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Developing and validating a scale to assess customer experience during the order fulfillment process in the e-commerce context

Desarrollar y validar una escala para evaluar la experiencia del cliente durante el proceso de cumplimiento de pedidos en el contexto del comercio electrónico

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ABSTRACT

This study develops and validates a novel multidimensional scale for assessing customer experience during the order fulfillment process in e-commerce, addressing the lack of measurement tools focused on the post-purchase stage. While prior research has mainly examined operational metrics such as delivery speed or service quality, it often neglects the emotional and experiential dimensions of fulfillment. Drawing on experiential marketing theory, this study proposes a comprehensive framework that integrates both functional (e.g., accuracy, tracking) and emotional (e.g., enjoyment, smoothness) components of the customer experience. The research was conducted in two stages —pretest and full-scale validation— based on a survey of 385 online consumers in Russia. This empirical context, representing a large and fast-growing digital market, offers valuable insights beyond traditional Western-centric studies. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), the analysis revealed six key dimensions of the fulfillment experience: convenience, enjoyment, smooth delivery, parcel tracking, communication support, and the accuracy and condition of the delivered product. This study contributes to customer experience literature by positioning order fulfillment as a critical experiential touchpoint in the post-purchase stage. Beyond its theoretical value, the validated scale offers a practical diagnostic tool for e-commerce providers seeking to enhance service quality and customer satisfaction across diverse market contexts.

Keywords: Customer experience, Order fulfillment process, E-commerce, Scale development, Post-purchase stage, Retail industry, Emerging markets.

R E S U M E N

Este estudio desarrolla y valida una nueva escala multidimensional para evaluar la experiencia del cliente durante el proceso de cumplimiento de pedidos en el comercio electrónico, abordando la carencia de instrumentos de medición centrados en la etapa poscompra. Mientras que investigaciones previas han analizado principalmente indicadores operativos, como la velocidad de entrega o la calidad del servicio, a menudo se han pasado por alto las dimensiones emocionales y experienciales del cumplimiento. Basándose en la teoría del marketing experiencial, este estudio propone un marco integral que integra tanto componentes funcionales (p. ej., exactitud, seguimiento) como emocionales (p. ej., disfrute, fluidez) de la experiencia del cliente. La investigación se llevó a cabo en dos etapas —pretest y validación a gran escala— mediante una encuesta a 385 consumidores en línea en Rusia. Este contexto empírico, que representa un mercado digital amplio y de rápido crecimiento, ofrece perspectivas valiosas más allá de los estudios tradicionalmente centrados en Occidente. Utilizando Modelado de Ecuaciones Estructurales por Mínimos Cuadrados Parciales (PLS-SEM), el análisis reveló seis dimensiones clave de la experiencia de cumplimiento: conveniencia, disfrute, fluidez en la entrega, seguimiento del paquete, soporte de comunicación y exactitud y estado del producto entregado. Este estudio contribuye a la literatura sobre experiencia del cliente al posicionar el cumplimiento de pedidos como un punto de contacto experiencial crítico en la etapa poscompra. Más allá de su valor teórico, la escala validada ofrece una herramienta práctica de diagnóstico para que los proveedores de comercio electrónico mejoren la calidad del servicio y la satisfacción del cliente en diversos contextos de mercado.

Palabras clave: Experiencia del cliente, Cumplimiento de pedidos, Comercio electrónico, Desarrollo de escalas, Etapa poscompra, Industria minorista, Mercados emergentes.

1. INTRODUCTION

The rapid development of digital technologies continues to transform consumer behavior and business operations, with e-commerce representing one of the most dynamic and fast-growing phenomena in the global economy (Astete-Meza *et al.*, 2025; Hanafizadeh *et al.*, 2017; Verhoef *et al.*, 2021; Vrhovac *et al.*, 2023). Global online retail sales are projected to grow from $4.248 trillion in 2020 to $7.391 trillion by 2025 (SOAX, 2025), with emerging markets showing particularly rapid adoption. In these contexts, structural, infrastructural, and behavioral conditions create unique challenges and opportunities, reinforcing the need to reassess conventional assumptions about customer experience in online retail environments.

While much academic attention has been devoted to pre-purchase and purchase stages, the post-purchase phase remains relatively underexplored, particularly in e-commerce settings (Cao *et al.*, 2018; Javed & Wu, 2020). One key component of this phase is order fulfillment, commonly defined in logistics literature as a set of operational activities ensuring that goods are delivered accurately, efficiently, and at the lowest possible cost (Loate *et al.*, 2017; Nguyen *et al.*, 2018). However, this functionalist view overlooks the experiential nature of customer interactions during this stage. With rising customer expectations, intensified competition, and the rise of omnichannel strategies, order fulfillment is becoming more than a backend operation —it is now a critical experiential touchpoint in shaping brand perceptions, trust, and long-term loyalty (Klein & Popp, 2022; Pine & Gilmore, 2011; Xiao *et al.*, 2018).

Despite these developments, few studies have conceptualized the order fulfillment process through a customer-centric lens, and validated measurement instruments remain scarce. Existing frameworks primarily focus on functional performance indicators such as delivery speed, accuracy, or cost, but fail to capture the emotional and perceptual aspects of how consumers experience the receipt of their orders (Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023). Moreover, most empirical studies have been conducted in developed markets, with limited attention to emerging economies, where the contextual specificity of fulfillment logistics may significantly shape customer experience (Nguyen *et al.*, 2018; Olsson *et al.*, 2022).

This study aims to reframe the understanding of customer experience during the order fulfillment process by extending existing conceptualizations of this stage beyond its traditional treatment as a purely logistical and functional domain. Drawing on experiential marketing theory and a review of existing measurement scales, the study positions order fulfillment as a critical but underexplored touchpoint in the post-purchase phase. It develops and validates a multidimensional measurement scale that captures how customers experience this stage in e-commerce, considering both operational and emotional factors. In doing so, the study also seeks to generalize and contextualize existing knowledge toward emerging markets, using Russia as an empirical setting to highlight how fulfillment experiences are shaped by localized digital, logistical, and institutional conditions.

This research contributes to the academic literature by advancing the conceptualization of customer experience in the post-purchase phase—an area that remains comparatively underdeveloped. By integrating insights from marketing and logistics, the study proposes a shift from viewing order fulfillment as a set of operational tasks to recognizing it as a rich site of experiential value co-creation. The proposed scale captures how customers perceive and feel during the fulfillment process, bridging the gap between functional service delivery and emotional engagement. In doing so, the study not only provides a theoretically grounded measurement instrument but also offers a practical tool for e-commerce firms seeking to enhance customer experience in a strategically critical phase of the online shopping journey.

2. LITERATURE REVIEW

2.1. Customer Experience at the Post-Purchase Stage: A Literature Perspective

Customer experience (CE) has become a key area of strategic focus for retailers, especially in the context of digital transformation and omnichannel commerce. As firms can no longer compete solely on price or product features, the ability to deliver a seamless, memorable, and emotionally engaging experience has emerged as a significant differentiator (Olsson *et al.*, 2022; Verhoef *et al.*, 2015). The concept of CE was first introduced by Holbrook and Hirschman (1982), who argued that consumer behavior is not exclusively determined by rational evaluations but also by symbolic, emotional, and hedonic aspects of consumption. This experiential perspective was later formalized by Schmitt (1999), who conceptualized customer experience as a holistic construct encompassing sensory, emotional, cognitive, behavioral, and relational dimensions.

Over time, the notion of CE has evolved into a multidimensional concept that captures customer responses across multiple channels and touchpoints (Brakus *et al.*, 2009; Lemon & Verhoef, 2016). According to Lemon and Verhoef (2016), the customer journey comprises three main stages —pre-purchase, purchase, and post-purchase— each of which can significantly influence overall satisfaction, brand trust, and behavioral outcomes. While considerable attention has been devoted to pre-purchase activities (e.g., website design, advertising) and purchase interactions (e.g., checkout experience, sales assistance), the post-purchase phase has received comparatively less scholarly attention (Cao *et al.*, 2018; Javed & Wu, 2020).

The post-purchase stage encompasses various customer-firm interactions that occur after the transaction, such as delivery, returns, after-sales service, and follow-up communication (Verhoef *et al.*, 2009). These touchpoints can significantly shape customer perceptions of reliability, responsiveness, and emotional connection, and may even determine whether a one-time buyer becomes a loyal customer (Homburg *et al.*, 2015; Meyer & Schwager, 2007). As omnichannel retailing becomes the norm, managing post-purchase experiences presents new challenges and opportunities. The growing complexity of customer journeys and the proliferation of digital touchpoints have intensified the need for firms to understand how value is co-created during and after the purchase (Schrotenboer *et al.*, 2022; Vakulenko *et al.*, 2019).

Importantly, recent studies emphasize that CE is not merely the sum of service quality indicators but a subjective and emotionally charged process shaped by consumer expectations, cultural contexts, and affective responses (Becker & Jaakkola, 2020; Waqas *et al.*, 2021, Gahler *et al.*, 2023). This perspective is rooted in experiential marketing theory, which posits that consumers seek immersive, affective, and memorable interactions rather than just utilitarian value (Pine & Gilmore, 2011; Schmitt, 1999). While experiential marketing has primarily been applied to brand experiences, in-store design, or pre-purchase digital interactions (Brakus *et al.*, 2009), its relevance to the post-purchase stage —particularly logistics and fulfillment— remains underexplored.

2.2. Order Fulfillment as a Customer Experience Touchpoint

The order fulfillment process —typically defined as the set of operational activities involved in receiving, processing, packing, and delivering a customer order— has traditionally been viewed as a logistics function aimed at achieving efficiency, accuracy, and cost optimization (Lin, 1996; Loate *et al.*, 2017). From this perspective, the customer is treated as the recipient of service outputs rather than an active participant in the fulfillment experience.

However, recent research suggests that the fulfillment process constitutes an important stage of the customer journey that can influence both satisfaction and behavioral intentions (Nguyen *et al.*, 2018; Olsson *et al.*, 2022). The rise of e-commerce, particularly in omnichannel contexts, has increased the frequency and complexity of fulfillment-related interactions, making them central to the overall perception of service quality (Klein & Popp, 2022; Xiao *et al.*, 2017). As consumers increasingly expect fast, transparent, and seamless deliveries, their experience during fulfillment —including emotional reactions such as enjoyment or anxiety— becomes a relevant subject for empirical investigation (Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023).

A growing body of literature has explored specific touchpoints within the fulfillment process. For example, convenience refers to the perceived ease, flexibility, and time-saving aspects of the delivery process (Jiang *et al.*, 2013; Seiders *et al.*, 2007). Unlike efficiency, which typically focuses on cost reduction or operational optimization, convenience is centered on the customer and primarily reflects minimizing perceived effort from the customer's perspective. The ability to track deliveries in real time has been linked to increased feelings of control and reassurance (Esper *et al.*, 2003; Vrhovac *et al.*, 2023). Communication support —such as updates, customer service accessibility, and responsiveness— plays a role in reducing perceived uncertainty and fostering emotional engagement (Alkhalifah, 2022). The accuracy and condition of received products remain core elements, but they alone do not capture the full spectrum of fulfillment-related perceptions (Wahab *et al.*, 2023; Zhong *et al.*, 2021). Delivery accuracy involves adherence to the time window the customer selects and the correct configuration of the order, ensuring that the consumer receives the exact product ordered (Zhong *et al.*, 2021). The order's condition is determined by preserving all the product's properties and original quality after delivery (Wahab *et al.*, 2023).

Functional elements are increasingly complemented by emotional and perceptual dimensions. Drawing on affective experience theory and the hedonic consumption framework (Holbrook & Hirschman, 1982), enjoyment can stem from the anticipation of delivery or the unboxing moment itself (Klaus & Maklan, 2013; Vakulenko *et al.*, 2019). Unlike satisfaction, which is a cognitive evaluation of expectations vs. outcomes, enjoyment is an emotional state triggered during or immediately after the fulfillment encounter. Similarly, the concept of smooth delivery refers not just to timeliness but to how effortless and coordinated the entire process feels to the customer —echoing the importance of perceived flow in service encounters (Rose *et al.*, 2012; Vrhovac *et al.*, 2023). Unlike delivery reliability, which focuses on whether an order is fulfilled accurately and on time (Mentzer *et al.*, 2001; Rao *et al.*, 2011).

Researchers have also examined the role of visual appeal —such as the aesthetics of delivery packaging, the appearance of delivery personnel, or the condition of the delivery vehicle or parcel locker— as potential contributors to the fulfillment experience (Olsson *et al.*, 2022; Vrhovac *et al.*, 2023). While more subjective and difficult to quantify, these sensory and emotional responses form part of a broader experiential logic aligned with Schmitt's (1999) theory of experiential marketing.

Table 1 summarizes key studies that have identified experiential factors relevant to the order fulfillment process, organizing them by construct and corresponding references.

Table 1
Existing academic literature on factors of customer experience during the order fulfillment process

Factor	Sources
Convenience	Seiders *et al.* (2007), Jiang *et al.* (2013), Vakulenko *et al.* (2019), Vrhovac *et al.* (2023)
Enjoyment	Klaus & Maklan (2013), Olsson *et al.* (2022), Vakulenko *et al.* (2019), Vrhovac *et al.* (2023)
Visual appeal	Olsson *et al.* (2022), Vrhovac *et al.* (2023)
Smooth delivery	Klein, Popp (2022), Rose *et al.* (2012), Vrhovac *et al.* (2023)
Parcel tracking	Arıkan *et al.* (2023), Esper *et al.* (2003), Vakulenko *et al.* (2019), Vrhovac *et al.* (2023)
Communication support	Alkhalifah (2022), Vrhovac *et al.* (2023)
Accuracy and condition	Vakulenko *et al.* (2019), Vrhovac *et al.* (2023), Wahab *et al.* (2023), Zhong *et al.* (2021)

Source: Compiled by the authors.

2.3. Existing Scales for Measuring Customer Experience in the Context of Order Fulfillment

Several customer experience (CE) measurement scales have been developed across different domains, each offering distinct conceptual emphases and contextual applications. For example, the EXQ (Experiential Quality) scale developed by Kuppelwieser and Klaus (2021) captures experiential value in general service settings and includes dimensions such as product experience, peace of mind, outcome focus, and moments of truth. While it emphasizes emotional and holistic aspects of service experience, it does not address delivery- or logistics-related interactions.

In another context, Gupta (2016) introduced a Customer Experience Quality (CEQ) scale adapted from service quality models. This framework includes reliability, personalization, customer delight, and interaction quality, offering a blend of emotional and functional dimensions. However, it was designed for general service environments and does not specifically address the e-commerce delivery process.

In the online retail setting, Kumar and Anjaly (2017) developed a post-purchase CE scale that includes dimensions such as customer support, return process, and delivery speed. Their work focuses on post-transactional customer service but does not isolate the order fulfillment experience from broader service interactions.

Garg *et al.* (2014) proposed a CE scale tailored to the banking industry, capturing dimensions like interaction experience, emotional experience, and brand experience. Although rich in emotional content, its application is limited to the financial services context and lacks relevance for logistics-intensive sectors such as e-commerce.

In the domain of delivery logistics, Olsson *et al.* (2023) investigated customer experience in unattended last-mile delivery services. Their model includes aspects such as waiting time, predictability, and convenience, with an emphasis on the final step in the fulfillment process. However, it does not address earlier stages such as order processing or parcel tracking, which may also shape customer perceptions.

Together, these scales provide a useful foundation for understanding the multidimensional nature of customer experience, including both functional and affective elements. However, their scope and focus vary widely depending on industry context, purchase stage, and mode of delivery. Table 2 provides a comparison of key characteristics across these studies.

Table 2
Comparison of Existing Scales for Measuring Customer Experience in the Context of Order Fulfillment

Study	Focus Context	Key Dimensions	Post-Purchase Specific?	Emotional Dimension?	Delivery/ Fulfillment Focus?	Emerging Market?
Gupta (2016)	General services	Reliability, Personalization, Delight	×	Partial	×	×
Kumar & Anjaly (2017)	Online retail	Customer Support, Problem Handling, Returns	✓	×	×	×
Garg *et al.* (2014)	Banking	Interaction, Emotional, Brand Experience	×	✓	×	×
Kuppelwieser & Klaus (2021)	General CE (EXQ)	Product Experience, Peace of Mind, Moments of Truth	×	✓	×	×
Olsson *et al.* (2023)	Last-mile delivery	Predictability, Waiting Time, Unattended Delivery	✓	✓	✓ (limited to delivery)	×

Source: Compiled by the authors.

2.4. Conceptual Model and Scale Development

This study defines customer experience during the order fulfillment process as a multidimensional construct that reflects both functional and emotional responses elicited during the delivery of online purchases. Grounded in experiential marketing theory (Holbrook & Hirschman, 1982; Schmitt, 1999), this perspective positions fulfillment as a critical experiential touchpoint within the post-purchase phase of the customer journey. Rather than viewing order delivery as a purely operational process, the model integrates sensory, affective, and cognitive dimensions that shape how customers perceive and evaluate their interactions with retailers.

Although traditionally conceptualized as a logistical sequence emphasizing speed, accuracy, and cost efficiency (Lin, 1996; Loate *et al.*, 2017; Mentzer *et al.*, 2001), the fulfillment process increasingly plays a role in shaping overall customer experience. Recent studies have shown that various aspects —such as emotional anticipation, perceived control, visual impressions, and communication responsiveness— contribute meaningfully to how customers experience delivery and post-purchase service (Olsson *et al.*, 2022; Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023).

Building on these insights, the model proposed in this study incorporates seven distinct yet interrelated dimensions. Convenience refers to the ease and flexibility of receiving a parcel and how well the process aligns with the customer's lifestyle (Jiang *et al.*, 2013; Seiders *et al.*, 2007). Enjoyment captures the emotional gratification and positive anticipation associated with receiving a delivery (Klaus & Maklan, 2013; Vakulenko *et al.*, 2019). Visual appeal accounts for the aesthetic perception of couriers, delivery vehicles, and pickup locations, as noted in recent explorations of sensory aspects in last-mile logistics (Olsson *et al.*, 2022; Vrhovac *et al.*, 2023). Smooth delivery reflects the perceived flow and simplicity of the delivery process, including how coordinated and frictionless the experience feels (Klein & Popp, 2022; Rose *et al.*, 2012). Parcel tracking highlights the importance of transparency and the customer's sense of control over the delivery (Arıkan *et al.*, 2023; Esper *et al.*, 2003). Com-

munication support refers to the availability and responsiveness of delivery-related communication, including multichannel customer service (Alkhalifah, 2022; Vrhovac *et al.*, 2023). Finally, accuracy and condition measure whether the product arrives complete, undamaged, and as expected (Wahab *et al.*, 2023; Zhong *et al.*, 2021).

These dimensions were synthesized into a theoretical framework in which customer experience is modeled as a second-order reflective construct formed by seven first-order dimensions. This conceptualization guided the development of the measurement scale and provided the basis for empirical validation. Figure 1 presents the structure of the proposed model.

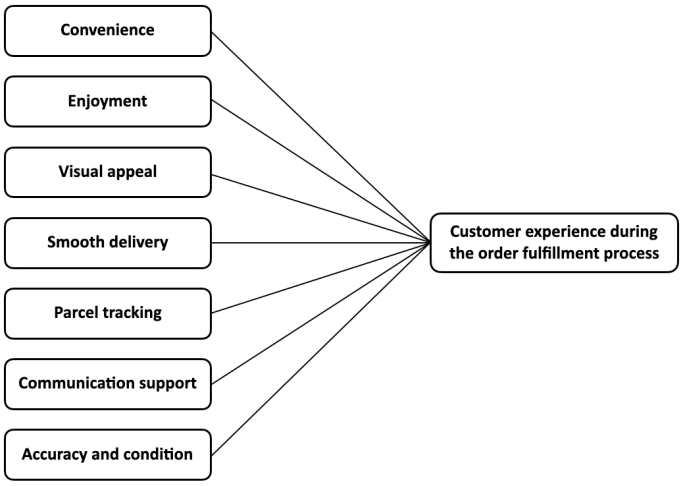

Figure 1
A theoretical model of the factors shaping the customer experience during the order fulfillment process
Source: Compiled by the authors.

3. METHODOLOGY

3.1. Research Design

This study employs a quantitative research design (Creswell & Creswell, 2017) to explore factors shaping customer experience during order fulfillment. The research follows a two-phase structure. First, a preliminary pre-test was conducted to refine the theoretical model and measurement items. Second, a full-scale consumer survey was carried out, and the resulting data were used to validate the model.

The study uses Partial Least Squares Structural Equation Modeling (PLS-SEM) as the main analytical method. PLS-SEM is widely used in marketing and consumer behavior research due to its suitability for handling non-normal data distributions, moderate to small sample sizes, reflective and formative constructs, and complex model structures (Hair *et al.*, 2019; Richter *et al.*, 2016; Shmueli *et al.*, 2019). It is also particularly effective for predictive modeling and for studies aimed at theory building in early-stage research (Sarstedt *et al.*, 2022). These features make PLS-SEM an appropriate choice for evaluating the newly developed scale and assessing the latent structure of the customer experience construct.

3.2. Sampling and Data Collection

The empirical study was conducted in April 2024 using a structured online survey administered to a consumer panel in Russia, an emerging e-commerce market. A third-party data provider was commissioned to recruit participants based on predefined screening criteria to ensure sample relevance and data quality. To qualify for inclusion, respondents had to be at least 18 years old and have made at least one online purchase that involved delivery (either by courier or pick-up point) within the last six months. Quotas were applied to achieve a balanced sample across gender, age, and education levels.

The choice of Russia as the empirical setting was motivated by its status as one of the largest and fastest-growing e-commerce markets among emerging economies. Its rapid digitalization, logistical diversity, and evolving consumer behavior make it a valuable context for examining customer experience during order fulfillment. Moreover, focusing on a digitally evolving market allows the study to extend current conceptualizations of customer experience beyond Western-centric settings (Vakulenko *et al.*, 2019; Yuen *et al.*, 2019).

The final sample consisted of 385 valid responses. The demographic characteristics of the respondents are summarized in Table 3. The sample included both male (48%) and female (52%) participants, with a wide distribution across age groups and income levels. Over 60% of the participants held higher education degrees, and the majority belonged to the most active e-commerce user segments —individuals aged 25–44. All participants were residents of Moscow or the Moscow region, a metropolitan area with high online shopping penetration and advanced last-mile delivery infrastructure.

Table 3
Sample descriptive statistics

Variable	Value labels	Count	Share in the sample
Gender	Male	184	48%
	Female	202	52%
Total		385	100%
Age group	18-24	47	12%
	25-34	90	24%
	35-44	107	28%
	45-54	78	20%
	Above 55	63	16%
Total		385	100%
Disposable income	Low	0	0%
	Low-to-medium	0	0%
	Medium	142	37%
	Mid-to-high	209	54%
	High	36	9%
Total		385	100%

Variable	Value labels	Count	Share in the sample
Education	Incomplete secondary education	27	7%
	Secondary education	70	18%
	Initial Vocational Education	14	3%
	Secondary Vocational Education	28	7%
	Higher education	237	62%
	Other	9	3%
Total		385	100%

Source: Compiled by the authors.

3.3. Measurement Scale

The initial measurement instrument was developed based on a comprehensive review of prior literature on customer experience, service quality, and e-commerce fulfillment, with particular reference to experiential marketing theory (Schmitt, 1999). This framework emphasizes the multidimensional nature of experience, encompassing both emotional and functional components of customer–firm interactions. The scale items were adapted and expanded from previously validated constructs (e.g., Klaus & Maklan, 2013; Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023) to reflect the unique context of digitally mediated fulfillment processes.

The resulting questionnaire was structured into three sections. The first section included control questions to screen for respondent relevance (e.g., "Have you ordered products online with delivery in the past 6 months?"). The second section contained the items corresponding to the proposed dimensions of customer experience during the fulfillment process —including convenience, enjoyment, parcel tracking, smooth delivery, communication support, and accuracy and condition of the order. Each construct was measured using multiple items on a five-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree"). The third section collected demographic information.

The original version of the instrument was developed in English and subsequently adapted to Russian using a back-translation procedure. Two bilingual experts independently translated and retranslated the scale to ensure semantic and conceptual equivalence, and minor adjustments were made to reflect linguistic and cultural norms relevant to the Russian e-commerce context (Boateng *et al.*, 2018).

3.4. Analytical Procedure

This study followed a multi-step analytical procedure to validate the proposed measurement model for customer experience during the order fulfillment process. The process included expert-based content validation, a pretest to refine the initial model, and a full-scale survey analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM).

In line with best practices in scale development (Boateng *et al.*, 2018), the study first employed qualitative validation by consulting five domain experts —three academic researchers and two senior e-commerce professionals— who reviewed the initial pool of items. Their feedback helped ensure conceptual relevance, language clarity, and alignment with the fulfillment experience in the e-commerce context. Based on their suggestions, several items were refined before launching the pretest phase.

The pretest, conducted with a subsample of 100 participants, allowed for an initial assessment of item performance and construct structure. Exploratory and confirmatory factor analyses were used to eliminate weak items and clarify dimensional structure prior to the main data collection.

After refining the instrument, the main survey data (N = 385) were analyzed using PLS-SEM, a method particularly suited to early-stage theory development, complex models with hierarchical constructs, and non-normal data distributions (Hair *et al.*, 2019; Shmueli *et al.*, 2019). The software SmartPLS v4 was used to estimate the measurement and structural models, evaluating internal consistency, convergent validity, discriminant validity, and overall model fit.

