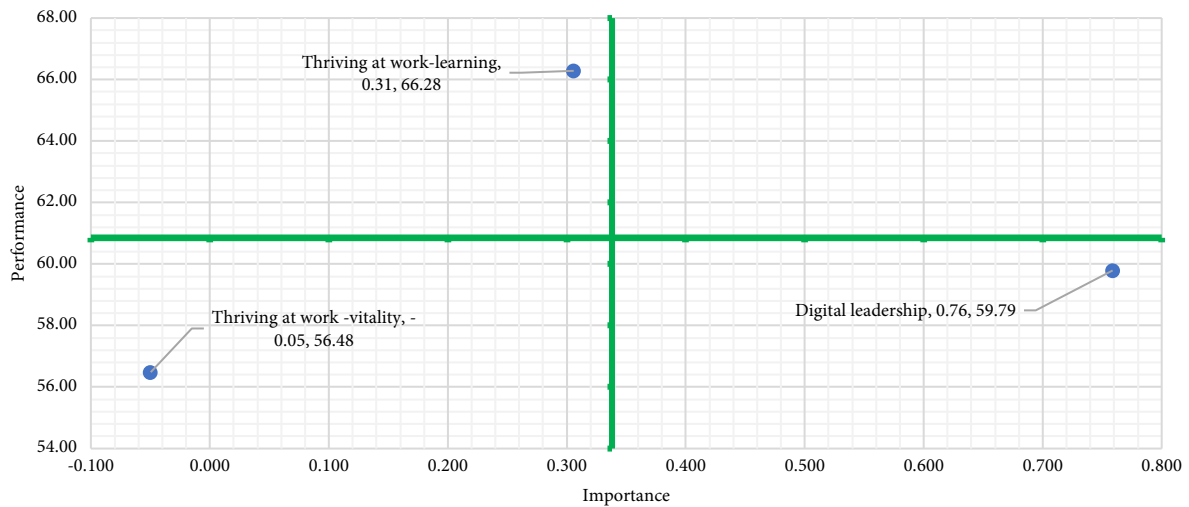


Figure 2. Adjusted importance-performance map of the constructs.
Source: Own calculations.

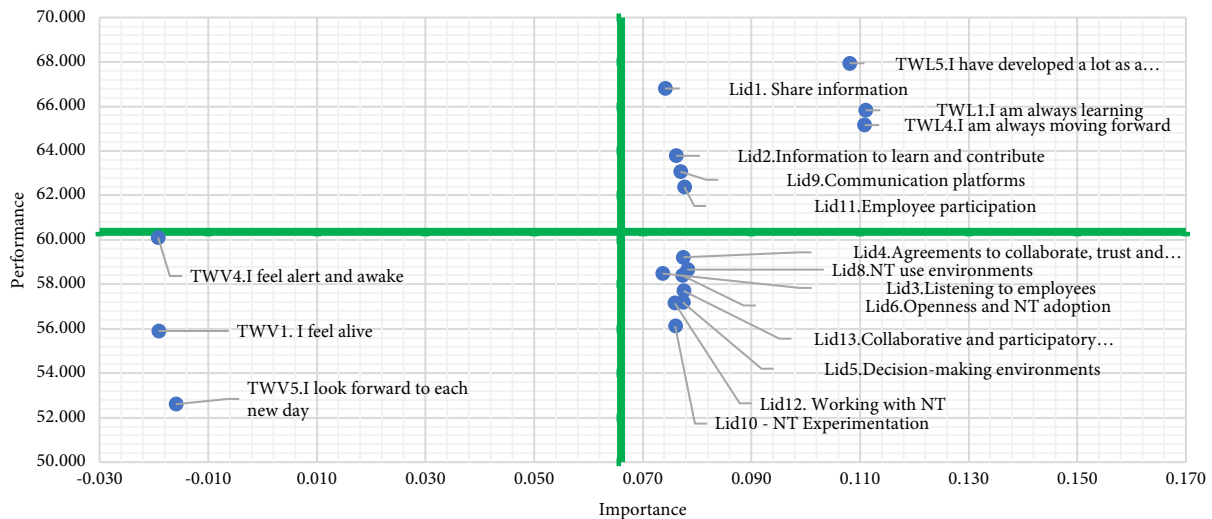


Figure 3. Adjusted importance-performance map of the items.
Note: NT new technology.
Source: Own calculations.

In the upper-right quadrant are seven indicators with high importance and high performance: three of thriving at work (learning dimension) "I have developed a lot as a person" (TWL5, importance=0.108, performance=67.943), "I am always learning" (TWL1, importance=0.111, performance=65.828), "I am always moving forward" (TWL4, importance=0.107, performance=65.160); two digital leadership – information, leaders/supervisors use digital media to "share the information that you need on the job" (Lid1, importance=0.074, performance=66.808), and "share the information needed to learn and/or contribute new ideas" (Lid2, importance=0.076, performance=63.780), one digital leadership – technology empowerment "Select communication platforms (such as WhatsApp, e-mail) that are more favourable to the company" (Lid9, importance=0.077, performance=63.068) and one of digital leadership – participation and experimentation "Seek to involve employees in a variety of activities" (Lid11, importance=0.078,

performance=62.378). The lower-left quadrant shows the indicators with low importance and low performance and includes the three thriving at work - vitality items. Finally, in the upper-left quadrant are located the indicators with low importance and high performance: in this study the quadrant is empty.

4. Discussion

Industry 4.0 has benefits in social sustainability, as it gives employees the opportunity to master emerging technologies, which in turn fosters their motivation, satisfaction, and dynamism (Maware & Parsley, 2023). However, this context also poses new challenges for leaders and management of organisations (Bianco et al., 2021). Furthermore, in the case of lean manufacturing, the principles of value and process improvement cause tension, especially when they are realized at the expense of employees' working conditions (Al-Hakim & Sevdalis, 2021).

Previous studies have pointed out that research on the impact of leadership in lean manufacturing initiatives is scarce (Tortorella et al., 2021). It is also argued that more research is needed regarding the antecedents and consequences of thriving at work (Kleine et al., 2019). Thus, in the context of the export manufacturing industry, located in Ciudad Juarez, this research had two objectives: to analyse whether digital leadership has direct and indirect effects on lean manufacturing practices, through the mediation of thriving at work, and to evaluate the importance and comparative performance of constructs and indicators on lean manufacturing practices, as a construct of interest.

The results reveal that digital leadership directly and indirectly influences lean manufacturing practices through its effect on the learning dimension of thriving at work. These findings are in agreement with previous studies (Aripin et al., 2023; Pagliosa et al., 2019; Qureshi et al., 2023; Walker & Qian, 2020) that point out that digital leaders promote lean manufacturing practices when they are able to foster and facilitate the development of people, a primary factor for continuous improvement (Chen & Kanfer, 2006; Lin et al., 2020; Rego et al., 2021; Shahid et al., 2020; Walumbwa et al., 2017). Note that in this work, no influence of the vitality dimension of thriving at work on the use of lean manufacturing practices was identified.

To deepen the results of the effect of digital leadership and thriving at work on lean manufacturing practices, an analysis was conducted employing an importance and performance map. The results show that thriving at work (learning dimension) stands out for its importance and performance. In the case of lean manufacturing, the most important aspects are related to the employee's perception of personal development, learning, and continuous advancement. In addition, with regard to digital leadership, eight indicators were identified as highly important and underperforming: employees experimenting with new technologies, so that they contribute new ideas; preparing employees to work with new technologies; ensuring environments that encourage employees to make decisions; having the knowledge to build more participatory and collaborative environments; promoting the openness and adoption of new technologies; listening to employees; creating environments where new technologies are used; and fostering collaboration, trust, and participation.

Conclusions

This study demonstrates that digital leadership has a decisive role in strengthening lean manufacturing practices, particularly when leaders actively promote employee experimentation with new technologies and foster participatory and collaborative work environments. These leadership behaviours directly support the implementation of lean practices by enabling employees to contribute ideas and engage in continuous improvement activities.