To address the potential for common method bias, several procedural remedies were implemented during the survey design, including anonymity assurances, neutral wording, and randomization of item order across constructs. A post hoc statistical test using Harman's single-factor method was also conducted; the first unrotated factor accounted for less than 35% of the total variance, suggesting that common method bias was unlikely to significantly influence the results (Podsakoff *et al.*, 2003).

4. RESULTS

4.1. Preliminary Analysis and Scale Refinement

The scale development process began with a preliminary test on a sample of 100 respondents. Cronbach's alpha coefficients for most constructs exceeded the commonly accepted threshold of 0.7, indicating acceptable internal consistency. However, two constructs —"convenience" (α = 0.694) and "smooth delivery" (α = 0.611)— showed borderline reliability and were refined through item reduction. Specifically, items with factor loadings below 0.7 were eliminated to improve reliability metrics. The revised scale showed improved internal consistency across all constructs (Table 4).

Table 4
Path coefficients and factor loadings of measured items after preliminary testing

Construct	Outer Loadings	Item	Factor Loading
Convenience (CONV)	0.603	CONV1	0.712
		CONV2	0.899
		CONV3	0.759
		CONV4	0.704
		CONV5	0.721
Accuracy and condition(ACCON)	0.676	ACCON1	0.861
		ACCON2	0.839
		ACCON3	0.838
		ACCON4	0.801

Construct	Outer Loadings	Item	Factor Loading
Communication support(COMSUP)	0.618	COMSUP1	0.825
		COMSUP2	0.882
		COMSUP3	0.916
Enjoyment (ENJ)	0.650	ENJ1	0.952
		ENJ2	0.953
		ENJ3	0.883
		ENJ4	0.865
Parcel Tracking (PTRACK)	0.684	PTRACK1	0.900
		PTRACK2	0.868
		PTRACK3	0.899
		PTRACK4	0.824
		PTRACK5	0.811
Smooth delivery (SMDEL)	0.807	SMDEL1	0.925
		SMDEL2	0.870
		SMDEL3	0.704

Source: Compiled by the authors.

During this stage, the construct "visual appeal" was also excluded due to its weak empirical contribution. It exhibited low outer loadings and a poor path coefficient (0.129), suggesting limited explanatory power. While it was conceptually interesting, its ambiguity and lack of statistical robustness led to its removal. The conceptual implications of this decision are discussed further in Section 5.

4.2. Final Model Estimation

The refined model was validated using a full dataset of 385 responses. PLS-SEM was conducted using SmartPLS v.4. All six retained constructs demonstrated strong outer loadings, confirming indicator reliability (Table 5). Outer loadings represent the reflective relationships between the second-order construct (customer experience) and its first-order dimensions. Factor loadings at the item level also exceeded 0.7 for most items, indicating strong indicator reliability.

Table 5
Outer loadings from second-order construct (EXP) to first-order dimensions, and item-level factor loadings

Construct	Outer Loadings	Item	Factor Loading
Accuracy and condition (ACCON)	0.687	ACCON1	0.798
		ACCON2	0.797
		ACCON3	0.802
		ACCON4	0.770
Communication support (COMSUP)	0.721	COMSUP1	0.900
		COMSUP2	0.902
		COMSUP3	0.862
Convenience (CONV)	0.688	CONV1	0.823
		CONV2	0.865
		CONV3	0.774
		CONV4	0.883
		CONV5	0.800
Enjoyment (ENJ)	0.639	ENJ1	0.904
		ENJ2	0.907
		ENJ3	0.881
		ENJ4	0.869
Parcel tracking (PTRACK)	0.781	PTRACK1	0.782
		PTRACK2	0.786
		PTRACK3	0.806
		PTRACK4	0.752
		PTRACK5	0.719
Smooth delivery (SMDEL)	0.732	SMDEL1	0.801
		SMDEL2	0.815
		SMDEL3	0.768

Note: Outer loadings represent the reflective relationships between the second-order construct (Customer Experience) and its first-order dimensions. Factor loadings refer to indicator reliability at the item level.

Source: Compiled by the authors.

The model included six dimensions: accuracy and condition, convenience, enjoyment, parcel tracking, communication support, and smooth delivery. All first-order constructs significantly contributed to the second-order construct "customer experience," with outer loadings above 0.6. The R-square and adjusted R-square values for the first-order constructs further confirmed that the second-order construct accounted for substantial variance in each of the dimensions (Table 6).

Table 6
Measurement model validation (R-square and R-square adjusted)

	R-square	R-square adjusted
ACCON	0.472	0.472
COMSUP	0.519	0.519
CONV	0.473	0.472
ENJ	0.409	0.408
PTRACK	0.609	0.609
SMDEL	0.536	0.535

Notes: ACCON = Accuracy and condition, COMSUP = Communication support, CONV = Convenience, ENJ = Enjoyment, PTRACK = Parcel tracking, SMDEL = Smooth delivery.

Source: Compiled by the authors.

Figure 2 presents a visual representation of the validated model, including path relationships and R-square values. A full list of the finalized measurement items used in the validated model is provided in Appendix A.

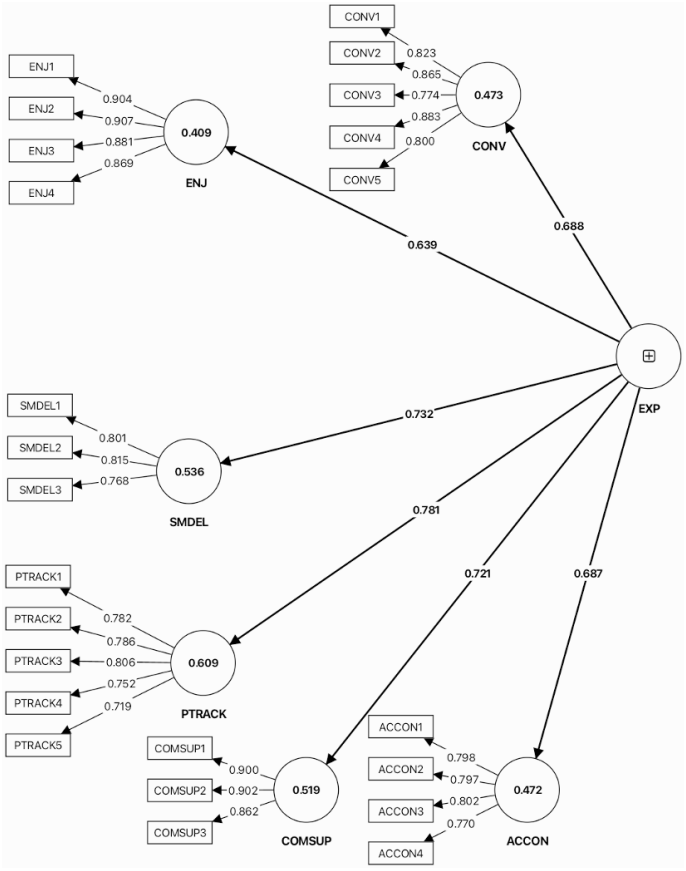

Figure 2
Structural equation model

Notes: CONV = Convenience, ENJ = Enjoyment, SMDEL = Smooth delivery, PTRACK = Parcel tracking, COMSUP = Communication support, ACCON = Accuracy and condition, EXP = Customer experience during the order fulfillment process. R-square values are presented in circles.

Source: Compiled by the authors.

To assess overall model fit, we used two commonly accepted indices in PLS-SEM: the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). The SRMR value based on correlations was 0.072 and the SRMR based on partial covariances was 0.059, both of which are below the conservative threshold of 0.08. The NFI was 0.914, exceeding the benchmark of 0.90, indicating acceptable model fit. These results jointly support the structural adequacy of the proposed model (Henseler *et al.*, 2016).

4.3. Reliability and Validity Assessment

Construct reliability was confirmed through Cronbach's alpha and Composite Reliability (CR), with all values exceeding the 0.7 threshold (Table 7). Convergent validity was assessed using the Average Variance Extracted (AVE), with values above 0.5 for all constructs, indicating that the constructs explained a substantial portion of the variance in their indicators.

Table 7
Measurement model validation (Cronbach's alpha, Composite reliability, and AVE)

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ACCON	0.802	0.804	0.871	0.627
COMSUP	0.866	0.868	0.918	0.789
CONV	0.886	0.890	0.917	0.689
ENJ	0.913	0.916	0.939	0.793
PTRACK	0.83	0.831	0.879	0.592
SMDEL	0.709	0.711	0.837	0.632

Notes: ACCON = Accuracy and condition, COMSUP = Communication support, CONV = Convenience, ENJ = Enjoyment, PTRACK = Parcel tracking, SMDEL = Smooth delivery.

Source: Compiled by the authors.

Discriminant validity was verified using both the Heterotrait-Monotrait (HTMT) ratio and the Fornell-Larcker criterion. All HTMT values were below the threshold of 0.85, and the square root of the AVE for each construct exceeded its correlations with other constructs (Tables 8 and 9), confirming discriminant validity.

Table 8
Measurement model validation (Discriminant validity)

	ACCON	COMSUP	CONV	ENJ	EXP	PTRACK	SMDEL
ACCON							
COMSUP	0.57						
CONV	0.448	0.324					
ENJ	0.242	0.376	0.387				
EXP	0.794	0.782	0.775	0.715			
PTRACK	0.494	0.567	0.376	0.548	0.874		
SMDEL	0.631	0.669	0.571	0.343	0.89	0.601	

Notes: ACCON = Accuracy and condition, COMSUP = Communication support, CONV = Convenience, ENJ = Enjoyment, PTRACK = Parcel tracking, SMDEL = Smooth delivery.

Source: Compiled by the authors.

Table 9
Measurement model validation (Fornell-Larcker criteria)

	ACCON	COMSUP	CONV	ENJ	EXP	PTRACK	SMDEL
ACCON	0.792						
COMSUP	0.481	0.888					
CONV	0.381	0.285	0.830				
ENJ	0.212	0.338	0.352	0.89			
EXP	0.687	0.721	0.688	0.639	0.580		
PTRACK	0.433	0.513	0.345	0.475	0.781	0.769	
SMDEL	0.483	0.523	0.458	0.284	0.732	0.492	0.795

Notes: ACCON = Accuracy and condition, COMSUP = Communication support, CONV = Convenience, ENJ = Enjoyment, PTRACK = Parcel tracking, SMDEL = Smooth delivery.

Source: Compiled by the authors.

5. DISCUSSION

This study proposed and validated a novel measurement scale to assess customer experience during the order fulfillment process in e-commerce. Unlike traditional logistics service quality models, which tend to focus on operational metrics such as delivery reliability and timeliness, this study places equal importance on the emotional and experiential aspects of the order fulfillment process. The validated scale consists of six factors —accuracy and condition, enjoyment, parcel tracking, smooth delivery, communication support, and convenience— which collectively reflect how consumers perceive the post-purchase phase as a multifaceted, experience-laden interaction.

The findings build on and extend prior conceptualizations of customer experience. In line with the experiential marketing theory (Schmitt, 1999), which emphasizes the role of emotional, sensory, and behavioral responses in shaping consumer value, the scale highlights the emotional intensity of the fulfillment stage —traditionally considered merely logistical. The inclusion of enjoyment, for instance, operationalizes the hedonic aspects of delivery anticipated by early experiential scholars (Holbrook & Hirschman, 1982) but rarely formalized in fulfillment research.

The construct of accuracy and condition, widely reflected in prior logistics service quality models (e.g., Mentzer *et al.*, 2001; Rao *et al.*, 2011), continues to be a foundational dimension in the post-purchase phase. Similarly, parcel tracking and communication support —as discussed by Vakulenko *et al.* (2018, 2019) and Alkhalifah (2022)— are validated as essential elements that reduce uncertainty and increase transparency during last-mile delivery.

Smooth delivery, drawing on the "flow" and "seamlessness" themes introduced in recent user experience studies (e.g., Vrhovac *et al.*, 2023; Klein & Popp, 2022), captures customers' desire for low-friction and predictable service. This reflects a shift from operational definitions (e.g., on-time delivery) toward subjective perceptions of effortlessness, consistent with the experiential paradigm.

Convenience, long recognized in service marketing literature (Seiders *et al.*, 2000; Berry *et al.*, 2002), is confirmed as a relevant factor in shaping fulfillment experience, especially when linked to control and flexibility in delivery options.

In contrast, the visual appeal dimension —proposed in prior studies (e.g., Vrhovac *et al.*, 2023) and included in our initial item pool— was excluded during scale refinement. Its exclusion aligns with the conceptual critique that sensory aesthetics, while meaningful in retail or product design contexts (Brakus *et al.*, 2009), may be peripheral in function-driven, standardized delivery environments, particularly when mediated through third-party logistics or contactless methods.

5.1. Theoretical Contributions

This research contributes to the academic marketing literature by advancing the understanding of customer experience during the post-purchase stage —an area that has traditionally received less attention compared to pre-purchase or purchase interactions (Holbrook & Hirschman, 1982; Lemon & Verhoef, 2016). Building on experiential marketing theory (Pine & Gilmore, 2011; Schmitt, 1999), the study reconceptualizes order fulfillment as an experiential touchpoint that encompasses not only logistical efficiency but also emotional resonance.

While previous models of customer experience have often emphasized brand interaction, digital interfaces, or service quality (Brakus *et al.*, 2009; Homburg *et al.*, 2015), this study expands the conceptual boundaries by including the fulfillment process as an integral and measurable component of the customer journey. The findings support the growing view that post-purchase activities contribute meaningfully to customer perceptions and behavioral outcomes (Becker & Jaakkola, 2020; Waqas *et al.*, 2021).

The validated measurement scale incorporates both operational elements (e.g., accuracy, parcel tracking, convenience) and emotional components (e.g., enjoyment, smooth delivery, communication support), offering a dual-lens approach that reflects how customers experience this stage in digitally mediated retail environments. This duality aligns with the experiential marketing perspective, where value emerges from customers' cognitive, affective, and relational responses across all stages of interaction (Brakus *et al.*, 2009; Schmitt, 1999).

Furthermore, the model was validated in the context of a large and complex emerging market, contributing to the geographic and contextual extension of CE theory. This allows for a more inclusive understanding of how fulfillment experience is shaped by local market conditions and evolving consumer expectations.

5.2. Practical Implications

The findings of this study have relevant implications for e-commerce retailers, logistics providers, and digital service designers seeking to enhance customer experience in the post-purchase stage. By identifying six distinct dimensions —accuracy and condition, enjoyment, parcel tracking, smooth delivery, communication support, and convenience— the study offers actionable insights for improving customer satisfaction and long-term loyalty through more meaningful and responsive fulfillment strategies.

Ensuring delivery accuracy and condition requires investment in quality control, packaging reliability, and last-mile partner accountability. Firms may implement verification steps such as real-time tracking, proof of delivery, or customer confirmation mechanisms to minimize order errors and product damage. Meanwhile, communication support can be strengthened by offering multichannel interfaces —including chatbots, messaging apps, and social media— combined with proactive updates such as delivery notifications or delay alerts. Such features not only reduce uncertainty but also contribute to emotional engagement and perceived reliability.

The factors of smooth delivery and parcel tracking both emphasize the importance of control and flow in the fulfillment process. Smooth delivery —encompassing timing precision and seamless handover— can be enhanced through advanced route planning, flexible time slot selection, and convenient alternatives like parcel lockers or contactless drop-offs. At the same time, user-friendly, real-time tracking solutions embedded in mobile apps or integrated into messaging platforms ensure visibility across the delivery journey and help manage customer expectations.

In terms of enjoyment, companies may design the unboxing moment as a positive and emotionally rewarding experi-

ence through elements such as personalized packaging, surprise samples, or thank-you notes. Even simple aesthetic enhancements may elevate perceptions of care and delight. Enhancing convenience, meanwhile, involves offering flexible delivery options —such as time window choices, rescheduling features, or integration with calendars and smart home systems— to reduce perceived effort and increase repurchase intention.

Beyond business practice, the proposed scale may also be of value to policymakers and consumer protection agencies, providing a validated tool for assessing service quality in online retail. As post-purchase logistics become more central to the digital economy, establishing clear benchmarks for experiential fulfillment could inform regulatory standards and best-practice guidelines.

5.3. Limitations and Future Research Directions

While this study provides a validated framework for understanding customer experience during e-commerce order fulfillment, several limitations open avenues for future research. Methodologically, the cross-sectional design prevents observation of how customer experience may evolve over time. A longitudinal approach could offer insights into how fulfillment perceptions change with repeated use, seasonal cycles, or shifts in service quality. Additionally, the study employed a quantitative survey-based design; future research could integrate qualitative methods such as in-depth interviews or diary studies to capture symbolic meanings, emotional responses, and situational nuances that are not easily reflected in structured survey items. Combining methodological approaches may help uncover hidden drivers of fulfillment experience and better reflect the complexity of consumer behavior.

Contextually, the focus on Russia as an empirical setting — although justified by its status as a fast-growing and digitally evolving e-commerce market— limits the external generalizability of the findings. Consumer expectations and logistical challenges may differ across markets with varying degrees of digital infrastructure, cultural norms, and delivery ecosystems. Therefore, the model would benefit from cross-cultural validation across both developed economies (e.g., United States, Germany) and other emerging markets (e.g., Brazil, India). Additionally, future studies could consider industry-specific variations by applying the scale across diverse product categories such as grocery, fashion, electronics, or pharmaceuticals, where fulfillment expectations may differ substantially.

From a conceptual standpoint, further work could explore emerging variables that may influence fulfillment experience. Although this study identified six key dimensions, additional factors relevant to current e-commerce trends —such as perceived sustainability of delivery, the role of predictive technologies, or the use of hyper-personalized services— could become salient in the near future. Furthermore, the construct of visual appeal was excluded from the final model due to weak empirical performance and conceptual ambiguity. However, this factor may merit further investigation in contexts where brand aesthetics, courier presentation, or packaging design play a symbolic or experiential role — particularly in luxury retail or fashion logistics. In sum, this study offers a foundation for a more holistic exploration of the fulfillment experience and encourages continued theoretical and empirical refinement in this growing field of research.

6. CONCLUSIONS

This study set out to reframe the understanding of customer experience during the order fulfillment process in e-commerce by developing and validating a multidimensional measurement scale grounded in experiential marketing theory. While prior research has typically approached this stage from a functionalist perspective centered on logistics performance, our work conceptualizes order fulfillment as a critical experiential touchpoint within the broader post-purchase phase of the customer journey.

The proposed scale captures six key dimensions that shape how consumers interpret and respond to order fulfillment interactions: accuracy and condition, parcel tracking, communication support, enjoyment, smooth delivery, and convenience. These dimensions reflect both functional and emotional aspects of the experience and were derived through a rigorous process involving expert validation, pretesting, and empirical testing using PLS-SEM.

The study makes three main theoretical contributions. First, it advances academic understanding of the post-purchase stage by integrating customer-centric and experiential views into the study of fulfillment. Second, it provides a validated instrument that can be applied in future research and industry practice to assess and enhance customer experience at this critical stage. Third, by using Russia as an empirical context, the study offers insights into how fulfillment experiences are formed in digitally evolving markets, where infrastructural and behavioral conditions differ from those in developed economies.

Beyond its theoretical contribution, the study offers practical guidance for e-commerce firms, logistics providers, and digital platform managers seeking to enhance customer satisfaction, loyalty, and service differentiation through the post-purchase stage. The validated scale can serve as a diagnostic tool for identifying strengths and weaknesses in order fulfillment performance from the customer's perspective. Additionally, policy makers and regulators involved in consumer protection and digital commerce may benefit from the study's insights when developing standards for delivery quality and transparency.

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APPENDIX A

Measurement Scale of the customer experience during the order fulfillment process

Item	Question
Convenience (Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023)	
CONV1	I consider delivery of goods to be a convenient alternative to shopping in a physical store.
CONV2	I perceive delivery as a convenient alternative to in-store shopping.
CONV3	I think ordering and receiving delivery requires less effort than going to the store.
CONV4	I choose delivery because I can select a convenient way to receive or pick up my order.
CONV5	I choose delivery because I can select a convenient time to receive or pick up my order.
Enjoyment (Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023)	
ENJ1	I look forward to receiving my ordered items.
ENJ2	I look forward to the delivery moment.
ENJ3	I feel happy when meeting the courier or picking up my order.
ENJ4	I enjoy ordering delivery.
Visual Appeal (Vrhovac *et al.*, 2023)	
VISAP1	The appearance of the delivery person is important to me.
VISAP2	Visual impression during delivery matters to me.
VISAP3	The appearance of the delivery vehicle is important to me.
VISAP4	The appearance of the pickup location is important to me.
Smooth Delivery (Vrhovac *et al.*, 2023)	
SMDEL1	Receiving online orders is easy for me.
SMDEL2	When someone delivers my order, the process is simple.
SMDEL3	Communicating with delivery personnel is easy for me.
SMDEL4	I do not care who delivers my orders.
Parcel Tracking (Vakulenko *et al.*, 2019; Vrhovac *et al.*, 2023)	
PTRACK1	I would like to know where my parcel is during delivery.
PTRACK2	I enjoy tracking my deliveries.
PTRACK3	I check the status of my parcel during delivery.
PTRACK4	I believe the delivery process is transparent.
PTRACK5	I usually have all the necessary information about my delivery.
Communication Support (Vakulenko *et al.*, 2019)	
COMSUP1	If I lack information about my delivery, I can usually get it quickly.
COMSUP2	I can usually get delivery information via multiple channels (app, messenger, social media, website, etc.).
COMSUP3	I can communicate with the company about my delivery across multiple channels simultaneously.
Accuracy and Condition (Vakulenko *et al.*, 2019)	
ACCON1	My delivery usually arrives on time.
ACCON2	My order is usually delivered to the correct address or pickup point.
ACCON3	I usually receive exactly what I ordered.
ACCON4	My order usually arrives in good condition.

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How Does Social Identity Influence Experiential Value, Customer Satisfaction, and Post-Purchase Intentions in Portuguese Slow Food Restaurants?

¿Cómo influye la identidad social en el valor de la experiencia, la satisfacción del cliente y las intenciones posteriores a la compra en los restaurantes de comida lenta portugueses?

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ABSTRACT

Although social identity has been previously studied, its connections with experiential value, customer satisfaction, and post-purchase intention remain unclear and deserve further investigation. Aiming at clarifying this relationship, a model grounded in social identity theory examines how social identification with Slow Food restaurant experiences impacts satisfaction and loyalty, considering the mediating role of experiential value in these restaurants. Drawing on a sample of 416 Slow Food restaurant consumers in Portugal, and analyzed through Structural Equation Modeling, the study reveals that social identity positively influences both the functional and emotional dimensions of experiential value. In addition, results highlight the strong influence of these experiences in shaping customer satisfaction and in driving positive post-purchase intentions, reinforcing the relevance of social identity for the success of these restaurants. The findings suggest that when customers feel identified with the philosophy of Slow Food, they tend to value the experience more intensely, which in turn leads to higher satisfaction and stronger loyalty intentions. Therefore, managers should uphold authenticity, environmental friendship and engagement with the local community to generate social identity during the gastronomic journey in Slow Food restaurants, creating a meaningful and lasting connection that sustains customer satisfaction and encourages loyalty over time.

Keywords: Social Identity; Customer Experience; Experiential Value; Customer Satisfaction; Slow Food; Slow Tourism.

RESUMEN

Pese a la existencia de investigaciones previas sobre identidad social, su integración con el valor experiencial, la satisfacción del cliente y las intenciones postcompra continúa siendo limitada, especialmente en contextos de consumo experiencial. Con el objetivo de profundizar en estas relaciones, este estudio propone y contrasta un modelo fundamentado en la teoría de la identidad social que examina cómo la identificación social con las experiencias en restaurantes de Slow Food influye en la satisfacción y la lealtad, considerando el papel mediador del valor experiencial en sus dimensiones funcional y emocional. A partir de una muestra de 416 consumidores de restaurantes Slow Food en Portugal, y mediante un Modelo de Ecuaciones Estructurales, los resultados evidencian que la identidad social influye positivamente tanto en la dimensión funcional como en la dimensión emocional del valor experiencial. Asimismo, se constata que dichas dimensiones influyen de manera determinante en la satisfacción del cliente y en la generación de intenciones postcompra favorables. Los hallazgos indican que, cuando los clientes se sienten identificados con esta filosofía de consumo sostenible y consciente, tienden a valorar la experiencia con mayor intensidad, lo que se traduce en mayores niveles de satisfacción y fidelidad hacia el establecimiento. En términos de gestión, los resultados subrayan la necesidad de preservar la autenticidad, el compromiso medioambiental y la vinculación con la comunidad local como elementos estratégicos para reforzar la identidad social del cliente durante la experiencia gastronómica y, con ello, consolidar un posicionamiento competitivo sostenible en el sector.

Palabras clave: Identidad social; Experiencia del cliente; Valor experiencial; Satisfacción del cliente; Slow food; Slow Tourism.