The findings also confirm that lean manufacturing practices are reinforced when leaders encourage decision-making autonomy, openness to technological adoption, and trust-based relationships within the organization. Such conditions are especially relevant in export-oriented manufacturing contexts, where employees are expected not only to comply with standardized processes but also to adapt to ongoing technological changes associated with Industry 4.0.

In addition, the results highlight a critical managerial priority: leaders must prepare employees to work effectively with new technologies and actively encourage experimentation. This preparation enables employees to develop the competencies required to participate meaningfully in digitalized and lean-oriented work environments. Overall, the conclusions establish that the effective integration of lean manufacturing practices within an Industry 4.0 context depends on digital leadership behaviours that consistently promote learning, participation, and employee capability development.

This study has several limitations that should be considered when interpreting the results. First, a non-probabilistic sample and a cross-sectional research design were employed. Consequently, future studies should adopt longitudinal designs with probabilistic samples to strengthen causal inferences and improve the generalizability of the findings.

Second, the research sample was treated as homogeneous. Future research should examine potential differences based on employee position or organizational role, which may provide a more nuanced understanding of how digital leadership and thriving at work influence lean manufacturing practices. In addition, replicating this study in different organizational and industrial contexts would allow for greater external validity. Future studies may also incorporate additional predictors of lean manufacturing practices to extend the explanatory power of the model.

further research is required to examine both the antecedents and consequences of thriving at work. Variables such as proactive personality, innovative behaviour, perceived organizational support, and leadership styles including authentic and ethical leadership represent relevant avenues for advancing this line of research.

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Reference

1. Abid, G., Ahmed, S., Fiaz Qazi, T., & Sarwar, K. (2020). How managerial coaching enables thriving at work. A sequential mediation. *Journal of Entrepreneurship, Management and Innovation*, 16(2), 131–160. <https://doi.org/10.7341/20201625>.
2. Agustina, R., Kamdi, W., Hadi, S., & Nurhadi, D. (2020). Influence of the Principal's Digital Leadership on the Reflective Practices of Vocational Teachers Mediated by Trust, Self Efficacy, and Work Engagement. *International Journal of Learning, Teaching and Educational Research*, 19(11), 24–40. <https://doi.org/10.26803/ijlter.19.11.2>.
3. Al-Hakim, L., & Sevdalis, N. (2021). A novel conceptual approach to lean: value, psychological conditions for engagement with work and perceived organizational support in hospital care. *International Journal for Quality in Health Care*, 33(4), 1–8. <https://doi.org/10.1093/intqhc/mzab148>.
4. Aripin, N. M., Hussain, S., & Nawanir, G. (2023). Movers and Shakers: Leadership Attributes for a Successful Lean Manufacturing Implementation. *Global Business and Management Research: An International Journal*, 15(2s), 116–126. <https://www.gbmrjournal.com/pdf/v15n2s/V15N2s-9.pdf>
5. Bartram, T., Cooper, B., Cooke, F.L., & Wang, J. (2023). Thriving in the face of burnout? The

- effects of wellbeing-oriented HRM on the relationship between workload, burnout, thriving and performance, *Employee Relations*, 45(5), 1234–1253. <https://doi.org/10.1108/ER-06-2022-0273>.
6. Bartsch, S., Weber, E., Büttgen, M., & Huber, A. (2021). Leadership matters in crisis-induced digital transformation: How to lead service employees effectively during the COVID-19 pandemic. *Journal of Service Management*, 32(1), 71–85. <https://doi.org/10.1108/JOSM-05-2020-0160>.
 7. Benkarim, A., & Imbeau, D. (2022). Exploring Lean HRM Practices in the Aerospace Industry. *Sustainability*, 14(9), Article 5208. <https://doi.org/10.3390/su14095208>.
 8. Benkarim, A., & Imbeau, D. (2021). Organizational Commitment and Lean Sustainability: Literature Review and Directions for Future Research. *Sustainability*, 13(3357), Article 3357. <https://doi.org/10.3390/su13063357>.
 9. Bianco, D., Godinho Filho, M., Osiro, L., & Ganga, G. (2021). Unlocking the Relationship Between Lean Leadership Competencies and Industry 4.0 Leadership Competencies: An ISM/Fuzzy MICMAC Approach. *IEEE Transactions on Engineering Management*, 1–25. <https://doi.org/10.1109/tem.2021.3069127>.
 10. Brown, D. J., Arnold, R., Fletcher, D., & Standage, M. (2017). Human thriving. *European Psychologist*, 22(3), 167–179. <https://doi.org/10.1027/1016-9040/a000294>.
 11. Buer, S. V., Strandhagen, J. O., & Chan, F. T. S. (2018). The link between Industry 4.0 and lean manufacturing: mapping current research and establishing a research agenda. *International Journal of Production Research*, 56(8), 2924–2940. <https://doi.org/10.1080/00207543.2018.1442945>.
 12. Cepeda-Carrión, G., Nitzl, C., & Roldán, J. L. (2017). Mediation analyses in partial least squares structural equation modeling: Guidelines and empirical examples. En H. Latan, & R. Noonan (eds.), *Partial least squares path modeling. Basic concepts, methodological issues and applications* (pp. 173–195). Springer International Publishing, Cham.
 13. Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Lawrence Erlbaum Associates. <https://doi.org/10.4324/9780203771587>.
 14. Chatterjee, S., Chaudhuri, R., Vrontis, D., & Giovando, G. (2023). Digital workplace and organization performance: Moderating role of digital leadership capability. *Journal of Innovation & Knowledge*, 8(1), Article 100334. <https://doi.org/10.1016/j.jik.2023.100334>.
 15. Chen, G., & Kanfer, R. (2006). Toward a Systems Theory of Motivated Behavior in Work Teams. *Research in Organizational Behavior*, 27, 223–267. [https://doi.org/10.1016/s0191-3085\(06\)27006-0](https://doi.org/10.1016/s0191-3085(06)27006-0).
 16. Dvir, T., Eden, D., Avolio, B. J., & Shamir, B. (2002). Impact of Transformational Leadership on Follower Development and Performance: A Field Experiment. *Academy of Management Journal*, 45(4), 735–744. <https://doi.org/10.5465/3069307>.
 17. Fujimoto, Y., Azmat, F., & Uddin, J. (2024). Inclusive leadership toward reshaping corporate purpose for sustainable development. *Leadership*, 20(5), 289–313. <https://doi.org/10.1177/17427150241258878>.
 18. García-Vázquez, B., Vargas-Salgado, M. M., & Máñez-Guaderrama, I. (2023). Validez de Contenido de un instrumento para medir Liderazgo 4.0. *DYNA*, 90(229), 170–174. <https://doi.org/10.15446/dyna.v90n229.108410>.
 19. Gatell, I. S., & Avella, L. (2024). Impact of Industry 4.0 and circular economy on lean culture and leadership: Assessing digital green lean as a new concept. *European Research on Management and Business Economics*, 30(1), Article 100232. <https://doi.org/10.1016/j.iedeen.2023.100232>.
 20. Goh, Z., Eva, N., Kiazad, K., Jack, G. A., De Cieri, H., & Spreitzer, G. M. (2021). An integrative multilevel review of thriving at work: Assessing progress and promise. *Journal of Organizational Behavior*, 43(2), 197–213. <https://doi.org/10.1002/job.2571>.
 21. Hair Jr, J. F., Anderson, R. F., Tatham, R. L. & Black, W. C. (1999). *Análisis Multivariante* (5ta Edición ed.). Madrid: Prentice Hall Iberia.