1. INTRODUCTION

Service companies must continuously innovate their strategies to succeed in highly-demanding markets (Abd-Elrahman & Kamal, 2022). In this line, the growing importance of fostering identity connections between brands and consumers stems from its potential to strengthen emotional bonds, foster loyalty, and enhance competitive advantage (McGowan *et al.*, 2017). The higher personal connection and social identification of consumers with the company, and the higher involvement with its marketing efforts, the higher customer value and loyalty for companies (Rather & Hollebeek, 2019). These connections enable brands to go beyond transactional relationships, creating deeper engagement that drives sustained value. Thus, business managers need to better understand those factors that can influence the success to improve decision-making (Muneeb *et al.*, 2020); purchases are no longer the only objective to reach success, other relational and non-transactional metrics are used to measure success, e.g., customer engagement (Rosário & Casaca, 2023).

Undoubtedly, marketing practices can help establish and build self-identity and social identity between brands and customers. Social Identity Theory (SIT) provides a robust framework for understanding how individuals' affiliations with social groups influence behaviors, particularly in consumer-brand interactions (Taifel & Turner, 2004)**.** SIT suggests that individuals derive part of their self-concept from group membership, which can be strategically cultivated by brands to foster stronger connections. Therefore, understanding how SIT can be applied in business settings can provide valuable insights to improve customer relationships (Obaze *et al.*, 2021). Thus, we are witnessing the redefinition of organizations' strategic principles and the implementation of new guidelines for their communication and marketing areas (Ferreira *et al.*, 2021). Specifically, the hospitality industry represents an ideal setting to examine these dynamics, as it inherently relies on creating immersive and memorable experiences that engage consumers on social and emotional levels (Rather & Hollebeek, 2019). Slow Food Restaurants (SFRs) combine features of ethnic or thematic restaurants (DiPrieto & Levitt, 2019, Lego *et al.*, 2002), sustainable restaurants (Jang & Kim, 2024), and other types of highly experiential restaurant concepts. They emphasize not only food quality but also community, culture, sustainability, and authenticity, which are strongly linked to consumers' social identities and shared values. In this study, SFRs are analyzed through the lenses of Social Identity Theory (SIT) to investigate the dynamics between social identity, experiential value, and behavioral intentions. In our proposal, the social identity in restaurants will be directly linked to the experiential marketing developed by Schmitt (1999), which emphasizes the creation of long-term bonds with customers through in-place stimulus (Dandis *et al.*, 2023). Due to the nature of this business, restaurant managers can enhance consumer relationships through experiential marketing strategies, providing exclusive and personalized experiences (Amin & Tarun, 2019). It makes possible to create a special connection to meet customers' needs and to create remarkable experiences (Gingiss, 2021), where consumers can become value co-creators to improve the consistency and to attend different expectations (Han *et al.*, 2020). For instance, the same experience can be interpreted differently by each individual, reflecting the unique perceptions and expectations of consumers (Lugosi *et al.*, 2020). The recognition of such variability can help craft meaningful and consistent customer experiences. The challenge for strategists is to determine what kind of experiences could generate a higher positive effect on consumers and motivate them to adopt a positive interaction with the brand (Amin & Tarun, 2019). This task is particularly salient in the context of Slow Food Restaurants, where the experiential and social aspects of the culinary experience are central to the value offered. Emotional engagement and the sense of belonging fostered through shared social identity play pivotal roles in shaping customer satisfaction and loyalty (Zheng *et al.*, 2023). With this aim, restaurant managers are moving their business from provisioning food or beverages to creating places where visitors become part of an experience with new stimuli that increase their satisfaction (Ma *et al.*, 2023). This idea fits with the Slow Food movement, characterized by sustainability, authenticity, and a slower pace of life (Slow Food, 2023a), offering a unique context to explore the intersection of social identity and experiential marketing. Currently, SFRs are gaining momentum as they align with broader customer trends emphasizing mindful consumption, cultural heritage, and environmental consciousness (Petrini, 2013).

However, despite their growing relevance, limited research has examined the dynamics of social identity, experiential value, and post-purchase consumer behaviors in this niche, making this study both timely and necessary. This research intends to be a key step in studying this industry as it reveals an exciting opportunity for innovation (Dias *et al.*, 2021). Specifically, this research aims to address critical gaps in understanding how social identity influences experiential value and consumer satisfaction, and how these factors, in turn, affect their post-purchase intentions in the context of SFRs. In this line, this article aims to explore the role of social identity in shaping consumers' intention to revisit restaurants, with a particular focus on how this relates to gastronomic experiences as a distinct strategy in the restaurant sector. The study further investigates how social identity contributes to experiential value and how these elements influence customer satisfaction and post-purchase behaviors. These objectives aim to fill a gap in literature by exploring the intersection between social identity, experiential marketing, and customer behavior in the restaurant industry. Specifically, they demonstrate why SFRs serve as a rich and illustrative context to test and extend these theoretical insights, while also contributing to a deeper understanding of the psychological and behavioral aspects that influence customer loyalty.

2. LITERATURE REVIEW

2.1. Slow Food and Slow Tourism

The Slow Food concept, initiated by Carlo Petrini, opposes fast food chains and the "McDonaldization" of food (Petrini & Pollan, 2001). It promotes sustainable food consumption, regional culinary traditions, and a slower lifestyle (Dias *et al.*, 2021). The movement emphasizes the right to healthy eating while respecting the environment through fair trade, biodiver-

sity protection, and ecological balance (Petrini, 2013). Its core principles are "good" (quality and healthy food), "clean" (environmentally friendly production), and "fair" (equity for both consumers and producers) (Petrini, 2005; Slow Food, 2023a). Despite its presence in 160 countries, academic research on the movement remains limited (Dias *et al.*, 2021).

Building on these principles, Slow Tourism emerged from the Slow Food and Slow Cities movements in Italy during the 1980s and 1990s (Dickinson *et al.*, 2010). It advocates for conscious, sustainable travel that emphasizes local culture, reduces travel speed, and uses eco-friendly transportation (Cittaslow International, 2023). Both movements prioritize local authenticity and sustainability, opposing mass consumption and standardized experiences (Dickinson *et al.*, 2010), The rise of slow tourism reflects tourists' high-quality needs under the accelerated pace of contemporary life (Wu *et al.*, 2024). As a response to these high-quality expectations, slow tourism emphasizes immersion in place, atmosphere, and shared social norms, often reinforced through practices of digital disconnection that enable deeper engagement with local environments and communities, thereby enhancing the experiential and symbolic value of local food and culinary traditions (Syvertsen & Jorge, 2025). Local cuisine is viewed as a means of cultural engagement, reinforcing Slow Food's goals of preserving culinary heritage and supporting regional economies while also reflecting broader principles of Slow Food justice, which translate these values into equity, resident and tourist well-being, cultural flourishing, and heritage conservation (Corvo & Matacena, 2017; Gürsoy, 2021). Experiences with local and ethnic cuisine have been shown to actively shape tourists' travel behaviors and intentions, highlighting how food can serve as a key motivator for engaging with culinary destinations (Aziz *et al.*, 2025). Moreover, slow tourism experiences have been found to contribute to tourists' well-being and personal transformation, as engaging deeply with local culture, food, and communities' fosters reflection, learning, and emotional satisfaction (Vo-Thanh *et al.*, 2025). This shared ideology values quality, cultural heritage, and ecological balance over speed and homogenization (Blakey, 2012).

Thus, a growing body of tourism research has explicitly examined Slow Food principles within different tourism contexts. For instance, studies on rural tourism and agritourism show that Slow Food initiatives contribute to strengthening local food systems, enhancing tourists' engagement with producers, and reinforcing destination identity (Everett & Slocum, 2013; Huang *et al.*, 2023). Research on food festivals and gastronomic events inspired by Slow Food values further illustrates how these initiatives promote local culinary heritage and experiential authenticity, while offering alternatives to standardized food consumption in tourism settings (Dimitrovski *et al.*, 2024; Hsu *et al.*, 2021). Additionally, empirical studies focusing on culinary routes and local food networks demonstrate that Slow Food-related tourism experiences encourage meaningful host–guest interactions and support small-scale producers, positioning food as a central element of place-based tourism development (Everett, 2019; Everett *et al.*, 2008).

2.2. Experiential Marketing and Social Identification

Over the past decade, the business world has undergone significant changes, driven by the creation of numerous products aimed at meeting consumer needs and achieving profitability. The relationship between companies and consumers has become a crucial factor in ensuring the future success of a business, and the increasing competition in markets demand new strategies to engage customers (Bowden, 2009; Santos *et al.*, 2025). Companies need to "offer" value to customers, and managers may learn on how to differentiate themselves in a world with increasing aggressive strategies (Aka *et al.*, 2016). However, managers have realized that a good antidote against those aggressive strategies is one that can hardly be replicated, namely, the experience provided to the consumer, as this helps to differentiate brands and build customer loyalty (Andreini *et al.*, 2019). As example, the food service industry has recognized that simply offering good-quality products and services is not enough to ensure business success. Instead, it has highlighted the need to provide unique and memorable experiences (Kim *et al.*, 2019).

Based on this assumption, "experiential marketing" emerged (Schmitt, 1999), and many developed societies began to enter into the experience economy, where most valuable economic offers began through experiences (Schmitt & Zarantonello, 2013). Experiences can be viewed as singular events not under the individual's control, but as a result from external influences that encompasses the totality of the person (Schmitt, 1999). Therefore, from the consumer perspective, experiences should be enjoyable, involving, and memorable for those who take part of them (Oh *et al.*, 2007).

Several authors have characterized experiences in experiential dimensions. For instance, Schmitt (1999) has defined experiential marketing as a concept built upon five different types of experiences recognized as strategic experiential modules, which marketers can design to fulfill consumer needs: the sensory module, the affective module, the thinking module, the behavior module, and relational module. Although Schmitt does not explicitly address the notion of "self and social identity," the Relate dimension is interpreted as the domain in which the brand experience influences the consumer's social identity and sense of belonging.

This social and entity module is related to the relationships that go beyond the individual's personal feelings, linking them to something outside their private state (Schmitt, 1999). This dimension of experience plays a critical role in shaping consumer engagement by connecting individuals to broader societal, cultural, and brand-related communities (Mousavi *et al.*, 2017). The inherent campaign in "relating" individuals prompt them to desire to improve themselves. These campaigns draw attention to the need for individual behaviors to be positively understood by others (e.g., colleagues, girlfriend, family, etc.); consequently, they relate their behaviors to a broader social system (subculture, country, among others).

SIT posits that people form their identities through their affiliations with social groups, and these affiliations help protect and enhance their self-identity (Tajfel, 1978). The creation of group identities involves categorizing one's "in-group" in contrast to an "out-group," and a tendency to view one's own group behavior in a more favorable light compared to the out-group. This leads to a favorable connection with a collective, deindividualized identity grounded in group membership (Turner & Reynolds, 2012). In consumer behavior, this means that individ-

uals do not merely purchase products for functional purposes; they also seek brands and communities that reflect and reinforce their social identity (Bagozzi & Dholakia, 2002). Under a societal context, in pursuit of further social goals, social self-identity becomes increasingly significant as individuals define their self-view in comparison to others (Brewer & Gardner, 1996). For example, in the Slow Food community, members identify as part of a group that values sustainability, healthy eating, and the preservation of local food cultures (Slow Food, 2023a). Furthermore, members of this community tend to view their group favorably compared to others who may not prioritize sustainable or local food. This sense of belonging not only strengthens their personal identity but also fosters deeper emotional ties to the community, influencing their behaviors, preferences, and advocacy for the movement (Mousavi *et al.*, 2017).

Two types of social self-identity can be distinguished: collective and relational (Zhang *et al.*, 2014). On the collective level, social identity is derived from social identity theory in psychology (Hornsey, 2008), emphasizing how identity forms through viewing oneself as part of a collective group or social category (Tajfel, 1982). Individuals use shared characteristics of the group (e.g., demographics, occupations, culture, and organizational membership) to identify as group members and prioritize group-level traits and attributes (Tajfel, 1974). In consumer-brand interactions, this is particularly relevant as brands cultivate strong group identities, creating shared narratives and values that align with their audience's sense of self (Algesheimer *et al.*, 2005). At the collective level, Slow Food community members use common characteristics, such as a commitment to sustainability and traditional cuisine, to define their identity within the group (Slow Food, 2023b). These shared traits strengthen group cohesion and collective identification. On the relational level, social identity addresses the circumstances where individuals form role connections with specific people and emphasize the self in interpersonal interactions (Sluss & Ashforth, 2007). Slow food members form personal connections within the community, building relationships based on shared interests and experiences in practicing mindful eating. These personal connections are vital for maintaining and strengthening the community.

These two types of social self-identity can coexist within a single individual, becoming active at different times or in various situations (Spassova & Lee, 2013). For instance, while an individual may strongly associate with a brand community at a collective level, their engagement with specific members or influences within the group may simultaneously foster social identity (Mousavi *et al.*, 2017). Similarly, brand communities are social groups that individuals voluntarily join, maintain, and benefit from through their participation (Kim *et al.*, 2008). Brands and brand consumption can aid in classifying individuals into social groups, such as online brand communities. This dynamic is evident in digital brand communities, where individuals actively interact, share experiences, and co-create meaning around the brand, reinforcing both their personal and collective identity (Stokburger-Sauer, 2010).

Based on SIT, people raise their self-esteem through associations with individuals and organizations that resonate with their ideal self (Tajfel, 1982). Social identity thus represents the force of a consumer social connections with other community members through a shared collective identity (Dholakia *et al.*, 2009). Thus, people can set their personal identities by joining these social circles, following their rules and beliefs, and investing their efforts in the betterment of these groups (Johnson & Lowe, 2015). The strength of these social ties influences consumer commitment and long-term engagement, making social identity a crucial driver in brand loyalty and advocacy (Mousavi *et al.*, 2017). Connecting with a brand community on a social level is a crucial element that drives engagement and fosters member bonds (Mishra & Bakry, 2021). As a result, brands that successfully integrate social identity dynamics into their marketing strategies can cultivate stronger consumer attachment, advocacy, and long-term loyalty behaviors (Bagozzi & Dholakia, 2002).

2.3. Functional and Emotional Value and Social Identity Effects

Sheth *et al.* (1991) define functional value as the perceived utility gained from the ability of an alternative to perform functionally, utilitarianly, or physically. In addition, an alternative acquires functional value through the possession of important functional, utilitarian, or physical attributes; that is, the functional value can be measured in a profile of choice attributes. From another perspective, functional value can be described as the cognitive or financial benefit that the customers gain from the service or product (Watanabe *et al.*, 2020; Yuan & Wu, 2008).

On the other hand, Sheth *et al.* (1991) define emotional value as the perceived utility acquired from the ability of an alternative to arouse feelings or affective states. An alternative acquires emotional value when it is associated with certain feelings or when it precipitates or perpetuates these feelings, thus, emotional value can be measured in a profile of feelings associated with the alternative (Sheth *et al.*, 1991). In other words, emotional value refers to the feelings and emotional reactions that customers obtain during and after the experience (Watanabe *et al.*, 2020; Yuan & Wu, 2008).

Despite significant discussion among experts from different fields regarding consumption (Bögenhold & Naz, 2018), in developing a comprehensive and interdisciplinary approach to consumption, the experience cannot be overlooked anymore. It is thus necessary an assessment of consumption as an all-encompassing experience, including emotional and functional aspects, and the goal of experiential marketing is to focus on customer experiences (Ihtiyar *et al.*, 2018).

Several studies show a relationship between experiential value and experiential marketing (Ihtiyar *et al.*, 2018; Nadiri & Gunay, 2013; Pham & Huang, 2015; Salomão & Santos, 2022; Yuan & Wu, 2008). Nevertheless, few have directed their focus specifically toward the social identity module. As a result, when delving deeper into the topic Schmitt (1999) suggested that experiential marketing should offer emotional and functional value to the customer. Furthermore, this argument overlapped with each type of experiential marketing experience from a product perspective (Schmitt, 1999). And, in this context, Berry *et al.*, (2002) added that an experience can bring emotional and functional values to customers.

Considering the existing literature, numerous empirical studies conducted in coffee shops and fast food restaurants have demonstrated a favorable relationship between experiential mar-

keting and experiential value (Ihtiyar *et al.*, 2018; Nadiri & Gunay, 2013; Salomão & Santos, 2022). Additionally, recent research in culturally themed restaurants in Indonesia demonstrate empirically that a sense of community influences both functional and emotional dimensions of experiential value, which in turn positively affect consumer behavioral intentions, with cultural identity moderating favourable attitudes (Suhartanto *et al.*, 2025). Similarly, Graciotti and Balzano (2025), using a mixed-methods approach, show that Italian consumers of local food experience enhanced emotional and functional value when their personal and social identities align with local traditions, place attachment, and connectedness with nature, thereby reinforcing sustainable and mindful consumption behaviors. Also drawing on identity theories, Jang and Kim (2024) propose an integrative model that combines self-identity and social identity to explain how members of restaurant brand communities in the United States form attitudes toward restaurants' sustainability initiatives and engage in sustainable behavioral changes.

In the context of the Slow Food sector, consumers may perceive greater experiential value when they identify with a community that shares common values and preferences. For instance, when individuals feel a strong sense of belonging to a group that prioritizes high-quality dining experiences, ethical sourcing, they are more likely to assign higher emotional (McGowan *et al.*, 2017) and functional value to their dining experiences (Jung *et al.*, 2014). This study wants to prove the relationship between social identity and experiential value through the following hypotheses:

H1: Social identity significantly impacts emotional value in SFRs.

H2: Social identity significantly impacts functional value in SFRs.

2.4. Customer Satisfaction

Customer satisfaction becomes essential to outperform competitors in the restaurant industry (Suchánek & Králová, 2019). Enhancing consumers' motivation to return necessitates constant efforts from restaurant management to enhance the overall positive customer experience (Chun & Nyam-Ochir, 2020). Satisfaction plays a crucial role in shaping consumer behavior and influencing managerial decisions within the food service industry (DiPietro & Levitt, 2019). As a result, consumers' satisfaction could be evaluated after their overall evaluation of their experience of the restaurant's key attributes as price, food quality, and service (Lo *et al.*, 2024).

Satisfaction is a concept highly dependent on how consumers perceive whether the service experience met, fell short of, or surpassed their expectations (Ashworth & Bourassa, 2020). When performance is below what is desired, the organization harms its corporate image. Therefore, consumers need to be pleased, so that the execution meets or even surpasses their desires and the organization is seen as a complement to consumer satisfaction levels, as pleased customers become dedicated clients and represent the key source of organizational promotion (Warde, 2017). In other words, satisfaction is seen as the reaction of consumers to the product they expect (Fu *et al.*, 2020). The concept of satisfaction then arises from the comparison between the actual performance of brands and consumer expectations (Lemon & Verhoef, 2016).

2.4.1. Mediating Effects of Experiential Value on Customer Satisfaction in SFRs

An extra consideration concerning customer satisfaction is exactly its relationship with experiential value. In this regard, several studies have proven that experiential value directly and positively impacts customer satisfaction (Ihtiyar *et al.*, 2018; Pham & Huang, 2015; Van Dat, 2020), the higher levels of experiential value, the greater positive satisfaction scores. As a result, two hypotheses are suggested:

H3: Emotional value in SFRs is positively related to customer satisfaction.

H4: Functional value in SFRs is positively related to customer satisfaction.

2.4.2. Customer Satisfaction and Post-Purchase Behavior

Post-purchase behavior refers to the stage in which customer satisfaction or dissatisfaction is assessed after experiencing a product or service (Kotler, 1998). However, a gap exists between purchase intention and actual purchase. While intentions do not fully account for future behavior, research indicates that they are the primary predictors of it (Ajzen and Fishbein 2000). This phase is crucial as it reflects the effectiveness of the organization's efforts and marketing strategies while also generating feedback that can significantly impact the company, either positively or negatively, sometimes irreversibly. Therefore, businesses must analyze consumer sentiment to identify dissatisfaction, enabling them to implement corrective measures that enhance service quality and boost sales (Bojanic & Reid, 2010).

Several studies have examined the influence of customer satisfaction on post-purchase behavior (Hasan *et al.*, 2021; Ihtiyar *et al.*, 2018; Ma *et al.*, 2022; Rodríguez-López *et al.*, 2019). Within this framework, post-purchase behavior is often evaluated through key variables such as word of mouth (WOM), intention to revisit (IRV), and intention to pay more (IPM), which will be examined in this study.

Kotler & Keller (2012) define word-of-mouth communication as the process of sharing recommendations, either individually or within groups, about a product or service to convey personal experiences. Furthermore, when consumers have a positive or satisfying experience, they are likely to actively encourage those in their social network to adopt similar behavior. Consequently, WOM encompasses both favorable and unfavorable consumer reviews, influencing the purchasing decisions and behaviors of others (Ihtiyar *et al.*, 2018).

Another important aspect to consider is that purchase intention reflects the level of perceptual persuasion required for an individual to repurchase from a specific provider of goods or services, making it a key predictor of future transaction behaviors. Previous studies indicate that intentions play a crucial role in shaping individual behavior, as they allow consumers to assess all relevant influencing factors (Ihtiyar *et al.*, 2018). When buyers recognize that their choice was beneficial —meaning the product met their needs and preferences while delivering the expected service— this positively impacts on their future purchasing intentions or intention to revisit (IRV). In other words, any

dissatisfaction with aspects influencing customer satisfaction can reduce the likelihood of repeat purchases(Pascual-Nebreda *et al.*, 2023).

In addition, another way to assess consumers' behavioral intentions is to examine their intention to pay more (IPM) as part of the post-purchase process. IPM refers to the highest price a consumer is willing to pay for a product or service. Moreover, IPM is closely associated with both positive and negative consumer reviews, and it has a direct impact on an organization's profitability (Byrd *et al.*, 2016).

Although recent findings confirm a positive relationship between customer satisfaction and post-purchase behavior, limited research has been conducted in specific markets and sectors, such as the hospitality and tourism industry (Ihtiyar *et al.*, 2018). Therefore, three hypotheses were developed based on previous studies to examine the relationship between customer satisfaction and post-purchase behavior:

H5: Customer satisfaction with SFRs has a positive effect on WOM.

H6: Customer satisfaction with SFRs has a positive effect on IR.

H7: Customer satisfaction with SFRs food has a positive effect on IPM.

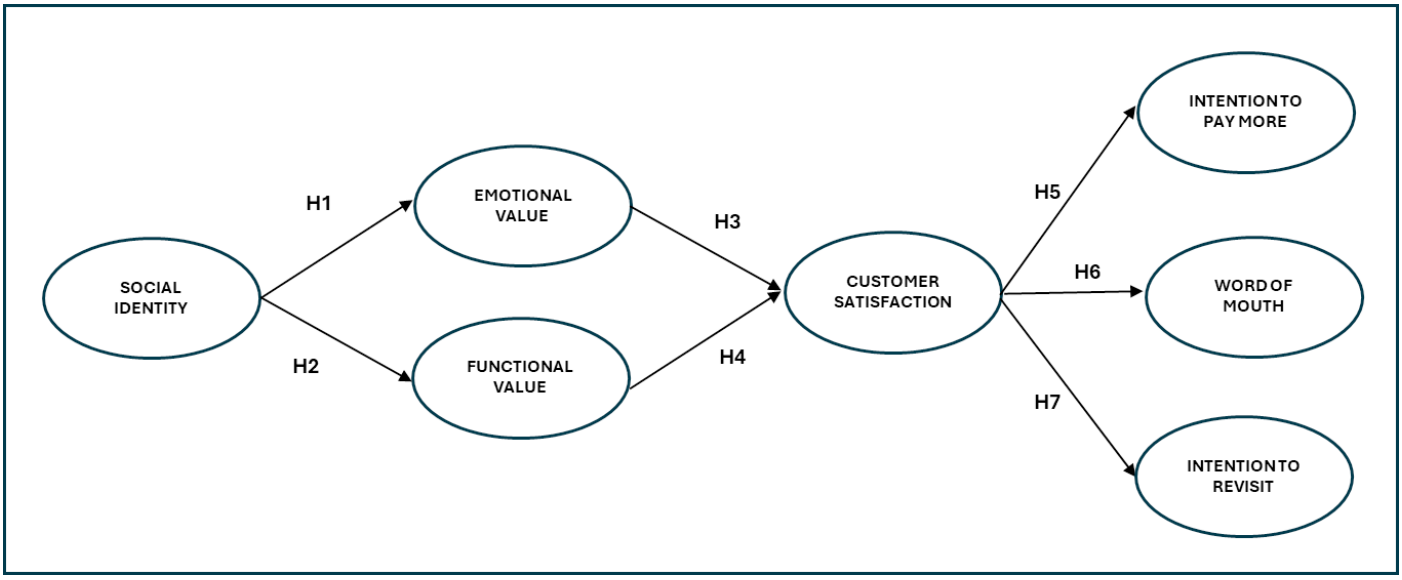

Figure 1
Research Model
Source(s): Authors 'own creation.

3. METHODOLOGY

3.1. Research Context

This research focuses on SFRs in Portugal. Although SFRs can be found in various regions of the country, they are most prevalent in six areas: Alentejo, Algarve, Alto Minho, Lisbon, Porto, and Arcos de Valdevez (Slow Food, 2023b). The restaurant sector holds significant importance in Portugal's economy, contributing to job creation, tourism growth, and overall GDP performance. In 2023, tourism consumption accounted for 15.8% of GDP (compared to 9.8% in 2021), with the restaurant sector being one of the leading contributors to tourism-related GDP (INE, 2023).