22. Hair Jr., J. F., Howard, M. C., & Nitzl, C. (2020). Assessing Measurement Model Quality in PLS-SEM Using Confirmatory Composite Analysis. *Journal of Business Research*, 109, 101–110. <https://doi.org/10.1016/j.jbusres.2019.11.069>.
23. Hair, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2024). *Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM) (2e)*. Thousand Oaks, CA: Sage.
24. Henseler, J., Ringle, C., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135. <https://doi.org/10.1007/s11747-014-0403-8>.
25. Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The Use of Partial Least Squares Path Modeling in International Marketing. *Advances in International Marketing. Advances in International Marketing*, 20. [https://doi.org/10.1108/s1474-7979\(2009\)0000020014](https://doi.org/10.1108/s1474-7979(2009)0000020014).
26. Hildenbrand, K., Sacramento, C. A., & Binnewies, C. (2018). Transformational leadership and burnout: The role of thriving and followers' openness to experience. *Journal of Occupational Health Psychology*, 23(1), 31–43. <https://doi.org/10.1037/ocp0000051>.
27. Hines, P., Butterworth, C., Greenlee, C., Jekiel, C., & Taylor, D. (2022). Turning the lean world upside down. *International Journal of Lean Six Sigma*, 13(5), 989–1024. <https://doi.org/10.1108/IJLSS-09-2021-0166>.
28. Kaur, H., Haque, A. U., & Gkasis, P. (2024, September). The impact of varying styles of leadership on team dynamics and project success. *Forum Scientiae Oeconomia*, 12(3), 51–69. https://doi.org/10.23762/FSO_VOL12_NO3_3.
29. Keyes, C. L. M. (2002). The Mental Health Continuum: From Languishing to Flourishing in Life. *Journal of Health and Social Behavior*, 43(2), Article 207. <https://doi.org/10.2307/3090197>.
30. Kleine, A. K., Rudolph, C. W., & Zacher, H. (2019). Thriving at work: A meta-analysis. *Journal of Organizational Behavior*, 40(9/10), 973–999. <https://doi.org/10.1002/job.2375>.
31. Koistinen, J., & Vuori, J. (2024). Asymmetries of responsibility in self-managing organization: Authoring shared and hierarchical control. *Leadership*, 20(4), 207–231. <https://doi.org/10.1177/17427150241264050>.
32. Kumar, N., Shahzeb Hasan, S., Srivastava, K., Akhtar, R., Kumar Yadav, R., & Choubey, V. K. (2022). Lean manufacturing techniques and its implementation: A review. *Materials Today: Proceedings*, 64, 1188–1192. <https://doi.org/10.1016/j.matpr.2022.03.481>.
33. Lévy Magin, J. P., & Varela Mallou, J. (2008). *Análisis multivariable para las ciencias sociales*. Madrid: Editorial Pearson Educación.
34. Liu, D., Zhang, S., Wang, Y., & Yan, Y. (2021). The antecedents of thriving at work: a meta-analytic review. *Frontiers in psychology*, 12, Article 659072. <https://doi.org/10.3389/fpsyg.2021.659072>.
35. Lin, C. pei, Xian, J., Li, B., & Huang, H. (2020). Transformational Leadership and Employees' Thriving at Work: The Mediating Roles of Challenge-Hindrane Stressors. *Frontiers in Psychology*, 11, Article 1400. <https://doi.org/10.3389/fpsyg.2020.01400>.
36. Lu, X., Wang, S., Wang, S., Gao, L., & Si, L. (2018). The process flow optimisation of crankshaft machining considering production logistics. *International Journal of Industrial and Systems Engineering*, 30(2), Article 125. <https://doi.org/10.1504/ijise.2018.094838>.
37. Maware, C., & Parsley, D. M. (2023). Can industry 4.0 assist lean manufacturing in attaining sustainability over time? Evidence from the US organizations. *Sustainability*, 15(3), Article 1962. <https://doi.org/10.3390/su15031962>.
38. Medyński, D., Bonarski, P., Motyka, P., Wysoczański, A., Gnitecka, R., Kolbusz, K., Dąbrowska, M., Burduk, A., Pawelec, Z., & Machado, J. (2023). Digital standardization of lean manufacturing tools according to industry 4.0 concept. *Applied Sciences*, 13(10), Article 6259. <https://doi.org/10.3390/app13106259>.
39. Mihardjo, L. W. W., Sasmoko, S., Alamsjah, F., & Elidjen, E. (2019a). Digital leadership role in developing business model innovation and customer experience orientation in industry 4.0.

- Management Science Letters*, 1749–1762. <https://doi.org/10.5267/j.msl.2019.6.015>.
40. Mihardjo, L. W. W., Sasmoko, S., Alamsyah, F., & Elidjen, E. (2019b). The influence of digital leadership on innovation management based on dynamic capability: Market orientation as a moderator. *Management Science Letters*, 1059–1070. <https://doi.org/10.5267/j.msl.2019.3.018>.
 41. Muhammad, N., Upadhyay, A., Kumar, A., & Gilani, H. (2022). Achieving operational excellence through the lens of lean and Six Sigma during the COVID-19 pandemic. *The International Journal of Logistics Management*, 33(3), 818–835. <https://doi.org/10.1108/IJLM-06-2021-0343>.
 42. Nagel, L. (2020). The influence of the COVID-19 pandemic on the digital transformation of work. *International Journal of Sociology and Social Policy*, 40(9/10), 861–875. <https://doi.org/10.1108/ijssp-07-2020-0323>.
 43. Narbona, J. (2016). Digital leadership, Twitter and Pope Francis. *Church, Communication and Culture*, 1(1), 90–109. <https://doi.org/10.1080/23753234.2016.1181307>.
 44. Nawanir, G., Lim, K., T., & Othman, S. N. (2015). Validation of lean manufacturing measurement instrument. *Journal of Technology and Operations Management*, 10(2), 25–36. <https://doi.org/10.32890/jtom2015.10.2.2>.
 45. Netland, T. H., & Ferdows, K. (2016). The S-curve effect of lean implementation. *Production and Operations Management*, 25(6), 1106–1120. <https://doi.org/10.1111/poms.125>.
 46. Niessen, C., Sonnentag, S., & Sach, F. (2011). Thriving at work-A diary study. *Journal of Organizational Behavior*, 33(4), 468–487. <https://doi.org/10.1002/job.763>.
 47. Oberer, B., & Erkollar, A. (2018). Leadership 4. 0: Digital Leaders in the Age of Industry 4.0. *International Journal of Organizational Leadership*, 7(4), 404–412. <https://doi.org/10.33844/ijol.2018.60332>.
 48. Pagliosa, M., Tortorella, G., & Ferreira, J. C. E. (2019). Industry 4.0 and Lean Manufacturing. *Journal of Manufacturing Technology Management*, 32(3), 543–569. <https://doi.org/10.1108/jmtm-12-2018-0446>.
 49. Paterson, T. A., Luthans, F., & Jeung, W. (2014). Thriving at work: Impact of psychological capital and supervisor support. *Journal of Organizational Behavior*, 35, 434–446. <https://doi.org/10.1002/job.1907>.
 50. Peng, B. (2021). Digital leadership: State governance in the era of digital technology. *Cultures of Science*, 5(4), 210–225. <https://doi.org/10.1177/2096608321989835>.
 51. Pfeffer, J. (2010). Building Sustainable Organizations: The Human Factor. *Academy of Management Perspectives*, 24(1), 34–45. <https://doi.org/10.5465/amp.24.1.34>.
 52. Porath, C., Spreitzer, G., Gibson, C., & Garnett, F. G. (2011). Thriving at work: Toward its measurement, construct validation, and theoretical refinement. *Journal of Organizational Behavior*, 33, 250–275. <https://doi.org/10.1002/job.756>.
 53. Qureshi, K. M., Mewada, B. G., Kaur, S., & Qureshi, M. R. N. M. (2023). Assessing lean 4.0 for Industry 4.0 readiness using PLS-SEM towards sustainable manufacturing supply chain. *Sustainability*, 15(5), Article 3950. <https://doi.org/10.3390/su15053950>.
 54. Rahardjo, B., Wang, F.-K., Yeh, R.-H., & Chen, Y.-P. (2023). Lean Manufacturing in Industry 4.0: A Smart and Sustainable Manufacturing System. *Machines*, 11(1), Article 72. <https://doi.org/10.3390/machines11010072>.
 55. Ratajczak, S. (2022). *Digital leadership at universities—a systematic literature review*. *Forum Scientiae Oeconomia*, 10(4), 133–150. https://doi.org/10.23762/FSO_VOL10_NO4_7.
 56. Rego, A., Cavazotte, F., Cunha, M. P. E., Valverde, C., Meyer, M., & Giustiniano, L. (2021). Gritty leaders promoting employees' thriving at work. *Journal of Management*, 47(5), 1155–1184. <https://doi.org/10.1177/0149206320904765>.
 57. Saleem, S., Humayun, S., Latif, B., Iftikhar, U., & Sharif, I. (2020). Identities hidden in challenges: the sequential mediation of thriving at work and employee investment. *Frontiers in Psychology*, 11, Article 555420. <https://doi.org/10.3389/fpsyg.2020.555420>.
 58. Salvadorinho, J., Ferreira, C., & Teixeira, L. (2024). A technology-based framework to foster the