3.2. Data collection and Sampling

For collecting data, a survey was carried out in September 2023 for a sample made up of the population residing in Portugal, aged 18 years or over. All participants were confirmed as consumers of Portuguese SFRs by including filter questions that asked whether they had recently dined at a restaurant affiliated with the Slow Food movement. The restaurants were selected for having official affiliation with the Slow Food movement, a minimum of two years of operation, and menus focused on local and seasonal ingredients, ensuring that the responses reflect real consumer experiences rather than general opinions. The questionnaire, administered over a three-month period, included two parts: the first incorporated statements measuring various constructs with a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree), while the second part gathered demographic information. Consumers were invited to participate in the survey immediately after their dining experience.

The research was disseminated online through a snowball approach across all districts of Portugal. Initially, the survey link was shared via email and social media groups related to food, gastronomy, and tourism. Participants who received the

survey were asked to forward it to friends, family, or acquaintances who had also dined at Portuguese Slow Food restaurants. This process continued iteratively until responses were gathered from all districts, ensuring a diverse and geographically representative sample. To guarantee that the data collected reflected genuine and recent experiences, filter questions were used to include only individuals residing in Portugal who had dined at Portuguese Slow Food restaurants and were 18 years of age or older. The survey was developed based on validated scales from prior studies for constructs such as social identity, experiential value, customer satisfaction, word-of-mouth, intention to revisit, and willingness to pay more. It was drafted in English, translated into Portuguese, and then translated back to ensure semantic accuracy. A pre-test was conducted to confirm clarity and alignment with intended meanings, and adjustments were made as needed. After eliminating questionnaires that did not fit the target population and filter criteria, the final sample resulted in 416 people. Using the G*Power 3.1.9.2 software, sample power was validated (F test > linear multiple regression: fixed model, R^2 deviation from zero) with the following parameters: $\alpha = 0.05$; $f^2 = 0.10$, number of predictors = 6. The software identified a sample power (1 -β) result of 0.99981, translating into less than 0.01% chance of having a type 2 error in this study (Cohen, 2013; El Maniani *et al.*, 2009). The next step was data analysis through Structural Equation Modeling (SEM), using the Partial Least Squares method in the SmartPls4 software.

Regarding the sociodemographic profile of those surveyed in this study, it is concluded that although more female respondents responded than male respondents, a balance between genders was found, given that the Portuguese population is slightly made up of more women than men (Pordata, 2023). On the other hand, the three most prominent age groups in the sample were those ranging from 26 to 35 years old, 36 to 45 years old, and 46 to 55 years old. Additionally, it was possible to conclude that most respondents had a degree or at least had completed secondary education. Finally, it was observed that most respondents are working. For more details about the profile of the respondents in this study, you can see Appendix Table A.1.

3.3. Item Specification

Appendix Table A.2 includes the different items used in this research. For the items that assessed social identity, experiential value, customer satisfaction, Word of Mouth, intention to revisit and finally the intention to pay more the Likert scale was applied as the measurement scale for the respective items, given that it was the scale chosen by the studies of authors mentioned above.

To ensure that interviewees fully grasped the content, all variables were translated and then back translated from English to Portuguese. Before the research was released, a pre-test was conducted involving ten subjects who were interviewed upon finishing the questionnaire to evaluate if their comprehension aligned with the intended meaning of the items. No inconsistencies with the original content were noted, thus confirming the face validity of the instrument.

4. RESEARCH RESULTS

Concerning the measurement model, as shown in Appendix Table A.2, the analysis revealed that all variables had factor loadings above 0.7; therefore, all items were maintained (Hair *et al.*, 2017). Furthermore, Appendix Table A.3 shows the analysis of convergent validity, internal consistency, and discriminant validity. Results accomplish the principles of convergent validity as all AVE values surpassed 0.5. Thus, the model was deemed to have converged satisfactorily (Henseler *et al.*, 2009). Furthermore, regarding the internal consistency analysis, the results demonstrated that all composite reliability (CR) values were greater than 0.7, these results being positive (Hair *et al.*, 2017). Additionally, all Cronbach alpha values were considered good or very good following the criteria proposed by Hair *et al.*, (2017). Ultimately, it was found that each square root of the AVEs surpassed the correlations between the constructs; hence, the results validated that discriminant validity was achieved (Fornell & Larcker, 1981).

The PLS algorithm found that the SRMR presented was 0.074, which is less than 0.08 (Henseler, Ringle, *et al.*, 2016). In turn, the value of the NFI indicator was greater than 0.09, showing a good fit of the model (Lohmöller, 1989). Finally, the RMS Theta indicator was below 0.12, also showing a good fit of the model (Henseler *et al.*, 2014) (Table 1).

Table 1
Model Fit

	Estimated Model	Evaluation criteria	Reference Studies
SRMR	0,074	<0,08	(Henseler, Hubona, *et al.*, 2016)
NFI	0,092	>0,09	(LohmÖller, 1989)
RMS Theta	0,101	<0,12	(Henseler *et al.*, 2014)

Source(s): Authors 'own creation.

Regarding the VIF (Variance Inflation Factor) values, Table 2 reflects that all hypotheses have a value lower than 5; therefore, these values should be accepted (Hair *et al.*, 2019). Furthermore, all hypotheses presented a value below 3, a very positive result, as it demonstrates the absence of multicollinearity.

Additionally, regarding the Pearson R^2, the analysis revealed that social identity weakly influences emotional ($R^2 = 0.259$) and functional value ($R^2 = 0.118$). Emotional and functional values moderately explain customer satisfaction ($R^2 = 0.656$), which, in turn, has a substantial effect on WOM ($R^2 = 0.803$) and a moderate impact on both intention to revisit ($R^2 = 0.496$) and intention to pay more ($R^2 = 0.474$) (Hair *et al.*, 2019).

To complete the analysis of Table 2, the calculation was carried out in Bootstrapping's SmartPLS4 to analyze the structural coefficients and their corresponding p-values. As a result, all research hypotheses were proven since their p-value was less than 0.005.

Table 2
Structural Model Results

Hypotheses	VIF	Standard Deviation	P Value	Conclusion
Effect on Emotional Value (R^2 0,259)	1.000	0.066	0.000	**Supported**
H1. Social Identity -> Emotional Value				
Effect on Functional Value (R^2 0.118)	1.000	0.081	0.000	**Supported**
H2. Social Identity -> Functional Value				
Effect on Customer Satisfaction (R^2 0,695)	1.289	0.047	0.000	**Supported**
H3. Emotional Value -> Customer Satisfaction				
Effect on Customer Satisfaction (R^2 0,695)	1.289	0.057	0.012	**Supported**
H4. Functional Value -> Customer Satisfaction				
Effect on WOM (R^2 0,803)	1.000	0.046	0.000	**Supported**
H5. Customer Satisfaction -> Word of Mouth				
Effect on Intention to Revisit (R^2 0,496)	1.000	0.056	0.000	**Supported**
H6. Customer Satisfaction -> Intention to Revisit				
Effect on Intention to Pay More (R^2 0,474)	1.000	0.024	0.000	**Supported**
H7. Customer satisfaction -> Intention to Pay More				

Source(s): Authors 'own creation.

5. DISCUSSION

Based on the first objective of the paper, that is; to analyze how social identity affects the consumers' experiential value in SFRs. It can be concluded from hypotheses 1 and 2 that social identity has a positive impact on experiential value in both its functional and emotional dimensions among consumers. This finding aligns with literature emphasizing that sense of community or social identity strengthens consumers' emotional engagement and perceived functional benefits in local and authentic culinary experiences (Suhartanto *et al.*, 2025; Graciotti & Balzano, 2025). Thus, those actions able to improve social identity can become a driving force to generate consumer engagement and loyalty, e.g., the development of a restaurant's brand community with thematic dining experiences or additional activities like workshops or training activities to demonstrate their know-how. These practices resonate with the principles of Slow Food and Slow Tourism, which prioritize cultural immersion, authenticity, and meaningful social interactions (Corvo & Matacena, 2017; Syvertsen & Jorge, 2025), suggesting that social identity-driven experiences enhance both the symbolic and experiential value of SFRs.

In previous literature, some studies have only demonstrated that social identity only affects one dimension of experiential value. For example, although H1 was proven in our study and other studies applied to coffee shops and fast food (e.g., Nadiri & Gunay, 2013; Salomão & Santos,2022), the same hypothesis was not proven in other studies also applied to coffee shops (e.g., Ihtiyar *et al.*, 2018). Something similar occurred with H2, although this was previously proven (e.g., Ihtiyar *et al.*, 2018; Nadiri & Gunay, 2013), there is a paper in the fast-food industry that did not (e.g., Salomão & Santos, 2022). This inconsistency may be attributed to the underexplored nature of SFRs and the unique experiences they offer, which integrate ethical sourcing, local gastronomy, and community identity, enhancing both emotional and functional perceptions of value.

Concerning the second objective, this manuscript examines how customer satisfaction, shaped by social identity and experiential value, influences post-purchase behavior, including intention to revisit, recommendation, and intention to pay more. Specifically, hypotheses 3 and 4 confirmed that experiential value has a positive relationship with customer satisfaction, an attitude directly connected with positive post-purchase behavior (confirmed in hypotheses 5, 6, and 7). These findings reinforce the experiential marketing perspective, highlighting that experiences providing emotional and functional value directly enhance satisfaction and subsequent behavioral intentions (Berry *et al.*, 2002; Ihtiyar *et al.*, 2018).

In summary, the adoption of social identity practices in SFRs, through connection with local culture or the enhancement of traditional cooking merged with cutting-edge approaches, can favor customer satisfaction and post-purchase attitudes. This demonstrates that engaging consumers through group affiliation, shared values, and immersive culinary experiences not

only strengthens loyalty but also promotes positive advocacy behaviors, consistent with Social Identity Theory and experiential marketing principles (Schmitt, 1999; Tajfel, 1982). These results align with previous research in different service settings (Ihtiyar *et al.*, 2018; Nadiri & Gunay, 2013; Pham & Huang, 2015; Salomão & Santos, 2022; Yuan & Wu, 2008). Therefore, the consistency of these findings across studies suggests a robust relationship between experiential value, satisfaction, and post-purchase outcomes in the restaurant sector, particularly emphasizing the role of social identity in the context of Slow Food restaurants, which may explain the stronger effects observed compared to conventional food service settings.

6. CONCLUSION

The model applied in this article follows a theoretical framework that explores the relationship between SIT, experiential value, immediate customer satisfaction, and post-purchase behavior, as supported by previous studies (Acar *et al.*, 2024; Salomão & Santos, 2022; Zheng *et al.*, 2023). By integrating SIT with experiential marketing frameworks, this research contributes to a more nuanced understanding of how consumer identity influences interactions with brands, specifically in the SFRs context. Thus, it reinforces that the social identity of consumers with a brand contributes to satisfaction through experiential value, which leads to positive post-purchase behavior (Prentice *et al.*, 2019). It also highlights that this satisfaction results in greater brand loyalty, repeat purchases, and positive word-of-mouth recommendations. These findings add weight to the growing literature suggesting that customer satisfaction is not just a transient feeling, but a key driver of long-term engagement and loyalty (Cankül *et al.*, 2024). It opens the field to combine experiential marketing with other theories in eclectic models to better understand the experiential nature of different businesses.

The findings underscore the crucial role that social identity plays in shaping consumer perceptions, preferences, and actions. By engaging consumers, organizations can influence how customers see themselves in relation to the brand, as individuals derive part of their identity from the social groups they belong to, including the brands they patronize (Tajfel, 1978). Furthermore, it is pertinent to note that this study was conducted within the domain of SFR, a departure from the conventional focus in much of the existing literature (Dias *et al.*, 2021). Consequently, it is argued that our contribution enhances theoretical discourse by furnishing nuanced insights stemming from the utilization of our framework in the context of Slow Food establishments.

As stated in introduction, this research intends to provide professionals with new insights to reinforce the social identity in the restoration landscape through a series of actionable strategies to foster consumer loyalty through identity-driven engagement. Although in the research context (Portugal), conventional managers may be less familiar with the social identity concept and its respective impact on the business world, it is important to note that this approach can significantly enhance customer engagement. Managers are encouraged to adopt experiential marketing strategies to strengthen consumers' social identity with their brands. By focusing on creating experiences that resonate with consumers' social self-concept, managers can build stronger emotional connections and drive customer loyalty, opening new communication strategies to strengthen the experience beyond cooking through related activities (e.g., workshops, co-creation of recipes that fuse traditional elements with a modern approach, presence of local producers, etc.). Consequently, it is advised that managers refrain from assuming that consumers' decisions are influenced solely by the utilitarian aspects of a product, such as quality and price. This assumption, as demonstrated by this study, does not align entirely with reality, opening avenues to create novel experiences that break the traditional approach of business. Consumers are willing to connect with new proposals that enhance their senses.

Conversely, from a societal perspective, Slow Food promotes environmentally sustainable practices, social welfare, and the conservation of biodiversity and local culinary traditions. In this context, adopting sustainable food practices contributes to the economic growth of this sector. Therefore, this study has the potential to positively influence society by motivating non-Slow Food restaurant managers to adopt more sustainable dining practices. Today's consumers increasingly favor ecologically conscious businesses, reflecting a shift in social identity towards prioritizing environmental and social responsibility. This shift in social identity is key to creating a more meaningful connection between consumers and brands that align with their values. As more restaurant managers recognize and act on this trend, they can reinforce the social identity of their consumers by integrating sustainable practices into their operations, strengthening customer loyalty and engagement (Ismail *et al.*, 2023).

The paper has some limitations. The study was conducted in Portugal, and despite the country's well-known gastronomic culture, this may limit the generalizability of the findings. Applying the model in other countries could provide valuable comparative insights and a broader understanding of how social identity operates in different socio-cultural contexts. Additionally, including the perspectives of foreign tourists, rather than focusing solely on domestic consumers, could further enrich the results. Moreover, a limitation of this study is that social identity was measured based on the experience in the Slow Food restaurant, without distinguishing between stable social identity and temporarily activated by the consumption context. This suggests that future studies could include cultural identity as a moderating variable to provide a deeper understanding of its influence. Furthermore, the research focused exclusively on Slow Food restaurants, without exploring other types of experiences such as festivals, fairs, or culinary routes, which could provide a richer understanding of the phenomenon. Examining these different formats would allow future studies to capture a wider range of tourist motivations, interactions, and cultural engagements, and could help identify which experiences are most effective in fostering authenticity and community development.

7. ETHICS STATEMENT

The data were collected through an anonymous online survey, in full compliance with the General Data Protection Regulation (GDPR). Prior to participation, respondents received

detailed information regarding the objectives of the study, the voluntary nature of their involvement, and their right to withdraw at any stage without penalty. No personally identifiable information was obtained, and all responses were stored securely with restricted access. The data was used solely for scholarly purposes.

8. SOURCE OF FUNDING

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9. CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Mariana Santos: Conceptualization; Methodology; Formal analysis and investigation; Writing - original draft preparation; Writing - review and editing; Resources. **Ana Dopico-Parada:** Conceptualization, Methodology; Writing - review and editing; Resources; Supervision. **Pablo Cabanelas:** Conceptualization; Writing - review and editing; Funding acquisition; Resources; Supervision.

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APPENDIX

Table A.1
Summary of Demographic Information (Percentage Distribution)

Variable	Options	N	%
Gender	Female	220	52,8
	Male	196	47,1
	None of the options above represent my gender	0	0,0
Age Range	18-25	45	10,8
	26-35	124	29,8
	36-45	98	23,6
	46-55	93	22,4
	56-65	44	10,4
	More than 65	12	2,9
Education	Elementary school	23	5,5
	Middle school	42	10,1
	High school	141	33,9
	Bachelor's degree	151	36,3
	Postgraduate	1	0,2
	Master's degree	53	12,7
	Doctorate	5	1,2
Professional Situation	Employee	330	79,3
	Self-employed	57	13,7
	Unemployed	3	0,7
	Student	14	3,4
	Retired	12	2,9
Gross Annual Income	≤ 5.000 euros	17	4,1
	Between 5.001 and 10.000 euros	12	2,9
	Between 10.001 and 13.500 euros	15	3,6
	Between 13.501 and 19.000 euros	54	13,1
	Between 19.001 and 27.500 euros	86	20,7
	Between 27.501 and 32.500 euros	85	20,4
	Between 32.501 and 40.000 euros	76	18,3
	Between 40.001 and 50.000 euros	33	7,9
	Between 50.001 and 100.000 euros	25	6,0
	≥ 100.000 euros	7	1,7
	N/A	6	1,4
District	Aveiro	17	4,1
	Beja	10	2,4
	Braga	15	3,6
	Bragança	5	1,2
	Castelo Branco	5	1,2
	Coimbra	5	1,2
	Évora	10	2,4
	Faro	16	3,8
	Guarda	5	1,2
	Leiria	5	1,2
	Lisboa	154	37,0
	Portalegre	6	1,4
	Porto	108	26,0
	Região Autónoma dos Açores	10	2,4
	Região Autónoma da Madeira	13	3,1
	Santarém	8	1,9

Variable	Options	N	%
District	Setúbal	9	2,2
	Viana do Castelo	4	1,0
	Vila Real	5	1,2
	Viseu	6	1,4

Source(s): Authors 'own creation.

Table A.2
Items and Factor Loadings

Item	Factor Loading	Authors
Social Identity 1- Attending this establishment helps me develop a relationship with my social environment.	0,775	Nadiri & Gunay, 2013; Schmitt, 1999; Bagozzi & Dholakia 2022
Social Identity 2- The friends with whom I share my social environment prefer this establishment, which makes me prefer it too.	0,849	
Social Identity 3- Attending this establishment fits within the social class to which I belong.	0,797	
Social Identity 4- In this establishment I feel like I'm in the right place where I should be.	0,863	
Social Identity 5- This restaurant has a lot of good reviews on social media.	0,735	
Emotional Value 1- I enjoy being in this establishment.	0,961	Mathwick *et al.*2001; Nadiri & Gunay, 2013; Sweeney & Soutar, 2001; Yuan & Wu, 2008
Emotional Value 2- This establishment makes me feel good.	0,969	
Emotional Value 3- This establishment makes me revisit it.	0,938	
Functional Value 1- The products offered by the establishment are reasonably priced.	0,903	
Functional Value 2- In this establishment I receive a good price / quality proposal for the products.	0,906	
Functional Value 3- This establishment is economical.	0,774	
Customer Satisfaction 1- I am satisfied with my decision to get some products/visit here.	0,954	Nadiri & Gunay, 2013; Oliver & Swan,1989; Yuan & Wu, 2008
Customer Satisfaction 2- Taking everything into consideration, I really liked this restaurant.	0,973	
Customer Satisfaction 3- Taking everything into account, the establishment's service meets my expectations.	0,961	
WOM1- - I will say positive things about this restaurant to other people.	0,952	Nadiri & Gunay, 2013; Zeithaml *et al.*, 1996
WOM2- I will encourage friends and relatives to visit this restaurant.	0,915	
WOM3- I will recommend it to someone who seeks my advice.	0,94	
Intention to Revisit 1- I consider this restaurant as my first option.	0,88	Nadiri & Gunay, 2013; Zeithaml *et al.*, 1996
Intention to Revisit 2- I intend to continue eating at this restaurant soon.	0,934	
Intention to Pay More 1- I will continue to buy products from this restaurant, even if the prices increase slightly.	0,964	Ihtiyar *et al.*, 2018; Zeithaml *et al.*,1996
Intention to Pay More 2- I don't mind paying more for the benefits I currently receive from this restaurant.	0,968	

Source(s): Authors 'own creation.

Table A.3
Convergent Validity, Internal Consistency and Discriminant Validity

Constructs	AC	CR (rho_a)	CR (rho_c)	AVE	1	2	3	4	5	6	7
1-Intention to Pay More	0.928	0.930	0.965	0.932	0.966						
2-Intention to Pay More	0.789	0.834	0.903	0.823	0.769	0.907					
3- Social Identity	0.864	0.885	0.902	0.648	0.527	0.578	0.805				
4- Customer Satisfaction	0.960	0.961	0.974	0.926	0.688	0.704	0.453	0.963			
5- Emotional Value	0.953	0.953	0.970	0.914	0.668	0.646	0.509	0.825	0.956		
6-Functional Value	0.833	0.909	0.897	0.745	0.452	0.456	0.344	0.501	0.474	0.863	
7- Word of Mouth	0.929	0.932	0.955	0.876	0.687	0.730	0.403	0.896	0.804	0.525	0.936

Source(s): Authors 'own creation.

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From Click to Visit: The Role of eWOM in the Choice of Spa Tourism Destinations under Information Acceptance Models

Del clic a la visita: el papel del boca-oído electrónico en la elección de destinos turísticos termales según los Modelos de Aceptación de la Información

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ABSTRACT

This study analyzes how tourists evaluate, accept, and use electronic word-of-mouth (eWOM) when choosing spa destinations, focusing on a wellness context where credibility, trust, and experiential relevance strongly shape decision-making. Drawing on an adaptation of the Information Acceptance Model (IACM), the research proposes and empirically tests a theoretical framework that integrates seven key constructs. Data were collected through a self-administered questionnaire completed by 302 visitors to spas and hot springs in the province of Ourense (Galicia, Spain), and the model was assessed using partial least squares structural equation modelling (PLS-SEM).

The findings reveal that Source Credibility, Information Credibility, and Needs of Information are the primary antecedents of perceived Information Usefulness. In turn, usefulness significantly predicts information acceptance and mediates the impact of credibility-related variables on visit intention. Several relationships incorporated into the adapted model are supported, highlighting the central role of trust and relevance in wellness tourism decision processes. Conversely, the limited direct influence of Information Quality on usefulness and intention suggests that formal message attributes are less decisive than authenticity and experiential resonance in this context.

This study advances the application of information acceptance theories to experiential tourism by demonstrating the explanatory power of the IACM in wellness settings. It also provides actionable insights for destination managers on designing credible, need-oriented digital content capable of enhancing eWOM effectiveness and strengthening visitors' intention to choose spa destinations.

Keywords: Electronic Word-of-Mouth; Information Acceptance Model; Hot Springs; Spa; Wellness Tourism.

R E S U M E N

Este estudio analiza cómo los turistas evalúan, aceptan y utilizan el boca-oído electrónico (eWOM) a la hora de elegir destinos termales, centrándose en un contexto de bienestar en el que la credibilidad, la confianza y la relevancia de la experiencia influyen considerablemente en la toma de decisiones. Basándose en una adaptación del Modelo de Aceptación de la Información (IACM), la investigación comprueba empíricamente un marco teórico que integra siete constructos clave. Los datos se recopilaron mediante un cuestionario autoadministrado a 302 visitantes de balnearios de la provincia de Ourense (Galicia, España), y el modelo se evaluó utilizando el modelo de ecuaciones estructurales (PLS-SEM).

Los resultados revelan que la credibilidad de la fuente, la credibilidad de la información y las necesidades de información son los principales antecedentes de la utilidad de la información. A su vez, la utilidad predice significativamente la aceptación de la información y media el impacto de las variables relacionadas con la credibilidad en la intención de visita. Se confirman varias relaciones del modelo adaptado, destacando el papel de la confianza y la relevancia en los procesos de decisión del turismo de bienestar. Por el contrario, la limitada influencia directa de la calidad de la información sobre la utilidad y la intención sugiere que los atributos formales del mensaje son menos decisivos que la autenticidad en este contexto.

Este estudio mejora la aplicación de las teorías de aceptación de la información al turismo experiencial al demostrar el poder explicativo del IACM en entornos de bienestar. También proporciona información útil para los gestores de destinos sobre el diseño de contenidos digitales creíbles, capaces de mejorar la eficacia del eWOM y reforzar la intención de los visitantes de elegir destinos termales.

Palabras clave: Comunicación Boca-oído electrónica; Modelo de Aceptación de la Información; Turismo termal; Balnearios; Bienestar.

1. INTRODUCTION

Wellness and spa tourism has become a strategic segment within contemporary tourism, driven by growing concerns about physical and mental health, emotional balance, and sustainable lifestyles (Smith & Puczkó, 2014; Pande & Sengupta, 2025). Beyond its economic relevance, this form of tourism is characterized by highly experiential, intangible, and emotionally laden services, which make travelers particularly dependent on external information sources when evaluating destinations (Dillette *et al.*, 2021). As a result, understanding how tourists process, assess, and adopt online information has become a central issue for both researchers and destination managers seeking to influence demand formation and destination choice in wellness-oriented markets (Araujo-Vila *et al.*, 2021).

In digital environments, electronic word-of-mouth (eWOM) and user-generated content (UGC) play a decisive role in shaping tourists' expectations, perceived value, and behavioral intentions, particularly in contexts where service quality cannot be easily evaluated prior to consumption (Filieri & McLeay, 2014; Litvin *et al.*, 2008; George & Ramos, 2024; Zain *et al.*, 2024). While extensive research has examined the effects of eWOM in general tourism and hospitality settings, significantly less attention has been devoted to wellness and spa tourism, despite its distinctive characteristics related to trust, emotional well-being, and experiential consumption (Asyraff *et al.*, 2024). This lack of context-specific evidence limits both theoretical understanding and managerial decision-making in destinations where credibility, perceived authenticity, and therapeutic value are core attributes (Tariya *et al.*, 2023).