- lean human resource 4.0 and prevent the great resignation: The talent management lift. *Technology in Society*, 77, Article 102510. <https://doi.org/10.1016/j.techsoc.2024.102510>.
59. Sartal, A., Llach, J., & León-Mateos, F. (2022). Do technologies really affect that much? exploring the potential of several industry 4.0 technologies in today's lean manufacturing shop floors. *Operational Research*, 22, 6075–6106. <https://doi.org/10.1007/s12351-022-00732-y>.
 60. Sasmoko, S., Mihardjo, L. W. W., Alamsjah, F., & Elidjen, E. (2019). Dynamic capability: The effect of digital leadership on fostering innovation capability based on market orientation. *Management Science Letters*, 9, 1633–1644. <https://doi.org/10.5267/j.msl.2019.5.024>.
 61. Schonberger, R. J. (2007). Japanese production management: An evolution—With mixed success. *Journal of Operations Management*, 25(2), 403–419.
 62. Sekhar, R., Solke, N., & Shah, P. (2023). Lean Manufacturing Soft Sensors for Automotive Industries. *Applied System Innovation*, 6(22) 1–30. <https://doi.org/10.3390/asi6010022>.
 63. Seidel, G., & Back, A. (2009). *Success Factor Validation for Global ERP Programmes*. In 17th European Conference on Information Systems, Verona. <https://www.alexandria.unisg.ch/213715/>.
 64. Shah, R., & Goldstein, S. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management*, 24(2), 148–169. <https://doi.org/10.1016/j.jom.2005.05.001>.
 65. Shahid, S., Muchiri, M. K., & Walumbwa, F. O. (2020). Mapping the antecedents and consequences of thriving at work. *International Journal of Organizational Analysis*, 29(1), 78–103. <https://doi.org/10.1108/ijoa-09-2019-1881>.
 66. Sivathanu, B., & Pillai, R. (2018). Smart HR 4.0 – how industry 4.0 is disrupting HR. *Human Resource Management International Digest*, 26(4), 7–11. <https://doi.org/10.1108/hrmid-04-2018-0059>.
 67. Spreitzer, G., Porath, C. L., & Gibson, C. B. (2012). Toward human sustainability: How to enable more thriving at work. *Organizational Dynamics*, 41, 155–162. <https://doi.org/10.1016/j.orgdyn.2012.01.009>.
 68. Spreitzer, G., Sutcliffe, K., Dutton, J., Sonenshein, S., & Grant, A. M. (2005). A socially embedded model of thriving at work. *Organization Science*, 16(5), 537–549. <https://doi.org/10.1287/orsc.1050.0153>.
 69. Streukens, S., Leroi-Werelds, S., & Willems, K. (2017). Dealing with nonlinearity in importance-performance map analysis (IPMA): An integrative framework in a PLS-SEM context. *Partial least squares path modeling: Basic concepts, methodological issues and applications*, 367–403. https://doi.org/10.1007/978-3-319-64069-3_17.
 70. Subramanian, N., & Suresh, M. (2024). Lean HRM practices in manufacturing SMEs: exploring the interplay among the influencing factors. *International Journal of Organizational Analysis*, 32(10), 2572–2609. <https://doi.org/10.1108/IJOA-08-2023-3916>.
 71. Tayaksi, C., Sagnak, M., & Kazancoglu, Y. (2020). A new holistic conceptual framework for leanness assessment. *International Journal of Mathematical, Engineering and Management Sciences*, 5(4), 567–590. <https://doi.org/10.33889/IJMEMS.2020.5.4.047>.
 72. Tigre, F. B., Curado, C., & Henriques, P. L. (2023). Digital Leadership: A Bibliometric Analysis. *Journal of Leadership & Organizational Studies*, 30(1), 40–70. <https://doi.org/10.1177/15480518221123132>.
 73. Tortorella, G. L., & Fogliatto, F. S. (2014). Method for assessing human resources management practices and organisational learning factors in a company under lean manufacturing implementation. *International Journal of Production Research*, 52(15), 4623–4645. <https://doi.org/10.1080/00207543.2014.881577>.
 74. Tortorella, G. L., Fettermann, D., Fogliatto, F. S., Kumar, M., & Jurburg, D. (2021). Analysing the influence of organisational culture and leadership styles on the implementation of lean manufacturing. *Production Planning & Control*, 32(15), 1282–1294.