Moreover, although persuasion and information acceptance frameworks have been widely applied to online consumer behavior, their use in wellness tourism remains fragmented (Zain *et al.*, 2024). Existing studies often focus either on general information acceptance mechanisms or on technology acceptance and usage intentions, without fully accounting for how credibility cues and information usefulness interact to shape behavioral intentions in experiential tourism contexts (Berné *et al.*, 2020; Berné *et al.*, 2023; Gilabert & Berné, 2024). In particular, the Information Acceptance Model (IACM) offers a theoretically robust yet underutilized framework for explaining how tourists cognitively evaluate and internalize eWOM, but its application to spa tourism remains largely unexplored (Cheung *et al.*, 2008; Sussman & Siegal, 2003).

To address this gap, this study adapts and empirically tests the IACM in the context of spa and hot springs tourism, extending the model in three keyways. First, it incorporates context-specific antecedents related to information credibility and information needs, reflecting the importance of trust and experiential relevance in wellness decision-making (Dillette *et al.*, 2021). Second, it extends the outcome structure of the model beyond information acceptance to include visit intention, enabling the examination of both cognitive and behavioral effects of eWOM (Erkan & Evans, 2016). Third, it validates the adapted model using survey data from spa and hot springs visitors and partial least squares structural equation modeling (PLS-SEM), providing robust empirical evidence on the mechanisms through which online information influences destination choice in wellness tourism.

By doing so, this study contributes theoretically by demonstrating the adaptability and explanatory power of the IACM in experiential and well-being-oriented tourism contexts, conceptually clarifying the role of credibility and usefulness in eWOM processing, and empirically linking information acceptance to visit intention (Cheung *et al.*, 2008; Erkan & Evans, 2016). From a managerial perspective, the findings offer actionable insights for destination managers and spa operators on how to design, curate, and manage online content strategies that enhance trust, perceived value, and consumer engagement in wellness tourism markets.

2. LITERATURE REVIEW

2.1. Spa, Hot Springs and Wellness Tourism

Wellness tourism, encompassing spa and hot springs experiences, has grown due to increasing consumer interest in holistic well-being, integrating physical, mental, and emotional health (Dillette *et al.*, 2021). Hot springs provide unique therapeutic benefits, including pain relief, improved circulation, and stress reduction (Araujo-Vila *et al.*, 2021; Dini & Pencarelli, 2022).

Previous studies highlight not only the health-oriented aspects but also socio-economic benefits, such as rural development and seasonality mitigation (Voigt & Laing, 2014). Nevertheless, much of the literature remains descriptive, focusing on benefits or usage patterns, without deeply examining how wellness tourism interacts with digital information flows or consumer decision-making processes. This gap signals the need to analyze how spa tourism experiences are shaped by online information, particularly eWOM.

2.2. User-Generated Content, eWOM, and Traditional Media

User-generated content (UGC) and electronic word-of-mouth (eWOM) are pivotal in shaping perceptions of tourist destinations, especially in sectors with experiential and subjective outcomes like wellness (Zain *et al.*, 2024). Unlike traditional marketing, eWOM conveys authenticity and peer validation, influencing both cognitive (e.g., service quality) and affective (e.g., emotions evoked) destination images (Gaffar *et al.*, 2022; Garay, 2019).

Research in hotel management has shown that eWOM characteristics significantly influence managerial decision-making and customer behaviour. In particular, Berné *et al.* (2020) demonstrate that eWOM attributes act as contextual variables that shape decision motives and organisational outcomes in hotels, highlighting credibility and content relevance as key evaluative dimensions. Similarly, Berné *et al.* (2023) confirm that credible, structured and strategically managed eWOM plays a central role in how hotel managers implement service improvements and how consumers form behavioural responses. Furthermore, Gilabert & Berné (2024) provide evidence that perceived usefulness and eWOM quality strongly condition managerial attitudes and subsequent adoption behaviours within the hotel ecosystem.

While prior studies confirm the impact of eWOM, they often treat UGC as a generic influence, without analyzing the interplay between source credibility, content quality, and user-specific in-

formation needs. Critically, there is limited examination of how these factors converge to influence decision-making in wellness tourism, leaving a theoretical gap in understanding the mechanisms through which eWOM shapes behavior.

2.3. Information Acceptance Model and their application to eWOM in Spa Tourism

The Information Acceptance Model (IACM), derived from the Information Adoption Model (IAM) and the Theory of Reasoned Action (TRA), provides a framework to understand how individuals evaluate online information and incorporate it into decision-making (Erkan & Evans, 2016). It emphasizes the combined effect of message-related factors, such as Information Quality, and source-related factors, such as Credibility, on Information Usefulness and subsequent information acceptance (Cheung *et al.*, 2008; Erkan & Evans, 2016; Sussman & Siegal, 2003). The model has been widely applied in technology and general online information research, and more recently in tourism, particularly in contexts where trust and perceived usefulness are central to consumer decisions.

However, the use of IACM in tourism research has several limitations. First, prior applications often overlook the specific experiential and emotional characteristics of tourism services, particularly wellness and spa tourism, where experiences are intangible, highly subjective, and linked to personal well-being. Second, the model has rarely accounted for information needs, the active motivation of users to search for specific, relevant information, which is crucial in health-oriented tourism decisions. Third, while IACM predicts information acceptance effectively, it has not consistently integrated behavioral outcomes, such as the intention to visit a destination, which limits its ability to explain the full decision-making process. Finally, most studies employing IACM tend to treat its constructs in isolation, without examining how information quality, credibility, and user needs interact in a holistic framework to influence both cognition and behavior.

The present study addresses these limitations through a deliberate adaptation of the IACM to spa and wellness tourism, capturing the importance of trust, authenticity, and relevance in shaping users' perceptions of eWOM content. Furthermore, the framework explicitly links these constructs to visit intention, providing a behavioral dimension that connects online information acceptance to real-world decision-making. Finally, contextualizing the model to spa and hot springs tourism allows for a more nuanced understanding of the role of experiential, emotional, and health-related cues in influencing both the perceived usefulness of information and its acceptance. This adaptation thus extends the theoretical applicability of IACM, enabling a richer, context-sensitive examination of how eWOM affects tourist behavior and contributes to theory by integrating cognitive, affective, and behavioral components in a single framework.

3. HYPOTHESIS DEVELOPMENT

In a digital environment where tourism decisions are increasingly influenced by other users' shared experiences, understanding the factors that determine the acceptance of electronic word-of-mouth (eWOM) is essential for anticipating tourist behavior. In the specific case of spa tourism, the search for and evaluation of information is even more critical due to the health, wellness, and personal care elements associated with these destinations. This work analyzes how classic variables from the IACM model (Information Credibility, Information Quality, Needs of Information, Information Usefulness, and Information Acceptance), interact within the eWOM framework to influence the intention and decision to visit spa and hot springs destinations. Finally, the final theoretical model is presented (Figure 1).

Source Credibility refers to the perceived expertise, trustworthiness, and impartiality of the information provider, whether peers, wellness influencers, or digital platforms. In wellness tourism, credibility is particularly critical because the evaluation of intangible health benefits depends on trust. Research shows that credible sources enhance users' perceptions of information usefulness, encourage acceptance of content, and ultimately increase the intention to visit the destination (Filieri & McLeay, 2014; Goyal & Taneja, 2023; Zeng & Gerritsen, 2014).

Hypothesis 1: Source Credibility has a positive relationship with Information Usefulness about spa tourism destinations.

Hypothesis 2: Source Credibility has a positive relationship with the acceptance of shared information about spa destinations.

*Hypothesis 3***:** *Source Credibility has a positive relationship with the intention to visit spa destinations.*

Information Quality includes clarity, completeness, accuracy, organization, and timeliness of the content. In wellness tourism, high-quality information reduces uncertainty, enhances trust, and increases users' confidence in making decisions about health-oriented experiences. Empirical studies highlight that detailed and well-structured content increases perceived usefulness and acceptance, thereby positively influencing visit intention (Cheung *et al.*, 2008; Rodrigues *et al.*, 2023; Wang & Yan, 2022).

Hypothesis 4: Information Quality about spa and hot springs destinations increases the perceived usefulness of that information.

Hypothesis 5: Information Quality about spa and hot springs destinations increases its acceptance by the user.

Hypothesis 6: Information Quality about spa and hot springs destinations increases the user's intention to visit them.

Information Credibility focuses on the truthfulness, consistency, and reliability of the content itself. In wellness tourism, credible content, such as verifiable facts, authentic testimonials, or scientifically backed claims, enhances perceived usefulness, promotes acceptance, and reinforces visit intentions (Erkan & Evans, 2016; González Rodríguez *et al.*, 2022).

Hypothesis 7: Information Credibility about spa and hot springs destinations increases its perceived usefulness.

Hypothesis 8: Information Credibility about spa and hot springs destinations has a positive and direct effect on user acceptance.

Hypothesis 9: Information Credibility about spa and hot springs destinations positively influences its visit intention.

Needs of Information reflect users' motivation to seek specific knowledge, particularly relevant in spa tourism for evaluating therapeutic benefits, safety, or facilities. Higher information needs lead to more careful evaluation of eWOM content, increasing perceived usefulness and acceptance (Dai *et al.*, 2022; Tariyal *et al.*, 2023).

Hypothesis 10: The greater the need for information is, the higher the perceived usefulness of eWOM about thermal destinations.

Hypothesis 11: Needs of Information about spa and hot springs destinations has a positive effect on the acceptance of user-generated content.

Hypothesis 12: Needs of Information about spa and hot springs destinations positively affects the intention to visit them.

Information Usefulness mediates the effect of Source Credibility, Information Quality, Information Credibility, and Needs of Information on acceptance and behavioral intention. When users find content helpful in resolving doubts, reducing risk, or confirming expectations, they are more likely to adopt it and translate that acceptance into a concrete intention to visit the destination (Cheung *et al.*, 2008; Filieri & McLeay, 2014; Goyal & Taneja, 2023).

Hypothesis 13: A positive attitude toward the usefulness of eWOM content increases its acceptance in spa and hot springs destinations.

Hypothesis 14: Acceptance of eWOM content significantly increases the intention to visit spa and hot springs destinations.

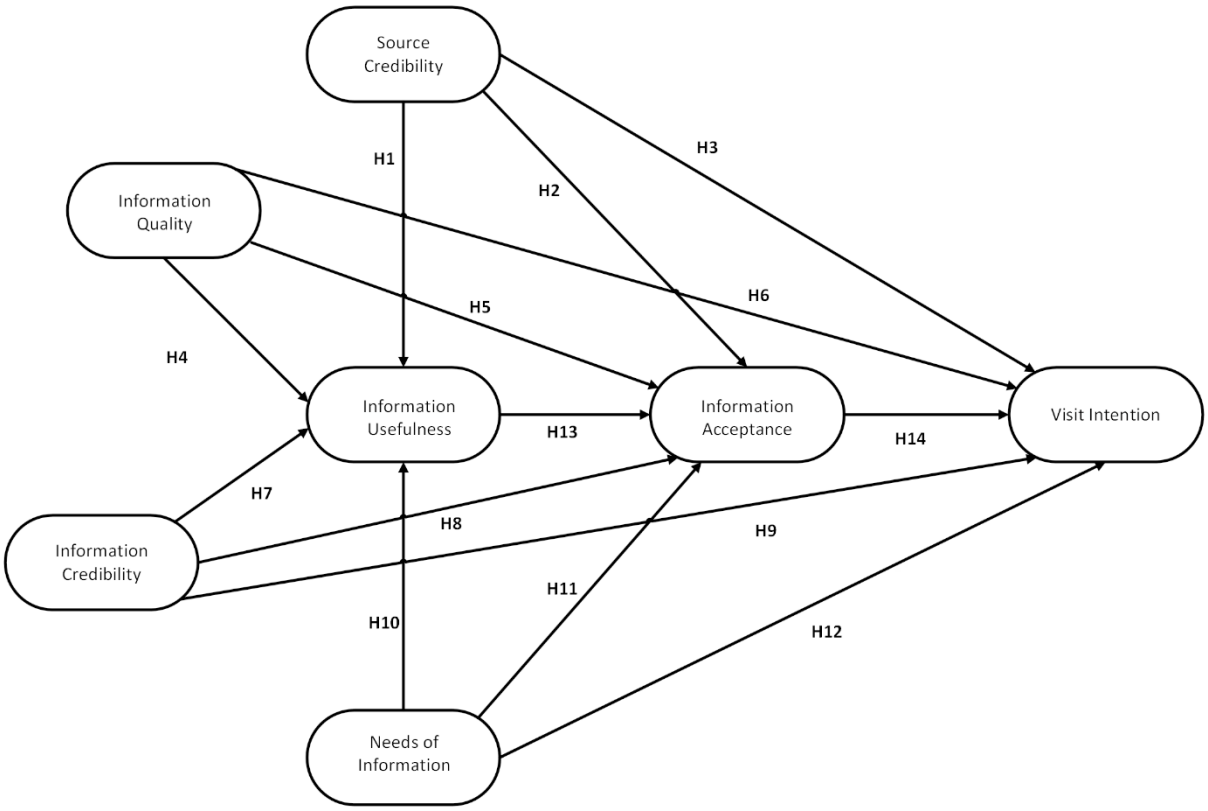

Figure 1
Theoretical model proposed
Source: Own elaboration.

4. RESEARCH DESIGN AND METHODOLOGY

This research pursues various objectives through the application of Structural Equation Modelling (SEM). The methodological approach adopted in this study follows the most recent and authoritative guidelines for the application of PLS-SEM (Hair *et al.*, 2011; Hair *et al.*, 2017; Hair *et al.*, 2019; Hair *et al.*, 2022; Henseler, 2018; Henseler, 2021; Henseler *et al.*, 2018), constituting the primary methodological reference in variance-based structural equation modelling.

Firstly, it involves an exploratory study aimed at preliminarily analyzing the relationships between the variables included in the proposed theoretical model. This model has been adapted from the approaches developed by Sussman and Siegal (2003) and Erkan and Evans (2016) regarding information acceptance models, though in this case, it is specifically oriented towards the context of online information related to spa and wellness tourism destinations.

In a second phase, the research adopts an explanatory approach, aimed at thoroughly examining the structure of the proposed theoretical model and its capacity to evaluate the ac-

ceptance and perceived usefulness of eWOM about spa centers as a precursor to tourists' visit intention. The analysis was structured around a two-step procedure involving assessment of the measurement model and subsequent evaluation of the structural model, including reliability, convergent and discriminant validity, collinearity checks, and path significance estimation.

Finally, a predictive dimension is considered, with the objective of determining whether the proposed model could generate consistent results when applied to a different sample. This phase allows for the evaluation of its potential generalizability to other contexts (Sarstedt & Danks, 2021; Shmueli & Koppius, 2011).

4.1. Questionnaire Development

Based on the proposed theoretical model, a questionnaire was developed to collect the information required for this research. In the first section, questions were included to gather participants' sociodemographic data, as well as information related to the use of social networks and the consultation of online reviews about spas and thermal centers. Subsequently, items corresponding to the seven constructs that form the adopted theoretical model were included. Table 1 details the included constructs, the corresponding items, and the bibliographic sources used for their development. This instrument was specifically adapted to the study context, focusing on the acceptance and use of information generated through eWOM in the field of spa tourism, taking the IACM model (Erkan & Evans, 2016) as a reference. A five-point Likert scale (1 = strongly disagree; 5 = strongly agree) was used to measure the items, a methodology commonly applied in SEM analyses (Hair *et al.*, 2022).

Since all measurement scales were originally developed in English, the questionnaire underwent a translation/back-translation procedure (Brislin, 1980). One researcher independently translated the items into Spanish, and a second expert performed a back-translation into English. Discrepancies were discussed until full semantic equivalence was reached. A pilot test with 25 participants was conducted to assess clarity and comprehension, resulting in minor wording adjustments.

Table 1
Constructs Used

Code	Construct	Indicators	References
SC	Source Credibility	4	Cheung *et al.*, (2008); Sussman & Siegal, (2003)
IQ	Information Quality	4	Cuong (2024); Erkan & Evans, (2016)
IC	Information Credibility	4	Cuong (2024); Erkan & Evans, (2016); Ngo *et al.*, (2024)
IN	Needs of Information	4	Erkan & Evans, (2016); Ngo *et al.*, (2024)
IU	Information Usefulness	4	Cheung *et al.*, (2008); Cuong (2024); Erkan & Evans, (2016); Ngo *et al.*, (2024)
IA	Information Acceptance	4	Cuong (2024); Erkan & Evans, (2016)
VI	Visit Intention	4	Erkan & Evans, (2016); García de Blanes *et al.*, (2024)

Source: Own elaboration.

4.2. Data Collection

Data was collected through a self-administered online survey on Google Forms, chosen for its efficiency, low cost, and anonymity (Dillman & Smyth, 2007). Conducted face-to-face from February to May 2025, a total of 302 valid responses were obtained. A homogeneous convenience sampling technique was applied, which is appropriate when the objective is to gather data from individuals who share key characteristics relevant to the phenomenon under study and when probability sampling frames are not feasible (Etikan *et al.*, 2016; Jager *et al.*, 2017). In this research, the target population consisted of visitors to spas and hot springs in the province of Ourense (Galicia, Spain), who represent a relatively homogeneous group regarding exposure to wellness tourism experiences and eWOM information. Participants were approached on-site through QR codes displayed at spa facilities, and only adults who had used at least one spa or hot spring within the last 12 months were invited to participate. Although non-probabilistic sampling limits strict generalizability, this design ensures environmental relevance and provides an adequate sample for PLS-SEM analyses, exceeding standard recommendations for minimum sample size (Hair *et al.*, 2022).

The questionnaire was anonymous and self-administered, and respondents provided informed consent before beginning the survey. Participation was voluntary and no incentives were offered. Permission to place QR codes in spa facilities was obtained through prior collaboration agreements with each establishment. To minimize response bias, items belonging to predictors and outcome variables were placed in separate blocks and scale anchors were kept consistent across constructs.

4.3. Sample Size

To determine the minimum required sample size for this study, various estimation methods were applied complementarily. First, according to Hair *et al.* (2022), in the context of Structural Equation Modeling using Partial Least Squares (PLS-SEM), a sample of at least 20 cases is sufficient to achieve a statistical power of 0.80, with a significance level of 0.05 and a minimum expected coefficient of determination of $R^2 = 0.50$, considering five independent variables in the model. On the other hand, following the methodological recommendations of Chin & Newsted (1999), based on the works of Cohen (1988)

and Green (1991), it is established that, to detect a medium effect size with a statistical power of 0.80 and a significance level of 0.05, the minimum required sample size would be 91 cases, also considering five predictors. Finally, when applying these criteria using the online calculator developed by Soper (2025), the recommended minimum sample size is 170 participants. In this regard, since a total of 302 valid responses were collected, it is concluded that the sample size is adequate for the purposes of this study.

4.4. Bias Control

Several procedural and statistical solutions were implemented to address common method bias (CMB) (Podsakoff *et al.*, 2003). Procedurally, anonymity was guaranteed, participation was voluntary, and predictor and criterion constructs were placed in different sections of the questionnaire to reduce respondents' ability to infer relationships. Additionally, item wording was simplified to minimize ambiguity. Furthermore, participants were informed that there were no right or wrong answers and that data would be analyzed only in aggregate form, helping reduce social desirability effects.

To assess common method bias (CMB), Harman's single-factor test was conducted by loading all measurement items into an unrotated principal component analysis. The results show that the first factor accounts for 47.4% of the total variance, which is below the 50% threshold typically used as an indication of substantial method bias (Podsakoff *et al.*, 2003). In addition, the full collinearity VIFs in Table 2 indicate that six constructs are below the 3.3 threshold and only one (Information Usefulness) falls within the conservative 3.3-5.0 range (Kock & Lynn, 2012; Kock, 2015). Taken together, these results suggest that CMB is unlikely to threaten the validity of the findings.

Table 2
Full collinearity VIFs (Common Method Bias)

SC	SQ	IC	IN	IU	IA	VI
2.736	2.570	3.171	2.563	3.775	2.767	1.725

Source: Own elaboration.

5. ANALYSIS OF THE RESULTS

5.1. Descriptive Analysis

A descriptive analysis of the sample is shown in Table 3. Respondents were evenly distributed by sex and balanced by age, with Generation X slightly predominant (27.2%) and Generation Alpha scarcely represented. Most held a university degree (50.7%) or technical training (41.1%). The majority reported annual incomes between €10,000 and €18,000 (40.5%). Regarding online behavior, 56.6% spent 1-3 hours per day online, 57.3% used social media as their main information source about spas, and 41.7% had posted online comments. Most had visited 2-3 spas in the past year, with bookings split between online and other methods. The most visited centers in Ourense were Outariz, As Burgas, Arnoia, and Molgas (see Appendices).

5.2. Data review and filtering

Following the review of the descriptive data from the sample, a series of preliminary procedures were carried out before initiating the PLS-SEM analysis. First, the presence of missing values and outliers was examined, with 15 outlier observations identified and excluded from subsequent analysis. Additionally, the skewness and kurtosis values of the items included in the study were assessed. Although PLS-SEM is considered a non-parametric method, some authors recommend verifying the data's approximation to a normal distribution, since extreme values could affect the validity of the results (Hair *et al.*, 2022). In this regard, the analysis revealed that all items had skewness values below 3 and kurtosis values under 10, which, according to the criteria established by Matas-Terron (2023), indicates no significant evidence of deviation from normality in the data analyzed.

5.3. Measurement Model Analysis

The analysis of the measurement model was carried out using the PLS-SEM technique, with the objective of evaluating the relationships between the observed items and the latent variables, thereby determining the internal consistency and reliability of the proposed model (Hair *et al.*, 2017).

5.3.1. Item Reliability, internal consistency and convergent validity

As shown in Table 3, all retained indicators loaded above the 0.707 threshold value (Carmines & Zeller, 1979), which an indicator is considered to have acceptable reliability. About construct internal consistency, Composite reliability (ρc) values are ranged between 0.900 and 0.940, Cronbach's α values between 0.809 and 0.901, and AVE values are between 0.692 and 0.887 for all constructs, supporting internal consistency and convergent validity (Fornell & Larcker, 1981; Hair *et al.*, 2019; Nunnally & Bernstein, 1994).

Table 3
Item and Construct Reliability & Convergent Validity (AVE)

Construct	Indicators	Loadings	Cronbach's Alpha	Dijkstra-Henseler (rho_a)	Composite Reliability (rho_c)	AVE
Information Acceptance	**IA1**	0.914	0.809	0.810	0.913	0.840
	IA2	0.919				
Information Credibility	**IC1**	0.931	0.868	0.882	0.938	0.883
	IC2	0.949				
Information Usefulness	**IU3**	0.940	0.873	0.874	0.940	0.887
	IU4	0.944				
Needs of information	**IN3**	0.945	0.858	0.871	0.933	0.875
	IN4	0.926				
Source Credibility	**SC1**	0.755	0.879	0.901	0.916	0.733
	SC2	0.879				
	SC3	0.889				
	SC4	0.893				
Information Quality	**IQ1**	0.796	0.851	0.860	0.900	0.692
	IQ2	0.884				
	IQ3	0.859				
	IQ4	0.784				
Visit Intention	**VI1**	0.819	0.901	0.904	0.931	0.772
	VI2	0.912				
	VI3	0.912				
	VI4	0.869				

Source: Own elaboration.

5.3.2. Discriminant Validity

With regard to discriminant validity (that is, whether the constructs in the developed model are empirically distinct from each other), the results obtained from the HTMT (Heterotrait-Monotrait) matrix, developed by Henseler *et al.* (2015), were analyzed. The reference threshold used is 0.90 (Gold *et al.*, 2001). As shown in Table 4, all values are below this threshold, indicating the presence of discriminant validity in the model.

Table 4
Heterotrait-Monotrait Ratio (HTMT)

	IA	IC	IQ	IU	IN	SC	VI
Information Acceptance							
Information Credibility	0.326						
Information Quality	0.815	0.308					
Information Usefulness	0.555	0.863	0.306				
Needs of Information	0.808	0.475	0.796	0.494			
Source Credibility	0.289	0.835	0.326	0.803	0.296		
Visit Intention	0.515	0.588	0.369	0.686	0.483	0.496	

Source: Own elaboration.

Additionally, as shown in Table 5, the Fornell–Larcker criterion was fulfilled, with the square root of each construct's AVE exceeding its correlations with other constructs (Fornell-Larcker, 1981).

Table 5
Fornell-Larcker criterion

	IA	IC	IQ	IU	IN	SC	VI
Information Acceptance	0.916						
Information Credibility	0.276	0.940					
Information Quality	0.678	0.269	0.832				
Information Usefulness	0.467	0.756	0.268	0.942			
Needs of Information	0.678	0.414	0.689	0.430	0.935		
Source Credibility	0.258	0.734	0.288	0.713	0.278	0.856	
Visit Intention	0.440	0.523	0.325	0.610	0.426	0.450	0.879

Source: Own elaboration.

5.4. Structural Model Analysis

Once measurement model analysis has been completed, the next step is to analyze the structural model and verify how the constructs relate to each other.

5.4.1. Collinearity Diagnosis

First, it is essential to ensure that the internal model is free from multicollinearity, as high levels can distort the interpretation of the individual effects of constructs. To this end, it is necessary to calculate the Variance Inflation Factor (VIF), using a reference threshold value of 3 for detecting potential collinearity issues (Hair *et al.*, 2019). The results, presented in Table 6, show that all VIF values are below the established threshold, indicating the absence of significant collinearity among the constructs.

Table 6
Variance Inflation Factors (VIF)

	IA	IC	IU	IN	SC	IQ	VI
Information Acceptance							2.205
Information Credibility	2.986		2.501				2.506
Information Usefulness	2.863						
Needs of Information	2.359		2.207				2.581
Source Credibility	2.699		2.288				2.298
Information Quality	2.041		2.006				2.338
Visit Intention							

Source: Own elaboration.

5.4.2. Hypothesis Testing

Finally, the analysis of the results presented in Table 7 is carried out, which includes the estimated path coefficients between the different constructs of the model, as well as the statistical significance associated with each relationship. To evaluate the latter, a one-tailed bootstrap resampling technique based on the original samples was applied (Hair *et al.*, 2011), using a total of 10,000 bootstrap samples (Streukens & Leroi-Werelds, 2016). From this procedure, standard errors, t-values, and 90% confidence intervals were obtained. These results allow for the empirical testing of the hypotheses formulated in the theoretical framework. As observed in Table 7, all path coefficients fall within the established confidence intervals. However, when analyzing their statistical significance, the hypotheses supported by the data are: H1, H3, H5, H7, H9, H10, H11, H12, H13, and H14. In contrast, hypotheses H2, H4, H6, do not reach sufficient levels of significance and therefore are not considered supported. In the case of H8, the hypothesis must also be rejected, as the relationship obtained is in the opposite direction to that initially proposed.

Table 7
Hypothesis testing

Hypothesis	Path coefficients (β)	Indirect effect	Total effect	Standard errors	T statistics	5%	95%	p values	Decision
H1: SC -> IU	0.379		0.379	0.075	5.042	0.255	0.503	**0.000**	**Supported**
H2: SC -> IA	–0.122	0.189	0.067	0.086	1.423	–0.264	0.019	**0.077**	**Not supported**
H3: SC -> VI	0.128	0.020	0.148	0.070	1.836	0.013	0.242	**0.033**	**Supported**
H4: IQ -> IU	–0.111		–0.111	0.068	1.641	–0.222	0.000	**0.050**	**Not supported**
H5: IQ -> IA	0.443	–0.055	0.388	0.071	6.211	0.326	0.561	**0.000**	**Supported**
H6: IQ -> VI	–0.072	0.115	0.042	0.063	1.142	–0.177	0.032	**0.127**	**Not supported**
H7: IC -> IU	0.412		0.412	0.081	5.110	0.279	0.544	**0.000**	**Supported**
H8: IC -> IA	–0.254	0.206	–0.048	0.087	2.917	–0.398	–0.111	**0.002**	**Not supported**
H9: IC -> VI	0.323	–0.014	0.309	0.066	4.880	0.214	0.432	**0.000**	**Supported**
H10: IN -> IU	0.230		0.230	0.074	3.111	0.108	0.352	**0.001**	**Supported**
H11: IN -> IA	0.297	0.115	0.412	0.083	3.592	0.161	0.433	**0.000**	**Supported**
H12: IN -> VI	0.106	0.122	0.228	0.063	1.694	0.003	0.209	**0.045**	**Supported**
H13: IU -> IA	0.500		0.500	0.090	5.533	0.351	0.649	**0.000**	**Supported**
H14: IA -> VI	0.295		0.295	0.090	3.295	0.148	0.443	**0.000**	**Supported**

Measurement correlation-values: $p < 0.100$, $p < 0.050$, $p < 0.010$, $p < 0.001$.
Source: Own elaboration.

5.4.3. Determination Coefficient (R^2)

Once the supported and unsupported hypotheses within the structural model have been determined, the results of the PLS-SEM model obtained are presented in Figure 2, including the outer loadings of each item and the path coefficients for each proposed hypothesis. Additionally, the R^2 coefficients are also included, which indicate the explanatory power of the model. In this regard, for the variable *Information Usefulness*, an R^2 of 0.651 and an adjusted R^2 of 0.646 were obtained; for *Information Acceptance*, an R^2 of 0.634 and an adjusted R^2 of 0.627 were obtained; and for the variable *Visit Intention*, an R^2 of 0.379 and an adjusted R^2 of 0.368 were obtained.

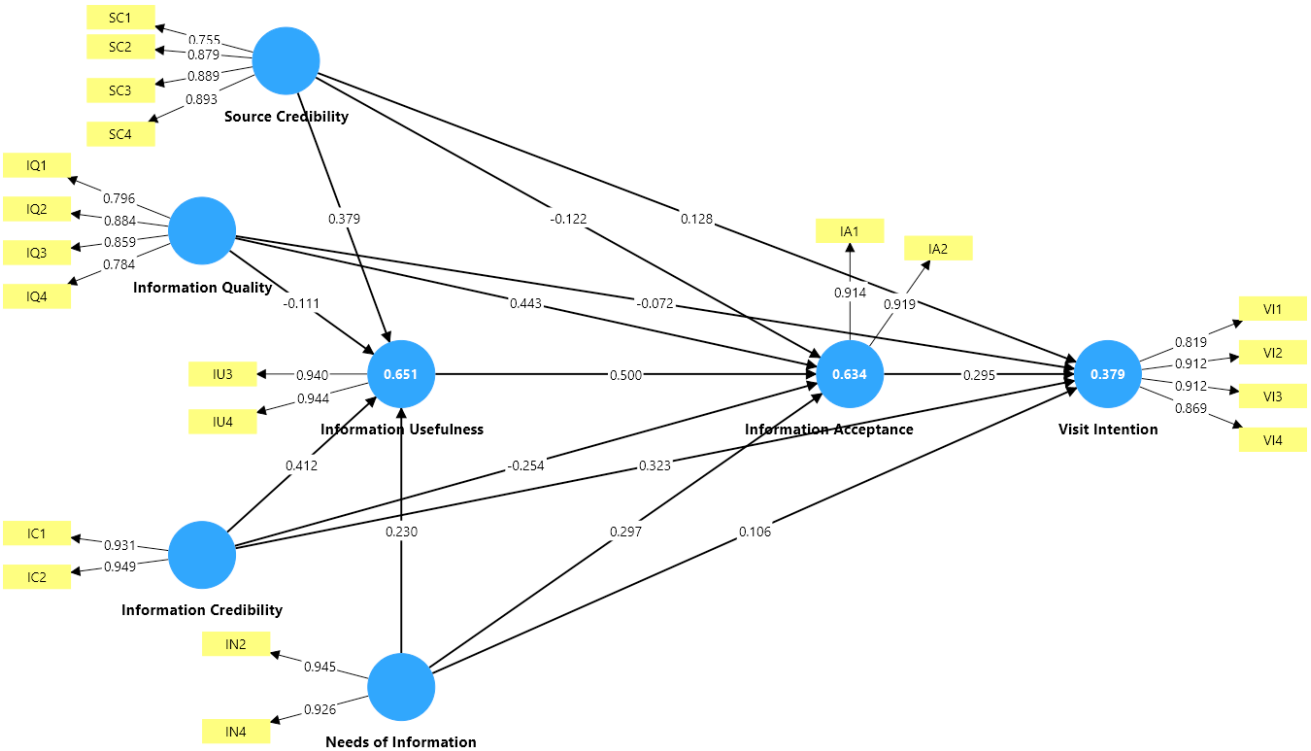

Figure 2
PLS-SEM model
Source: Own elaboration. Adapted from Smart PLS-4.

5.5. Out-of-sample predictive power (PLSpredict)

Finally, the predictive capability of the developed model was evaluated to determine its applicability to future samples different from the one used in the present study. For this purpose, the PLSpredict algorithm was employed, which allows estimating the predictive power of the model (Shmueli *et al.*, 2019).

Table 8 shows the values of the Q^2 statistic corresponding to each of the items of the endogenous constructs. All obtained values are positive, indicating that the proposed PLS model has a predictive capability superior to that of predictions generated by the benchmark model (Shmueli *et al.*, 2019).

Additionally, the prediction errors of the PLS model were compared with those of the linear regression model (LM) generated by the algorithm. As shown in Table 8, the Root Mean Squared Error (RMSE) values of the PLS model are lower than those of the LM in all cases, except for two indicators of the Visit Intention construct.

Table 8
Model's predictive power

Prediction's summary	Q^2	PLS-SEM_RMSE	LM_RMSE	Difference RMSE
IA1	0.422	0.520	0.538	–0.018
IA2	0.450	0.499	0.503	–0.005
IU3	0.541	0.552	0.579	–0.027
IU4	0.574	0.574	0.586	–0.012
VI1	0.226	0.701	0.688	0.013
VI2	0.308	0.683	0.687	–0.004
VI3	0.210	0.744	0.747	–0.003
VI4	0.247	0.829	0.821	0.008

Source: Own elaboration.

Additionally, the predictive power of the model is further analyzed using the Cross-validated Predictive Ability Test (CVPAT), where it is essential that the model has a lower average loss difference than the averages of the indicators (IA) (Sharma *et al.*, 2022), and the linear model (LM) prediction benchmark (Shmueli *et al.*, 2019).

Table 9
Cross-validated Predictive Ability Test

CVPAT vs. IA	Average loss difference	t	p
Information Acceptance	–0.201	5.808	0.000
Information Usefulness	–0.401	7.225	0.000
Visit Intention	–0.181	5.565	0.000
Overall	–0.241	7.456	0.000
CVPAT vs. LM	**Average loss difference**	**t**	**p**
Information Acceptance	–0.012	1.383	0.168
Information Usefulness	–0.022	2.666	0.008
Visit Intention	0.005	0.617	0.538
Overall	–0.006	0.836	0.404

Source: Own elaboration.

As shown in Table 9, the model's average loss is significantly lower than the average of the indicators, which supports the predictive validity of both the individual constructs and the model. However, when comparing the model's average losses with those of the reference linear regression model (LM), it is observed that only in the Information Usefulness construct are these losses significantly lower.

6. CONCLUSIONS

This study has empirically validated a theoretical model based on the IACM to explain the acceptance and use of eWOM in the context of spa tourism in northwestern Spain. The results obtained through PLS-SEM confirm that Source Credibility, Information Credibility, and Information Usefulness are key factors significantly influencing content acceptance and the intention to visit spa and hot spring destinations. Significant relationships were also detected in paths added to the original IACM model, expanding the scope of the research.

6.1. Discussion

This research advances a user-centered analytical perspective that reveals the cognitive processes through which travelers evaluate and internalize online information. In general terms, the results confirm that Source Credibility, Information Credibility, and Needs of Information are determining factors in Information Usefulness, which in turn influences eWOM acceptance and the intention to visit spas and hot springs destinations, aligning with previous research (Filieri & McLeay, 2014; Erkan & Evans, 2016; Song *et al.*, 2021). In this sense, findings portray a decision process in spa and wellness tourism that is fundamentally grounded in trust and information relevance. Tourists appear to rely on eWOM when it provides credible, experience-proximal cues that help them imagine benefits, reduce uncertainty, and form actionable intentions.

Firstly, results show that Source Credibility positively affects Information Usefulness. This aligns with Cheung *et al.*

(2008) and Goyal & Taneja (2023), highlighting that perceived expertise and honesty increase trust, especially in emotionally engaging contexts like wellness tourism. However, the direct effect of Source Credibility on Information Acceptance was not confirmed. This suggests that credibility alone does not ensure acceptance; the information must first be perceived as useful. In contrast, Source Credibility directly influences Visit Intention. This means that, a prestigious source, such as an institutional website with associated eWOM, could generate visit intention even if the information is not perceived as useful or accepted.

Furthermore, Information Credibility has been detected a strong predictor of Information Usefulness. This aligns with González-Rodríguez *et al.* (2022) and Goya & Taneja (2023), emphasizing that content truthfulness and coherence influence usefulness, acceptance, and visit intention. This highlights the importance for spa managers to provide authentic, verifiable, and emotionally relevant content. However, the direct effect between Information Credibility and Information Acceptance was rejected, indicating that credibility alone does not ensure acceptance, usefulness must be perceived first. Finally, results show that credible information directly affects visit intention, even if it is not perceived as useful or acceptable. To sum up, credibility appears to serve as a risk-reduction function in wellness tourism: when travellers believe that either the messenger or the message can be trusted, they are more likely to treat the content as diagnostic and to progress toward acceptance and intention.

While well-structured, clear and complete information facilitates acceptance, its influence on Information Usefulness and immediate intention is more limited than might be expected. In a domain where people anticipate subjective well-being outcomes, credibility and personal relevance appear to outweigh purely formal attributes of quality. This finding contrasts with studies such as Rodrigues *et al.* (2023) and Wang & Yan (2022), which highlight the importance of structure, clarity, and emotional richness of content in forming favorable attitudes towards tourism destinations. One possible explanation is that, in wellness tourism, users prioritize credibility and practical usefulness of content over formal quality. This reinforces the idea that perceived quality does not always translate into behavioral action, especially if it is not perceived as relevant or trustworthy. This does not diminish the value of quality standards; rather, it indicates that, in wellness, stylistic refinement is likely to be persuasive only when embedded in content that feels authentic and trustworthy. This nuance qualifies generic tourism findings on information quality and underscores the importance of aligning message form with the specific anxieties, aspirations and evaluation heuristics that characterise spa decision-making.

A consistent pattern is that travellers with stronger information need to engage more intensively with eWOM, extract greater perceived usefulness from it, and are more inclined to accept it. In practical terms, wellness visitors who seek clarity about therapeutic benefits, safety, accessibility or specific facilities appear to invest more effort in evaluating reviews and testimonials, and that effort pays off in the form of actionable guidance. This result aligns with Dai *et al.* (2022) and Tariyal *et al.* (2023), who argue that users with greater informational needs tend to engage more actively with eWOM, especially in high involvement contexts like wellness tourism. Furthermore, this finding suggests that digital content should be designed to respond to specific informational needs, which would increase its persuasive impact.

On the other hand, results of this study exhibit convergence with prior research conducted in hotel settings. For instance, the strong influence of credibility on Information Usefulness and Visit Intention aligns with Berné *et al.* (2020), who identify credibility as a contextual variable that shapes decision processes in hotels. Similarly, Berné *et al.* (2023) show that credible eWOM can trigger concrete organisational actions and behavioural responses in the hotel ecosystem. Regarding Information Quality, the partial support found in this research is aligned with Gilabert & Berné (2024), who argue that the impact of eWOM quality depends on its perceived usefulness and the evaluative motives of decision-makers. This reinforces the idea that in experience-driven tourism contexts, the influence of information quality may be indirect or contingent on deeper psychological mechanisms, including perceived relevance and usefulness. Overall, the parallels with hotel-based research validate the theoretical structure of the adapted IACM and demonstrate that the cognitive mechanisms underlying eWOM acceptance extend across related hospitality sectors.

Across the model, Information Usefulness emerges as the psychological axis through which credibility and motivation-related indicates are transformed into acceptance and, ultimately, into intention. When eWOM is experienced as practically helpful (answering concrete questions, reducing ambiguity, and enabling mental simulation of the spa experience), travellers are more willing to internalise it and to act upon it. These results are consistent with the IACM model postulates (Erkan & Evans, 2016) and recent studies such as García de Blanes *et al.* (2024), highlighting the mediating role of usefulness in the acceptance of tourist information.

The proposed model explains 65.1% of the variance in Information Usefulness, 63.4% in Information Acceptance, and 37.9% in Visit Intention. In this context, it should be considered that acceptable R^2 values depend on the research context and the discipline studied (Hair *et al.*, 2019). Values of 0.20 can be considered high in studies related to consumer behavior (Hair *et al.*, 2022), where visit decisions are usually influenced by multiple personal, contextual, and emotional factors. Therefore, the values obtained in the present model exceed this threshold by a wide margin. Furthermore, the R^2 values obtained for the variables Information Usefulness and Information Acceptance are high, supporting the robustness of the model. Since the objective of the study is to understand interpretation mechanisms, this level of explained variance is adequate and consistent with the exploratory and explanatory approaches adopted. It is recognized that the Visit Intention construct is complex and may depend on more variables than those included in the model, which could increase the final R^2 values. Additional factors such as price, time availability, social platform used, prior experiences, or destination image may not be contemplated in the model and could be useful in future research to improve its explanatory power.

PLSpredict results showed that all Q^2 values were positive, indicating that the PLS model outperforms the reference linear regression (LM) model in predictive capacity. This demonstrates the model's effectiveness in anticipating how users perceive and accept information about thermal centers. RMSE values were

lower for the PLS model across most indicators, especially for Information Usefulness, reinforcing its predictive robustness. These results allow concluding that the constructs Information Acceptance, Information Usefulness, and Visit Intention present an adequate predictive capability with respect to new observations. Finally, the CVPAT analysis confirmed that the PLS model has a significantly lower average prediction loss across constructs. Compared with the LM model, Information Usefulness was the only latent variable showing a significant difference. Therefore, a high predictive power can be conclusively confirmed only for this construct.

6.2. Theoretical Implications

This study offers several theoretical contributions that extend current understandings of eWOM and information acceptance processes in experiential tourism contexts.

First, the findings expand the scope of eWOM by demonstrating that credibility play a foundational role not only in transactional or purchase-oriented decisions but also in experience-driven choices, such as selecting a spa or hot springs destination. In these settings, travellers rely on eWOM as a proxy for intangible and affective qualities of the experience, suggesting that credibility functions as a psychological anchor that enables visitors to anticipate sensory, emotional, and well-being outcomes. This shifts eWOM theory beyond its traditional focus on functional product evaluation and highlights its relevance in domains where expectations are shaped by imagination, trust, and the desire for restorative experiences.

Second, the study positions Needs of Information as a central and previously underexplored driver of eWOM processing. Rather than acting merely as a background motivation, Needs of Information operates as a catalyst that intensifies cognitive engagement, making travellers more likely to treat online reviews as diagnostically useful and behaviourally actionable. This insight advances information acceptance models by introducing a more dynamic view of user motivation, one that links the desire to resolve uncertainty with the depth of message elaboration and subsequent behavioural responses. In doing so, the model shows that informational motivation is not only antecedent but also transformative, shaping the way individuals filter, evaluate, and internalize online content in wellness contexts.

Third, the results highlight the pivotal and mediating function of Information Usefulness as the mechanism through which experiential attributes of eWOM become behavioural intentions. This reinforces usefulness as the cognitive core of Information Acceptance while revealing its heightened importance in well-being-oriented tourism. In such contexts, usefulness is not limited to providing instrumental guidance but also helps individuals envision how an experience aligns with personal goals of health, balance, and emotional restoration. Finally, the study deepens the theoretical understanding of how visitors construct meaning from eWOM when evaluating highly subjective experiences.

Collectively, these contributions demonstrate that eWOM theory evolves when applied to experiential rather than transactional decision-making. The model validated here shows that visitors navigating intangible, emotionally charged, and wellness-related choices process online information through mechanisms that are broader and more motivationally rich than those typically observed in conventional consumer behaviour.

6.3. Managerial Implications

Findings provide several actionable insights for spa and wellness destination managers on how to design and manage eWOM strategies that effectively influence visitor decision-making.

First, given that credibility is a key determinant of both Information Usefulness and Visit Intention, managers should prioritise actions that increase trust in digital environments. This includes encouraging verified and detailed reviews, showcasing staff qualifications, and using formats that convey authenticity, such as video testimonials or behind-the-scenes content, instead of highly polished promotional messages. This approach enhances the credibility cues visitors rely on to assess the intangible benefits of spa experiences.

Second, the central role of Information Needs suggests that managers must identify and directly respond to the most common questions of wellness travellers (e.g., therapeutic effectiveness, hygiene, accessibility, staff expertise, expected sensations or benefits). Content such as guided walkthroughs, FAQs, or Q&A formats helps to meet these needs and encourages deeper processing of eWOM, increasing perceived reliability.

Finally, because Information Usefulness acts as a mediator between Credibility and Visit Intention, managers should develop content that assists users in making informed choices: visual itineraries, personalised recommendations, evidence-based explanations of treatments, or simple service-comparison tools. Such materials transform eWOM into a practical planning resource, it would be necessary to strengthen its acceptance and its effect on behavioural intentions.

7. LIMITATIONS AND FUTURE RESEARCH AGENDA

Although this research provides a robust assessment of the IACM in the context of spa and wellnes tourism, several limitations arise from the pattern of supported and unsupported hypotheses that deserve specific reflection.

First, four relationships originally proposed in the model were not supported (H2, H4, H6, H8), revealing conceptual nuances in how wellness travellers process online information. For instance, the non-significant effect of Source Credibility on Information Acceptance (H2) suggests that credibility alone is not sufficient for users to internalise eWOM. Travellers appear to require that credible information be processed as useful before it becomes actionable. This is considered a challenge for the assumptions of classical information acceptance models.

Similarly, Information Quality did not significantly predict either Information Usefulness (H4) or Visit Intention (H6). This contradicts findings in general tourism contexts and indicates that, within wellness tourism, formal attributes of quality (clarity, completeness, structure) may be less influential than perceptual attributes such as authenticity or relevance to personal well-being needs. Future research should therefore reconsider whether

"quality" in experiential settings should be conceptualised more affectively, rather than structurally.

The lack of support for H8 reinforces this interpretation: although credible content increases Information Usefulness and Visit Intention, it may not translate directly into acceptance unless travellers perceive that information as personally meaningful. This opens a pathway to explore motivational fit or goal congruence as mediators of information processing in wellness contexts.

Building on these findings, several opportunities should be explored. First, future studies should examine whether travellers interpret credibility and quality through emotional resonance, experiential relevance, or affective authenticity rather than through classical informational criteria. Mixed-methods designs could reveal how wellness tourists define "trustworthy" and "useful" information. Furthermore, qualitative analysis could help explain why travellers may trust a message yet not incorporate it into their decision-making. Second, since several credibility-related hypotheses were not supported, future research should test variables such as emotional congruence, perceived relevance, wellness motivations, or perceived risk reduction as potential mediating mechanisms. Third, because unsupported hypotheses may reflect local behavioural patterns, replication in destinations with different wellness traditions, digital cultures, or risk perceptions would help assess boundary conditions of the adapted IACM. Finally, factors such as prior spa experience, health status, platform type, or social influence may clarify the inconsistent effects observed for Information Quality, integrating them into expanded models.

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APPENDIX

Table A.1
Sociodemographic Data of the Sample

Variable		Frequency	Percentage
Sex	Man	148	49.00%
	Woman	154	51.00%
Year of birth	Before 1964 (Baby Boomers)	73	24.20%
	1965-1981 (Gen. X)	82	27.20%
	1982-1994 (Millenials)	70	23.20%
	1995-2009 (Gen. Z)	67	22.20%
	2010-2025 (Gen. Alpha)	10	3.30%
Level of studies	Post Graduate Studies	153	50.70%
	Technicians	124	41.10%
	Undergraduate Studies	13	4.30%
	High School	12	4.00%
	No Studies	0	0.00%
Annual income	Less than 10,000€	37	12.40%
	10,000-18,000€	121	40.50%
	19,000-35,000€	62	20.70%
	36,000-60,000€	69	23.10%
	More than 60,000€	10	3.30%
Numer of internet hours spent	None	0	0.00%
	1-3 hours	171	56.60%
	4-5 hours	77	25.50%
	6-7 hours	37	12.30%
	More than 8 hours	17	5.60%
Sources to search information about hot springs or spas (various responses)	Social media	173	57.28%
	Opinion's websites	87	28.80%
	Official websites	72	23.84%
	Press	57	18.87%
	TV	76	25.16%
	Radio	64	21.19%
Made online comments about hot springs or spas?	Yes	126	41.7%
	No	176	58.30%
Number of hot springs or spas visited in last year	None	6	2.00%
	1	66	21.90%
	2-3	141	46.70%
	4-5	55	18.20%
	More than 5	34	11.30%
Hot springs or spas booked online?	Yes	154	51.70%
	No	144	48.30%
Hot springs or spas visited in Ourense's province (various responses)	A Chavasqueira	33	10.90%
	Muiño da Vega	70	23.20%
	Outariz	204	67.50%
	As Burgas	160	53.00%
	Prexigueiro	73	24.20%
	Cortegada	49	16.20%
	Arnoia	93	30.80%
	Molgas	85	28.80%
	Laias	70	23.20%
	Carballiño	73	24.20%
	Partovia	70	23.20%
	Lobios	59	19.50%

Source: Own elaboration.

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Corporate social performance as a market force: Analysing its impact on stocks' tail risk and upside potential in the Spanish equity market

El desempeño social corporativo como fuerza de mercado: Análisis de su impacto sobre el riesgo de cola y el potencial alcista en el mercado continuo español

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ABSTRACT

This study examines the impact of corporate social performance (CSP) and its subdimensions (workforce, human rights, community, and product responsibility) on firms' tail risk and upside potential in the Spanish stock market. Focusing on the period from 2014 to 2021, annual corporate financial performance (CFP) metrics were computed through filtered historical simulation (FHS), a semiparametric approach based on Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models and bootstrapping. This approach allows the main stylized facts of stock returns (i.e., autocorrelation, volatility clusters, and heavy tails) to be accounted for and, at the same time, firms' financial performance to be computed from the simulated distribution. The main findings reveal a complex time-dependent connection between CSP and its subdimensions and firms' tail risk and upside potential. In fact, while CSP reduces tail risk in the short term, it increases maximum loss in the long term. Interestingly, the results do not provide any evidence of the existence of a risk–return trade-off effect. Finally, the study highlights the need to monitor specific CSP subdimensions such as human rights and community, since they entail higher tail risk and lower upside potential.