<https://doi.org/10.1080/09537287.2020.1799255>.

75. Tummers, L., Steijn, B., Nevicka, B., & Heerema, M. (2016). The Effects of Leadership and Job Autonomy on Vitality: Survey and Experimental Evidence. *Review of Public Personnel Administration*, 38(3), 355–377. <https://doi.org/10.1177/0734371x16671980>.
76. Veile, J. W., Kiel, D., Müller, J. M., & Voigt, K. I. (2019). Lessons learned from Industry 4.0 implementation in the German manufacturing industry. *Journal of Manufacturing Technology Management*, 31(5), 977–997. <https://doi.org/10.1108/JMTM-08-2018-0270>.
77. Vinodh, S., & Joy, D. (2012). Structural Equation Modelling of lean manufacturing practices. *International Journal of Production Research*, 50(6), 1598–1607. <https://doi.org/10.1080/00207543.2011.560203>.
78. Walker, A., & Qian, H. (2020). Developing a model of instructional leadership in China. *Compare: A Journal of Comparative and International Education*, 52(1), 147–167. <https://doi.org/10.1080/03057925.2020.1747396>.
79. Walumbwa, F. O., Muchiri, M. K., Misati, E., Wu, C., & Meiliani, M. (2017). Inspired to perform: A multilevel investigation of antecedents and consequences of thriving at work. *Journal of Organizational Behavior*, 39(3), 1–13. <https://doi.org/10.1002/job.2216>.
80. Wong, Y. C., Wong, K. Y., & Ali, A. (2009). A study on lean manufacturing implementation in the Malaysian electrical and electronics industry. *European Journal of Scientific Research*, 38(4), 521–535.
81. Xu, B.-D., Zhao, S.-K., Li, C.-R., & Lin, C.-J. (2017). Authentic leadership and employee creativity: testing the multilevel mediation model. *Leadership & Organization Development Journal*, 38(3), 482–498. <https://doi.org/10.1108/lodj-09-2015-0194>.
82. Zeike, S., Bradbury, K., Lindert, L., & Pfa, H. (2019). Digital leadership skills and associations with psychological wellbeing. *International Journal of Environmental Research and Public Health*, 16(4), 1–12. <https://doi.org/10.3390/ijerph16142628>.
83. Zhu, P. (2015). *Digital Master: Debunk the Myths of Enterprise Digital Maturity*. Lulu Publishing Services.



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