Keywords: Corporate social performance, Tail risk, Upside potential, Filtered historical simulation.

RESUMEN

Este estudio analiza el impacto del desempeño social corporativo (DSP) y sus subdimensiones (empleo, derechos humanos, comunidades locales, responsabilidad sobre productos) sobre el riesgo de cola y el potencial alcista en el mercado continuo español, durante el periodo 2014-2021. Las métricas de desempeño financiero han sido estimadas mediante simulación historical filtrada, un método semi paramétrico que combina modelos de heterocedasticidad condicional y remuestreo aleatorio con repetición. Esté método permite estimar la distribución empírica de las rentabilidades, considerando sus características principales (i.e., autocorrelación, clústeres de volatilidad y colas pesadas). Los resultados revelan una compleja dependencia temporal entre el DSP y sus subdimensiones y el desempeño financiero, medido por el riesgo de cola y el potencial alcista. Mientras que el DSP reduciría el riesgo de cola a corto plazo, generaría un aumento de la perdida máxima a largo plazo. Asimismo, los resultados no muestran evidencia empírica respecto a una compensación entre la rentabilidad y el riesgo. Finalmente, este estudio subraya la relevancia de analizar el efecto específico de subdimensiones como los derechos humanos o las comunidades locales, dado que parecen conllevar un mayor riesgo de cola y un menor potencial alcista.

Palabras clave: Desempeño social corporativo, Riesgo bajista, Potencial alcista, Simulación histórica filtrada.

1. INTRODUCTION

Socially responsible investment (SRI) plays a relevant role in the transition towards sustainable development, given its potential to influence the behaviour of companies (Widyawati, 2020). SRI strategies have evolved from more basic approaches, such as negative screening, to more sophisticated ones, like impact investing (Folqué *et al.*, 2021). In this context, attention to environmental, social and governance (ESG) factors affects the various stages of the investment process, starting with asset allocation (De Giuli *et al.*, 2024). Therefore, it appears highly relevant that different stakeholders, namely investors (both institutional and retail), policymakers and academics, fully comprehend the effect of ESG factors on the financial performance (FP) of investments (Cunha *et al.*, 2020).

The effect of ESG performance on the FP of stocks has mainly been analysed by considering the risk–return paradigm (Widyawati, 2020). However, the impact of firms' ESG performance on the risk of their stocks has recently gained attention in the scholarly literature. In this research area, empirical evidence often shows contradictory and mixed results (Bruna & Lahouel, 2022; Pistolesi & Teti, 2024; Rouine *et al.*, 2022). Papers refer to different theoretical frameworks to motivate their working hypotheses and when discussing their results. In summary, stakeholder theory and signalling theory appear to support an inverse relationship between ESG performance and risk (Diemont *et al.*, 2016; Wu & Hu, 2019). Nevertheless, according to agency theory, if high ESG performance is not perceived as genuine it may lead to higher risk (Landi *et al.*, 2022). Other authors go beyond the linear paradigm and propose a quadratic relationship (Korinth & Lueg, 2022; Pistolesi & Teti, 2024).

Most studies focus on classical risk metrics (i.e., overall, systematic, and idiosyncratic risk), and only a few analyse the effect of ESG performance on tail risk (Bax *et al.*, 2023; Diemont *et al.*, 2016; Lööf *et al.*, 2022; Viviani *et al.*, 2019; Zhang *et al.*, 2023). Tail risk reflects the maximum expected loss over a period, associated with a given probability. According to Diemont *et al.* (2016), "even minor variations in the VaR [Value at Risk] in terms of percentages can have great impact on the monetary value" (p. 228). Therefore, understanding the effect of ESG performance on tail risk may be relevant. The available empirical evidence highlights some aspects that may enable a proper understanding of this relationship. First, it appears to be highly relevant to analyse the effect of ESG performance at the disaggregated level. The findings of Diemont *et al.* (2016) reveal that the effect of corporate social responsibility (CSR) on tail risk varies with the different subdimensions. Secondly, ESG performance may affect tail risk in both the short and the long term (Lööf *et al.*, 2022). Finally, the nature of this relationship appears to depend on the ESG-awareness level (Zhang *et al.*, 2023), the expectations of investors (Diemont *et al.*, 2016), and the regulatory environment (Brooks & Oikonomou, 2018). The empirical analysis of a concrete market may provide valuable insights.

It may also be relevant to assess whether the risk–return trade-off holds in the case of ESG. Some authors argue that, in a market in equilibrium, stocks with high ESG performance may yield lower returns because the risk is perceived to be lower (Luo, 2022). Conversely, other scholars consider that, under the weak version of the efficient market hypothesis, taking ESG reporting into account may lead to higher returns (Ni & Sun, 2023). The integration of these two opposite views is proposed in the literature, by considering the existence of a transition period in which increasing ESG concerns and investor preferences provide superior returns on stocks with high ESG performance (Cornell, 2021; Pástor *et al.*, 2022).

This study focuses on the effect of corporate social performance (CSP) and its subdimensions (workforce, human rights, community, and product responsibility) on stocks' tail risk and upside potential. The focus is placed on the social dimension of ESG performance since most of the subdimensions of CSP are targeted at primary stakeholders (Dumitrescu & Zakriya, 2021). An empirical analysis is conducted in the Spanish stock market for the period 2014-2021. Tail risk and upside potential metrics are estimated through the filtered historical simulation (FHS) method. Likewise, the correlated random effects (CRE) approach is used to analyse the effects of CSP on tail risk and upside potential. This paper contributes to the literature in three ways. First, FP metrics that consider features of stock returns are employed. The estimated tail risk (upside potential) metrics account for series dependence, volatility clustering and heavy-tailed distribution. Second, the relationship between CSP and tail risk (upside potential) is analysed at the disaggregated level. The relationship appears to vary between the specific subdimensions. While some subdimensions may have a significant effect (either negative or positive), others may lack statistical significance. Moreover, some specific effects may not be reflected in the overall score because of compensatory effects. However, most of the previous scholarly literature appears to assess the effect of overall ESG performance (including the three pillars together). Third, this study focuses on a particular market. As has been previously discussed in other works, the effect of sustainability performance on tail risk (upside potential) appears to depend on the region under study. The relevance of SRI in Spain has grown significantly in the last decade. Assets managed in a way that considers ESG factors have increased from 125,239 million euros in 2013 to 236,894 million euros in 2023 (Spainsif, 2024).

The rest of this paper is structured as follows. First, the literature on the relationship between ESG performance and FP is reviewed, and hypotheses are developed. Secondly, the methods used in this study are explained in section 3. The sample is described in section 4. After this, empirical evidence is presented and discussed. Finally, implications and limitations are developed in the conclusions section.

2. LITERATURE REVIEW, THEORETICAL NOTES, AND DEVELOPMENT OF HYPOTHESES

The effect of ESG performance on risk is gaining increasing attention in the scholarly literature. In this research area, empirical evidence shows diverse results. Some studies find that high ESG performance lowers risk (Liu *et al.*, 2023; Shakil, 2021). This inverse relationship is explained in the literature by reference to two different theories, namely stakeholder theory and signalling theory. According to stakeholder theory, companies, through ac-

tive engagement with their stakeholders, reduce the probability of negative social events having an impact on their operations (Diemont *et al.*, 2016; Shakil, 2021; Viviani *et al.*, 2019). Companies with poor CSP may be exposed to several social risks such as consumer protests and labour strikes (Gao *et al.* 2025). Risks derived from adverse social events appear to be of concern to a wide range of stakeholders (including institutional investors), despite the difficulty of measuring them (Boiral *et al.*, 2020). Therefore, high performance in terms of material social issues may lower the risk perceived by investors.

Signalling theory also suggests an inverse relationship between CSP and risk. According to Wu and Hu (2019), negative news about a firm may lead to massive stock sell orders, given the information asymmetries between the company and investors. These authors suggest that financial markets might perceive CSR as a positive signal, reducing information asymmetries. Lower information asymmetries appear to contribute to a decrease in perceived risk. Therefore, if investors understand CSP as a positive signal, high CSP may reduce risk.

Conversely, a direct relationship between CSP and risk may be explained by agency theory. Managers may engage in social activities to enhance their reputation, raising the agency costs (Korinth & Lueg, 2022). Landi *et al.* (2022) argue that:

> This generates a non-negligible agency risk and leads to penalizing these companies in the stock market. In addition, the investments made toward sustainability by a company could be considered a sacrifice of profit for an unnecessary social or environmental cause, rather than an entrepreneurial opportunity that is preserved over time through an economic added value. (p. 1104)

Therefore, non-genuine social engagement appears to increase the risk perceived by investors, because of an inefficient allocation of resources. Moreover, high CSP may lead to higher risk in regions where the overall CSP of firms is already high. According to Diemont *et al.* (2016), in regions where the CSR commitment of companies and the expectations of investors are high, additional investment may not yield a benefit, and may thus increase the perceived risk.

Some authors have recently proposed the existence of a quadratic relationship between ESG performance and risk. Pistolesi and Teti (2024), for the U.S. stock market, document an inverted U-shaped relationship between ESG performance and systematic risk. This relationship appears to hold for the three pillars (i.e., environmental, social, and governance) individually. According to these authors, initial ESG investment requires a considerable amount of resources and yields relatively low benefits. This leads to higher perceived risk. Once a certain investment threshold is overcome, the benefits of ESG investment are realized and the risk perceived by investors is decreased. By contrast, Korinth and Lueg (2022) find a U-shaped relationship between ESG performance and risk in the German stock market. Results are consistent across environmental and social pillars. These authors explain that investors initially value the benefits of investing in ESG activities, reducing perceived risk. However, investors may consider that exceeding a certain threshold entails an inefficient allocation of resources, leading to a higher perceived risk.

Considering the diversity in empirical evidence, the employment of risk measures that properly account for the key features of stock returns may contribute to enhancing the robustness of the results. After analysing the performance of several Dow Jones sustainability indices (Global, Asia-Pacific, Emerging Markets, Europe, and US), Cunha *et al.* (2020) highlight the relevance of using financial performance metrics that consider the non-normality of stock returns. Likewise, some scholars have recently emphasized the relevance of assessing the impact of CSP on risk metrics that adequately consider the asymmetric preferences of investors regarding negative and positive deviations from expected returns (Gao *et al.*, 2025; Hoepner *et al.*, 2024). Tail risk reflects the maximum expected loss over a period associated with a given probability. This risk measure has been widely employed in internal market risk management frameworks, since it uses one number to summarize a complex reality (Marimoutou *et al.*, 2009). Moreover, the estimation of tail risk appears to play a relevant role in the regulatory capital requirements set by Basel III (Ruiz & Nieto, 2023). The accurate estimation of tail risk demands the consideration of certain stock return features, namely series dependence, volatility clustering and heavy-tailed distribution (Wang *et al.*, 2011).

Diemont *et al.* (2016) conducted one of the first studies on the relationship between sustainability performance and tail risk. These authors highlight various conclusions from their empirical study of the effect of CSR on the tail risk of a global equity sample (2003-2011). First, the effect appears to vary between the different CSR dimensions. The period under study may play a relevant role too, with the statistical significance of the relationship increasing under highly volatile market conditions. Finally, the relationship appears to depend on the region under study. Lööf *et al.* (2022) analyse the effect of ESG scores on the tail risk of an international sample of stocks. The empirical study is divided into two periods: 2018-2019 and 2020. The authors consider both the short-term and the long-term effect of ESG scores on firms' tail risk. The results indicate that better ESG scores lead to lower tail risk. In 2018-2019, the effect is only significant in the long term, but during the pandemic ESG scores also reduced tail risk in the short term. The environmental pillar appears to drive the long-term effect. Viviani *et al.* (2019) also study the effect of CSR on tail risk, analysing a global sample. Their findings document an inverted relationship between tail risk and CSR. At the disaggregated level, high performance in the following subdimensions appears to entail lower tail risk: human resources, environment, business behaviour, community involvement and human rights. Shafer and Szado (2020) show an inverse relationship between ESG performance and tail risk, over the period 2009-2015. Results are consistent across the three pillars. Abdelaziz *et al.* (2024) assess the impact of ESG performance on stock's extreme returns in the U.S. stock market, over the period 2016-2023. According to their findings higher ESG performance appears to reduce the magnitude of extreme returns. However, the effect over the probability of suffering extreme stock returns appears not to be clear. The environmental and social pillars display a similar pattern to that of the overall score. Gao *et al.* (2025) analyse the effect of ESG performance on the tail risk and upside potential of U.S. financial institutions, over the period 2016-2019. They find that financial institutions with higher ESG performance appear to have lower tail risk exposure and higher upside potential. Finally, Zhang *et al.* (2023)

analyse the relationship between ESG performance and tail risk at the fund level in China, during the period 2018-2021. These authors consider that the effect of ESG performance on fund tail risk depends on three different channels. Two of these, the firm and flow channels, are expected to lower tail risk. Conversely, under modern portfolio theory, the diversification channel is expected to increase tail risk. Zhang *et al.* (2023) argue that the final effect depends on which of the channels dominates.

Applying the previous reasoning and working on the basis that investors perceive the social engagement of firms in the Spanish stock market to be genuine, the following hypothesis is proposed:

H1: An increase in CSP lowers tail risk.

Additionally, it may also be relevant to analyse the effect of CSP on upside potential to assess whether the risk–return trade-off holds. Furthermore, investors appear to react heterogeneously to negative and positive deviations from expected returns (Gao *et al.*, 2025). The existence of a positive relationship between stock returns and CSP is supported by some studies. Based on the resource-based view, Inoue and Lee (2011) argue that high CSP may contribute to the creation of various intangible assets (e.g., employee commitment, customer loyalty, and corporate reputation). According to these authors, these intangible resources may positively influence investors' expectations for the future financial performance of the firm. However, it is also argued that CSP would only provide investors with superior returns if this information is not fully priced in (Mănescu, 2011; Ni & Sun, 2023). Furthermore, the existence of investors who obtain non-financial utility from investing in stocks with high CSP may also explain a positive effect on stock returns (Mănescu, 2011).

On the other hand, the empirical evidence provided by other studies points to a negative effect of CSP on stock returns. Several authors argue that, in a market in equilibrium, investors may perceive that companies with low CSP bear higher levels of risk, and so demand a premium (Ni & Sun, 2023). The empirical evidence provided by Luo (2022) points to the existence of an ESG premium in the UK stock market from 2003 to 2020. The results of Díaz *et al.* (2021) also show that an ESG factor significantly explains stock returns in the U.S. financial market during Covid-19. Lööf *et al.* (2022) show that the risk–return trade-off holds, through the assessment of the effect of ESG scores on both the tail risk and the upside potential of stocks. Likewise, investors may consider that the potential economic benefits associated with CSP do not exceed its costs, and hence may lower their expectations for the future financial performance of the firm. If CSP is not fully priced in, a negative effect on stock returns would be expected (Mănescu, 2011).

Other authors try to integrate these two opposing views by considering the idiosyncrasies of the period under study. Cornell (2021) distinguishes two periods: transition and equilibrium. According to this author, in the transition period, concerns regarding ESG issues rise, resulting in a higher demand for stocks with high ESG performance, and, thus, higher returns. When the market reaches an equilibrium, the preference of investors for companies with high ESG performance leads to lower discount rates, lowering the expected return. The evidence provided by the empirical analysis conducted by Pástor *et al.* (2022), in the U.S stock market, supports this hypothesis.

Taking into account the reviewed literature, and assuming that the risk–return trade-off holds for CSP in the Spanish stock market, the following hypothesis is proposed:

H2: An increase in CSP lowers the upside potential.

As has already been mentioned in this section, the effect of CSP on FP may vary over time. The existence of a transition period may explain the time-varying effect of CSP on upside potential (Cornell, 2021; Pástor *et al.*, 2022). Likewise, exceeding a certain threshold may entail changes in the risk that investors perceive to arise from additional investment in CSP (Korinth & Lueg, 2022; Pistolesi & Teti, 2024). Therefore, the following hypotheses are proposed:

H3(a): CSP affects tail risk differently in the short and the long term.

H3(b): CSP affects upside potential differently in the short and long term.

Another relevant aspect to consider is that the effect of CSP on FP may vary within the subdimensions. The studies reviewed in this section show that most of the existing research focuses on analysing the impact of ESG performance on tail risk (upside potential) at the aggregate level. Only a few studies assess the impact of specific stakeholders (Diemont *et al.*, 2016; Viviani *et al.*, 2019). Bouslah *et al.* (2013) suggest that "Two firms with the same aggregate CSP could have different relations with firm risk. Since CSP is a multidimensional construct that embodies several dimensions, the expected impacts on risk predicted by the theories reviewed in the previous section may differ by CSP dimension" (p. 1261). The fact that each subdimension targets a different stakeholder may explain the existence of specific effects at the disaggregated level (Dumitrescu & Zakriya, 2021). Higher performance in subdimensions targeted at primary stakeholders may contribute to the creation of intangible assets that are positively valued by investors (Inoue & Lee, 2011). Furthermore, subdimensions that are easily measurable, have a low degree of ambiguity and are widely accepted by investors are more likely to have an impact on FP (Bouslah *et al.*, 2013). The social dimension of ESG performance targets primary stakeholders (e.g. employees and customers). Likewise, investors appear to be more able to accurately assess the benefits and cost associated with further investments in this dimension, rather than those associated with environmental initiatives (Dumitrescu & Zakriya, 2021). The workforce subdimension is targeted at employees and measures the performance of the firm in the following four areas: diversity and inclusion, career development and training, working conditions, and health and safety. Higher performance in this subdimension may strengthen the commitment of employees, and, hence, have a positive effect on efficiency, productivity, and turnover (Esteban-Sanchez *et al.*, 2017). Product responsibility, a subdimension targeted at customers, assesses the performance of the firm in the following areas: responsible marketing, product quality and data privacy. According to the scholarly literature, high product responsibility may contribute to increased sales through customer loyalty (Inoue & Lee, 2011). Community performance encompasses social issues such as

public health, business ethics and being a good citizen. According to Esteban-Sanchez *et al.* (2017), the ultimate effect of this subdimension on FP depends on whether the reputational benefits exceed the cost from philanthropy. Inoue and Lee (2011) point to the degree of dependence between the firm's operations and local communities as a factor that may influence the effect on FP. Finally, human rights assesses the degree to which the firm respects fundamental human rights. Involvement in human rights violation damages the reputation of a firm (Tsai & Wu, 2022).

Accordingly, the following hypotheses are proposed:

H4(a): The effect of CSP on tail risk varies between its different subdimensions (workforce, human rights, community, and product responsibility).

H4(b): The effect of CSP on upside potential varies between its different subdimensions (workforce, human rights, community, and product responsibility).

3. MATERIALS AND METHODS

The analysis of the effect of CSP on the tail risk (upside potential) of stocks encompasses two fundamental challenges. The first challenge is the estimation of annual tail risk (upside potential) metrics. CSP involves long-term organisational change (Bruna & Lahouel, 2022), so it appears more appropriate to assess its impact on long-term tail-risk (upside potential) metrics. Most of the studies use shorter horizon metrics (Abdelaziz *et al.*, 2024; Lööf *et al.*, 2022; Shafer and Szado, 2020). Although daily tail risk (upside potential) metrics can be estimated directly from composite conditional mean and conditional variance models, the proper estimation of multi-period metrics appears to require a more sophisticated approach. The square-root-of-time rule has been popular in the estimation of multi-period risk metrics, but it underestimates the downside risk metrics because it ignores certain distributional features of stock returns (namely autocorrelation, volatility clustering and fat tails) (Wang *et al.*, 2018). Another approach is to employ two-step procedures. According to Ruiz and Nieto (2023), two-step procedures yield more robust estimates by first modelling the conditional variance of stock returns, and then computing the corresponding percentile or conditional expectation. Filtered historical simulation (FHS), an iterated two-step procedure, is the method selected for this study. Given the semiparametric nature of FHS, distributional assumptions regarding future stock returns are not required. Assumed future return distribution plays a significant role in tail risk estimation (Louzis *et al.*, 2014), and simplistic assumptions are often made (Mancini & Trojani, 2011). Furthermore, the employment of conditional variance models enables the consideration of a data generating process that accounts for the main stylized facts of stock returns (Wang *et al.*, 2011). The results of FHS appear to be adapted to the current state of volatility of the market, because of the employment of filtered standardized residuals (Marimoutou *et al.*, 2009). As a result, FHS may enable extreme values that were not included in the original dataset to be forecast (Barone-Adesi & Giannopoulos, 2001). Finally, another advantage often associated with FHS is that it yields a complete distribution of future returns (Mancini & Trojani, 2011). This advantage may enhance the robustness of the analysis since several tail risk (upside potential) measures can be directly computed from the simulated distribution, even at different confidence levels.

Second, the analysis of the effect of CSP on tail risk (upside potential) requires the variability of time series and cross-sectional data to be properly captured. In this study, a panel data analysis is conducted, through the CRE approach proposed by Mundlak (1978).

3.1. Filtered historical simulation (FHS)

The FHS is divided into three phases: risk modelling, filtering of historical returns and estimation of tail risk and upside potential metrics. In the first phase, risk modelling, composite conditional mean and conditional variance models are employed. These econometric time series models consider the following features of stock returns: series dependence, volatility clustering and heavy-tailed distributions (Bollerslev *et al.*, 1992; Engle & Bollerslev, 1986). Three possible conditional mean processes are considered, to account for series dependence: random walk (RW), AR(1), and ARMA(1,1) given by:

$$r_{i,t} = \alpha_i + \varepsilon_{i,t} \tag{1}$$

$$r_{i,t} = \alpha_i + \varphi_1 r_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

$$r_{i,t} = \alpha_i + \varphi_1 r_{i,t-1} + \varphi_2 \varepsilon_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

A symmetric and two asymmetric conditional variance models are considered, to model volatility clusters: GARCH (1,1), GJR (1,1,1) and EGARCH (1,1,1).

$$\sigma^2_{i,t} = \omega_i + \gamma_1 \sigma^2_{i,t-1} + \alpha_1 \varepsilon^2_{i,t-1} \tag{4}$$

$$\sigma^2_{i,t} = \omega_i + \gamma_1 \sigma^2_{i,t-1} + \alpha_1 \varepsilon^2_{i,t-1} + \delta_1 I\left[\varepsilon_{i,t-1} < 0\right] \varepsilon^2_{i,t-1} \tag{5}$$

$$\log \sigma^2_{i,t} = \omega_i + \gamma_1 \log \sigma^2_{i,t-1} + \alpha_1 \left[\frac{|\varepsilon_{i,t-1}|}{\sigma_{i,t-1}} - E\left(\frac{|\varepsilon_{i,t-1}|}{\sigma_{i,t-1}} \right) \right] + \delta_1 I\left[\frac{\varepsilon_{i,t-1}}{\sigma_{i,t-1}} \right] \tag{6}$$

Finally, two different distributions of the innovation are considered to account for the potential existence of heavy tails: Gaussian and Student's t.

The findings of Naik *et al.* (2020) show that the Bayesian information criterion (BIC) provides better results than the Akaike information criterion (AIC) when selecting smaller-order conditional variance models. In this study, the model that best fits each financial time series is selected according to the BIC. Daily logarithmic stock returns from 2004-2021 are employed.[1]

[1] The models that best fit each financial times series are not shown for brevity but are available upon request.

In the second phase of the FHS, historical returns are filtered following the methodological approach proposed by Barone-Adesi *et al.* (1999). This approach is conducted in four steps, as follows: 1) composite conditional mean and variance models are fitted, 2) i.i.d. standardized residuals are computed, 3) bootstrapping and, 4) simulation of n-paths of h-horizon daily returns are performed. The model selected, in the risk modelling phase, is fitted to each logarithmic return time series. Historical conditional means, conditional variances, and residuals are inferred. Thereafter, standardized i.i.d. residuals are computed ($z_{i,t}$). In this study, ten years of earlier daily stock returns are used for the estimation of the coefficients of the models.

In the third step, n-paths of h-horizon standardized residuals are generated, through random sampling with replacement (bootstrapping) (Le, 2020). Bootstrapping allows one to make no assumptions regarding the future distribution of the stock returns. The bootstrapped standardized residuals are introduced into the previously estimated composite conditional mean and conditional variance models, simulating the n-paths of h-horizon daily returns (Barone-Adesi *et al.*, 1999). The simulation algorithm works as follows. First, one-day-ahead conditional variance ($\sigma^2_{i,t}$) is forecasted by plugging into the conditional variance equation the last available residual ($\epsilon_{i,t-1}$) and conditional variance ($\sigma^2_{i,t-1}$). Afterwards, the respective standardized residual ($z_{i,t}$) is drawn from the previously generated n-paths of h-horizon sample. This standardized residual ($z_{i,t}$) is multiplied by the conditional standard deviation forecast ($\sigma_{i,t}$), reflecting the current state of volatility of the markets. This operation yields a forecast for the residual ($\epsilon_{i,t}$). Finally, one-day-ahead logarithmic return ($r_{i,t}$) is forecasted by plugging into the conditional mean equation the residual ($\epsilon_{i,t}$). This process is repeated h-times for each of the n-paths. In this study, 100,000 paths of 250 daily standardized residuals are generated for each year.

Simulated daily logarithmic returns can be aggregated as follows to compute h-period returns, given the additive property of logarithmic returns (Le, 2020):

$$r_{t,h} = \sum_{i=1}^{h} r_{t+i} \tag{7}$$

The filtering process is repeated for each of the eight years through a rolling window scheme, always using ten years of earlier daily stock returns.

In the final phase, the tail risk and upside potential metrics are calculated. Once the complete distribution of future stock returns for a given year has been estimated, several tail risk (upside potential) metrics can be directly computed. Tail risk is defined as the maximum expected loss with a probability p over a given period. Value at Risk (VaR) and Expected Shortfall (ES) are commonly employed as tail risk indicators (Le, 2020). Conversely, upside potential is defined as the maximum expected gain with a probability p over a given period. Value of Return (VoR) and conditional Value of Return (cVoR) can be employed as upside potential indicators.

While VaR is estimated as a percentile of a stock return distribution, ES is computed as the conditional expectation of all the losses above a given VaR level (Yamai & Yoshiba, 2005). ES has gained popularity (Ruiz & Nieto 2023), since disregarding losses over a given VaR level may have profound consequences (Yamai & Yoshiba, 2005). The same applies to the upside potential measures.

$$VaR_{i,t,\alpha} = -\inf\left[r_{i,t} \middle| P(R_{i,t} \le r_{i,t}) > \alpha\right] \tag{8}$$

$$ES_{i,t,\alpha} = E\left[r_{i,t} \middle| r_{i,t} \le VaR_{i,t,\alpha}(r_{i,t})\right] \tag{9}$$

$$VoR_{i,t,\alpha} = \left[r_{i,t} \middle| P(R_{i,t} \ge r_{i,t}) > \alpha\right] \tag{10}$$

$$cVoR_{i,t,\alpha} = E\left[r_{i,t} \middle| r_{i,t} \ge VoR_{i,t,\alpha}(r_{i,t})\right] \tag{11}$$

In this study, VaR, ES, VoR and cVoR measures are estimated at three different confidence levels (90%, 95% and 99%), to enhance the robustness of the analysis. Furthermore, it may be relevant for the various stakeholders to understand how the effect of CSP varies when the selected metric reflects a more extreme situation. The analysis may shed light on specific effects. ES/cVoR appears to be a more robust tail risk/upside potential indicator since it displays the conditional expectation of all the losses/gains beyond a given VaR/VoR level. Likewise, the higher the confidence level, the higher the maximum expected loss.

3.2. *Connecting corporate social performance and tail risk/upside potential*

The effect of CSP and its subdimensions on tail risk (upside potential) is analysed through the CRE regression approach proposed by Mundlak (1978). Panel data models are often used to handle the endogeneity that may arise from unobserved heterogeneity, by capturing the time series and cross-sectional variability of data (Wooldridge, 2010). The CRE approach combines the advantages of both fixed effect and random effects estimators, by considering the potential correlation between the individual random effects and the explanatory variables (Mundlak, 1978).

The CRE regression model proposed in this study considers both the short-term and the long-term effects of CSP and its subdimensions on the tail risk (upside potential). Sixty different models are estimated, considering the four independent variables (VaR, ES, VoR, cVoR) at three different confidence levels (90%, 95%, 99%). CSP and its four subdimensions (workforce, human rights, community, and product responsibility) are included as explanatory variables. In line with the work of Lööf *et al.* (2022), the following control variables are considered: market value (MV), price to earnings ratio (PER), dividend yield (DIVYIELD) and systematic risk (BETA). Time fixed effects haven been considered to control for the effect of atypical events, such as covid (Lahouel *et al.*,2022), on the dependent variable. The following expression shows an example of the estimated models. In this case, equation (12) captures the impact of CSP on the VaR of stocks.

$$\widehat{VaR_{i,t}} = \beta_0 + \mu_i + \beta_\omega CSP_{i,t} + \beta_b \overline{CSP_i} + \sum_{j=1}^{4} \beta_j FC_{i,t} + \lambda_t + \varepsilon_{i,t} \tag{12}$$

where $\widehat{VaR_{i,t}}$ is the VaR of company i in period t, μ_i is the stock-specific effect, which is uncorrelated with the error term $\varepsilon_{i,t}$, β_b and β_b refer to the within and between estimates, λ_t is the time effects, $FC_{i,t}$ refers to the values of the financial controls of stock i in period t, and $\overline{CSP_{i,t}}$ refers to the average CSP score for stock i. The between estimate measures the long-term influence of the variable, while the within estimate shows the short-term impact. The same rationale is applied to the tail risk (upside potential) metrics and the subdimensions of CSP.

4. SAMPLE SELECTION AND DESCRIPTION

Previous studies have pointed out that the relationship between CSP and tail risk (upside potential) may depend on the region under study. First, the nature of this relationship appears to be influenced by ESG awareness level (Zhang *et al.*, 2023), the expectations of investors (Diemont *et al.*, 2016) and the regulatory environment (Brooks & Oikonomou, 2018). Secondly, the reaction to extreme events may be heterogeneous within regions. Therefore, this study focuses on the empirical analysis of one region. Europe is the selected region, given the strong institutional support granted to the sustainability paradigm. In the last decade, the European Union has adopted several sustainability reporting mandates, namely the Non-Financial Reporting Directive (extended by the Corporate Sustainability Reporting Directive), the Taxonomy Regulation, the Sustainable Finance Disclosure Regulation, and Pillar 3 Disclosures on ESG Risks (Hummel & Jobst, 2024). However, EU member nations present divergent macroeconomic fundamentals (fiscal deficit, competitiveness, and solvency), and thus their stock markets may react differently to extreme events. The findings of Alexakis and Pappas (2018) show that European equity markets reacted heterogeneously to both the Global Financial Crisis (GFC) and the European Sovereign Debt Crisis (ESDC) in terms of the timing and magnitude of the financial contagion. Because of this, the focus is only on one European equity market, the Spanish stock market. According to the survey conducted by Spainsif (2024), the value of assets in Spain that are managed to take into account ESG factors has grown from 125,239 million euros in 2013 to 236,894 million euros in 2023. Regarding the evolution of tail risk, according to the findings of Shahzad *et al.* (2016), European stock markets can be classified into two groups. The VaR of the first group decreased to normal levels after the GFC and ESDC, while the VaR of the second group remained vibrant and registered peaks after 2012. The Spanish stock market belongs to the second group.

The relationship between CSP and its subdimensions and tail risk/upside potential, in the Spanish stock market, is analysed for the period 2014-2021. Financial data and CSP scores were obtained from the Thomson Reuters Refinitiv database. The initial dataset comprised the 121 stocks listed on the Spanish stock market. Only those companies showing complete data for scores for CSP and its subdimensions over the period of analysis were included in the final sample. Thus, after checking for the availability of CSP scores in the period under study, 44 stocks were identified. Those that did not have ten years of earlier stock prices were removed, yielding a sample of 34 stocks. Finally, stocks with recurrently extreme tail risk (upside potential) metrics were also excluded. A final sample of 29 stocks with a total of 215 stock-year observations was examined. Nearly 45% of the stocks are from companies that operate in the financial and industrial sectors. Consumer non-cyclicals is the sector with the lowest representation in the sample.

The availability of CSP scores and the length of stock returns time series has restricted the size of the sample, limiting the generalisability of the findings. The popularity of passive investment strategies has lately increased (Laborda *et al.*, 2024). The stocks in the sample represent 83.17% of the IBEX35 market capitalization on 31 December 2023. Thus, this sample could be considered representative of the Spanish stock market, although, the size of the sample limits the generalisability of the findings to a wider context.

Table 1 summarizes the main descriptive statistics of the tail risk and upside potential metrics. Figure 1 displays the boxplots by year of $ES_{0.05}$ and $cVoR_{0.05}$. Figure 1 reveals that 2014 was the year with the lowest maximum expected loss and variability in the Spanish stock market. Likewise, 2021 appears to be the year with the highest maximum expected loss and variability, because of the Covid-19 crisis. However, some stocks appear to have had an especially high upside potential during the pandemic. The year with the highest upside potential in the Spanish stock market was 2015.

Table 1
Descriptive statistics of tail risk and upside potential estimates

Variable	Mean	Median	Std. Dev.	Max	Min
$VaR_{0.1}$	−0.37	−0.37	0.14	−0.07	−0.84
$VaR_{0.05}$	−0.51	−0.52	0.17	−0.14	−1.11
$VaR_{0.01}$	−0.84	−0.84	0.26	−0.29	−1.79
$ES_{0.1}$	−0.58	−0.58	0.19	−0.17	−1.25
$ES_{0.05}$	−0.72	−0.72	0.23	−0.23	−1.54
$ES_{0.01}$	−1.05	−1.06	0.33	−0.37	−2.30
$VoR_{0.1}$	0.36	0.34	0.09	0.75	0.17
$VoR_{0.05}$	0.44	0.43	0.11	0.94	0.24
$VoR_{0.01}$	0.61	0.57	0.16	1.33	0.33
$cVoR_{0.1}$	0.47	0.45	0.12	1.01	0.26
$cVoR_{0.05}$	0.55	0.51	0.14	1.18	0.30
$cVoR_{0.01}$	0.71	0.65	0.20	1.55	0.37

Notes: $VaR_{0.1}$ denotes yearly Value-at-Risk at 90% confidence level. The rest of the variables are interpreted in the same way.

Source: Own elaboration.

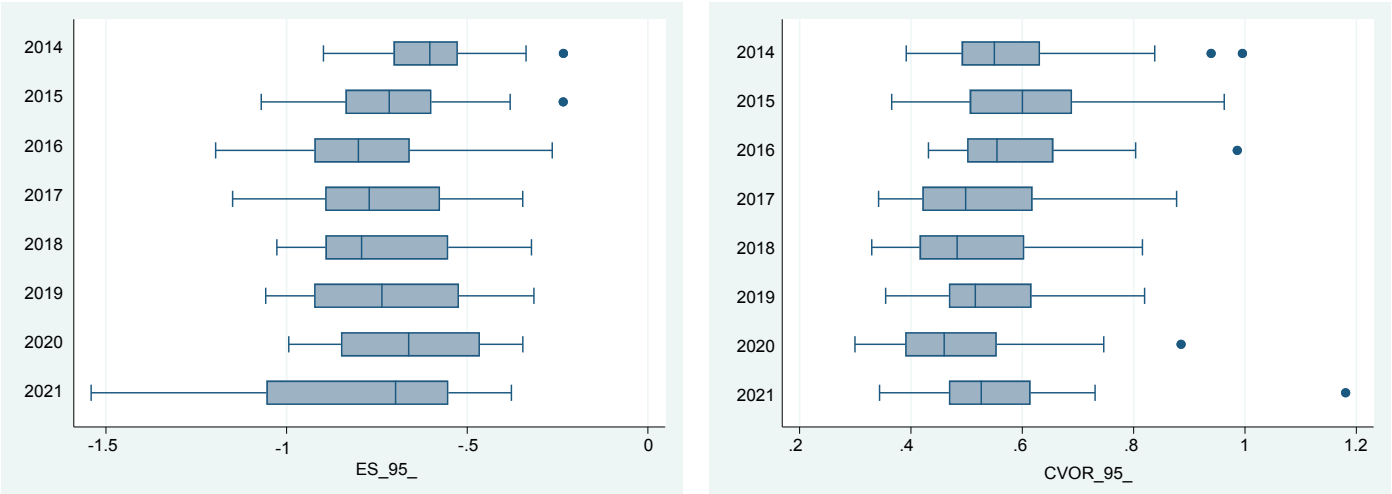

Figure 1
Boxplot of $ES_{0.05}$ and $cVoR_{0.05}$ by year
Source: Own elaboration.

Table 2 shows the main descriptive statistics of CSP scores and their subdimensions. Companies in the sample appear to display high CSP since, in general terms, most of them are in quartiles 1 and 2. These companies appear to perform especially well in terms of workforce. Likewise, the main descriptive statistics of the financial control variables (see Table 2) reveal that the sample contains companies of quite different sizes.

Table 2
Descriptive statistics of CSP scores and control variables

Variables	Mean	Median	Std. Dev.	Max	Min
CSP	79.45	86.29	19.12	98.19	0.90
Workforce	87.17	92.39	17.62	99.80	1.28
Human rights	71.19	80.00	26.54	98.31	0.00
Community	78.08	87.08	25.88	99.86	1.47
Product responsibility	79.71	87.71	23.92	99.70	0.00
MV	18185.94	7740.27	24218.72	105638.90	383.40
PER	22.15	16.35	19.13	135.80	3.20
DivYield	3.92	3.63	2.64	17.69	0.00
Beta	0.92	0.92	0.36	1.94	0.09

Notes: CSP denotes the overall social performance score of a company. The descriptive statistics of the scores of the four subdimensions (workforce, human rights, community and product responsibility) are also summarized in this table. MV denotes de Market Value of the company, PER denotes the Price-to-Earnings ratio of the company, Divyield denotes the dividend yield of a company.

Source: Own elaboration.

5. RESULTS AND DISCUSSION

5.1. *Corporate social performance and tail risk*

Tables 3 and 4 display the results of the panel data regression models that analyse the effect of CSP and its different subdimensions on the tail risk metrics (i.e., VaR and ES) in the Spanish stock market for the period 2014-2021. The results indicate that an increase in overall CSP decreases both VaR and ES, in the short term. However, an increase in overall CSP appears to increase both tail risk metrics in the long term. The empirical evidence supports **H1** only in the short term. Both the proper management of potentially socially adverse events (Diemont *et al.*, 2016; Shakil, 2021) and the reduction of information asymmetries (Wu & Hu, 2019) may have contributed to lowering the maximum loss. The results regarding the short term effect would be in line with previous empirical evidence (Gao *et al.*, 2025; Lööf *et al.*, 2022; Shafer & Szado, 2020; Viviani *et al.*, 2019). In relation to **H3(a)**, CSP appears to affect tail risk differently in the short and long term. This result could imply that investors considered that additional investments were unnecessary in the long term, either because of already high overall CSP (Diemont *et al.*, 2016) or because of agency costs (Landi *et al.*, 2022). The discrepancy between the short and long term effects contradicts the findings of Lööf *et al.* (2022). This could be explained by the fact that our study focuses on the Spanish stock market, while Lööf *et al.* (2022) analyses a global sample. This is in line with the findings of Diemont *et al.* (2016) that show that the relationship between corporate social performance and tail risk may vary within regions. Furthermore, this study employs long term tail risk metrics (i.e., yearly), whereas Lööf *et al.* (2022) use short term tail risk metrics (i.e., monthly).

Table 3
Effect of corporate social performance and its subdimensions on firms' Value at Risk

Indep/Dep	**$VaR_{0.1}$**	**$VaR_{0.05}$**	**$VaR_{0.01}$**	**$VaR_{0.1}$**	**$VaR_{0.05}$**	**$VaR_{0.01}$**	**$VaR_{0.1}$**	**$VaR_{0.05}$**	**$VaR_{0.01}$**	**$VaR_{0.1}$**	**$VaR_{0.05}$**	**$VaR_{0.01}$**	**$VaR_{0.1}$**	**$VaR_{0.05}$**	**$VaR_{0.01}$**
CSP(ω)	0.0012***	0.0014***	0.0017**												
	(0.0005)	(0.0005)	(0.0009)												
CSP(b)	−0.0025**	−0.0031**	−0.0048***												
	(0.0011)	(0.0013)	(0.0018)												
Workforce(ω)				0.0010**	0.0011**	0.0015*									
				(0.0004)	(0.0005)	(0.0008)									
Workforce(b)				−0.0009	−0.0012	−0.0020									
				(0.0008)	(0.0009)	(0.0014)									
Human rights(ω)							0.0006	0.0006	0.0008						
							(0.0004)	(0.0004)	(0.0006)						
Human rights(b)							−0.0020*	−0.0025**	−0.0039**						
							(0.0006)	(0.0013)	(0.0018)						
Community(ω)										0.0003	0.0004	0.0006			
										(0.0003)	(0.0004)	(0.0005)			
Community (b)										−0.0011	−0.0016	−0.0030**			
										(0.0009)	(0.0010)	(0.0015)			
Prod resp(ω)													0.0010**	0.0011*	0.0013
													(0.0005)	(0.0006)	(0.0008)
Prod resp(b)													−0.0016**	−0.0019**	−0.0025**
													(0.0007)	(0.0009)	(0.0013)
MV	2.4e−06***	2.7e−06***	3.3e−06**	2.3e−06***	2.6e−06***	3.1e−06**	2.5e−06***	2.8e−06***	3.5e−06**	2.4e−06***	2.7e−06***	3.3e−06**	2.4e−06***	2.6e−06***	3.4e−06**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PER	0.0003	0.0005*	0.0010**	0.0003	0.0005*	0.0010**	0.0003	0.0005*	0.0010**	0.0002	0.0004	0.0009**	0.0002	0.0004	0.0009**
	(0.0002)	(0.0003)	(0.0005)	(0.0002)	(0.0003)	(0.0005)	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0005)
DIVYIELD	0.0015	0.0014	0.0007	0.0012	0.0011	0.0002	0.0014	0.0013	0.0006	0.0008	0.0008	0.0000	0.0012	0.0030	0.0001
	(0.0023)	(0.0030)	(0.0051)	(0.0022)	(0.0029)	(0.0049)	(0.0023)	(0.0030)	(0.0051)	(0.0023)	(0.0031)	(0.0052)	(0.0023)	(0.0030)	(0.0050)
BETA	−0.1163***	−0.1446***	−0.2216***	−0.1162***	−0.1443***	−0.2205***	−0.1192***	−0.1482***	−0.2267***	−0.1210***	−0.1501***	−0.2288***	−0.1110***	−0.1390***	−0.2159***
	(0.0424)	(0.0490)	(0.0675)	(0.0438)	(0.0506)	(0.0694)	(0.0435)	(0.0502)	(0.0688)	(0.0457)	(0.0528)	(0.0719)	(0.0463)	(0.0540)	(0.0743)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table reports the main results of CSP (i.e., columns 1, 2, and 3), workforce (i.e., columns 4, 5, and 6), human rights (i.e., columns 7, 8, and 9), community (i.e., columns 10, 11, and 12) and product responsibility (i.e., columns 13, 14, and 15) on Value at Risk (VaR) at three different confidence levels (i.e., 0.90, 0.95, 0.99). Robust standard errors are displayed in parentheses. (ω) and (b) denote the within and between estimates respectively. ***p<0.01, **p<0.05, *0,1.

Source: Own elaboration.

Table 4
Effect of CSP over Expected Shortfall

Indep/Dep	$ES_{0.1}$	$ES_{0.05}$	$ES_{0.01}$	$ES_{0.1}$	$ES_{0.05}$	$ES_{0.01}$	$ES_{0.1}$	$ES_{0.05}$	$ES_{0.01}$	$ES_{0.1}$	$ES_{0.05}$	$ES_{0.01}$	$ES_{0.1}$	$ES_{0.05}$	$ES_{0.01}$
CSP(ω)	0.0014**	0.0015**	0.002												
	(0.0006)	(0.0007)	(0.0012)												
CSP(b)	−0.0034**	−0.0041***	−0.0059**												
	(0.0014)	(0.0016)	(0.0024)												
Workforce(ω)				0.0012**	0.0013*	0.0015									
				(0.0006)	(0.0007)	(0.0011)									
Workforce(b)				−0.0013	−0.0017	−0.0025									
				(0.0010)	(0.0012)	(0.0021)									
Human rights(ω)							0.0007	0.0007	0.0008						
							(0.0005)	(0.0005)	(0.0008)						
Human rights(b)							−0.0028**	−0.0034**	−0.0050**						
							(0.0014)	(0.0016)	(0.0023)						
Community(ω)										0.0004	0.0005	0.0006			
										(0.0004)	(0.0005)	(0.0007)			
Community (b)										−0.0019*	−0.0025*	−0.0040**			
										(0.0011)	(0.0013)	(0.0019)			
Prod resp(ω)													0.0012*	0.0012	0.0013
													(0.0006)	(0.0007)	(0.0011)
Prod resp(b)													−0.0020**	−0.0023**	−0.0030*
													(0.0010)	(0.0011)	(0.0017)
MV	2.8e−06***	3.1e−06**	3.8e−06*	2.7e−06***	2.9e−06**	3.5e−06*	3e−06***	3.3e−06**	4.1e−06**	2.9e−06***	3.2e−06**	3.9e−06*	2.8e−06***	3e−06**	3.7e−06*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PER	0.0006*	0.0008**	0.0015**	0.0006*	0.0008**	0.0015**	0.0006*	0.0008**	0.0015**	0.0005*	0.0007*	0.0013**	0.0005*	0.0007*	0.0014**
	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0004)	(0.0007)	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0004)	(0.0006)
Divyield	0.0013	0.0011	0.0004	0.0009	0.0006	−0.0003	0.0012	0.0010	0.0003	0.0006	0.0004	−0.0003	0.0009	0.0006	−0.0004
	(0.0034)	(0.0043)	(0.0070)	(0.0033)	(0.0042)	(0.0068)	(0.0034)	(0.0043)	(0.0070)	(0.0035)	(0.0044)	(0.0072)	(0.0034)	(0.0043)	(0.0069)
Beta	−0.1618***	−0.1953***	−0.2908***	−0.1613***	−0.1945***	−0.2899***	−0.1657***	−0.1997***	−0.2966***	−0.1676***	−0.2018***	−0.2987***	−0.1563***	−0.1896***	−0.2854***
	(0.0528)	(0.0607)	(0.0830)	(0.0544)	(0.0625)	(0.0852)	(0.0540)	(0.0619)	(0.0840)	(0.0567)	(0.0649)	(0.0871)	(0.0581)	(0.0668)	(0.0904)
TIME FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table reports the main results of CSP (i.e., columns 1, 2, and 3), workforce (i.e., columns 4, 5, and 6), human rights (i.e., columns 7, 8, and 9), community (i.e., columns 10, 11, and 12), and product responsibility (i.e., columns 13, 14, and 15) on Expected Shortfall (ES) at three different confidence levels (i.e., 0.90, 0.95, 0.99). Robust standard errors are displayed in parentheses. (ω) and (b) denote the within and between estimates respectively. ***p<0.01, **p<0.05, *0,1.

Source: Own elaboration.

The analysis of the relationship between tail risk and each of the four subdimensions individually may enable us to gain a better understanding. The disaggregated analysis may reveal whether the discrepancy between the short- and long-term effects at the aggregate level could really be explained by a threshold effect or, on the contrary, whether it is the combination of specific effects in the subdimensions. The results show that an increase in performance in the workforce subdimension decreases tail risk in the short term. This could indicate that investment in this subdimension may contribute to the creation of intangible assets, such as employee commitment, which reduce tail risk (Esteban-Sanchez *et al.*, 2017; Inoue & Lee, 2011). Better performance in terms of both community and human rights appears to lead to a higher tail risk in the long term. Investors may consider that further expenditure in these subdimensions does not compensate for the potential reputational gain, and thus the maximum loss increases because of an inefficient allocation of resources. Finally, in line with **H3(a)**, product responsibility displays a similar pattern to that of overall CSP. Although investors may grant a positive value to the potential benefits associated with higher performance in this subdimension (i.e., customer loyalty), an investment threshold could be exceeded, leading to an increase in tail risk (Korinth & Lueg, 2022). Therefore, the results support **H4(a)**, highlighting the relevance of analysing specific effects at the disaggregated level, since each subdimension addresses the needs of different stakeholders (Dumitrescu & Zakriya, 2021) and may therefore be subject to different drivers and motivations (Bouslah *et al.*, 2013).

The signs of the coefficients remain robust within both the tail risk metrics and the different confidence intervals. However, the findings show an increase in the confidence level of the estimated tail risk measure that appears to weaken the short-term effect and strengthen the long-term effect of CSP. The short-term effect is not significant when passing from VaR to ES. Unlike the results in other studies (Diemont *et al.*, 2016, Lööf *et al.*, 2022), these results may suggest that the greater the maximum loss, the lower the ability of CSP to reduce tail risk.

5.2. Corporate social performance and upside potential

Tables 5 and 6 display the results of the panel data regression models that analyse the effect of CSP on the upside potential metrics (i.e., VoR and cVoR) in the Spanish stock market for the period 2014-2021. According to the results, the effect of overall CSP on upside potential is not significant. Thus, **H2** and **H3(b)**, that propose a relationship between CSP and upside potential in general and over time, are not supported. Therefore, empirical evidence regarding the risk–return trade-off at the aggregate level is not found in this study. In line with the results of Mănescu (2011), this could indicate either that the effect of CSP on upside potential is irrelevant or that CSP is already priced in. The existence of positive and negative effects that are balanced out at the disaggregated level may also explain the lack of statistical significance.

In relation to **H4(b)**, the effect of each of the four subdimensions is individually analysed. The subdimensions of workforce and product responsibility display a similar pattern to that for the overall CSP. This could imply that the effect on the upside potential of the benefits associated with further investment in these subdimensions (i.e. employee commitment and customer loyalty) have either been already priced in or lack relevance (Mănescu, 2011). Performance in terms of human rights appears to lower the upside potential in the long term. Likewise, an increase in community performance appears to lead to a decrease in upside potential in the short term. This may indicate that the potential economic benefits associated with a further improvement in corporate reputation exceed its cost and, thus, lower upside potential. Therefore, it may be relevant to monitor companies with high human rights and community performance since they appear to have higher extreme losses and lower maximum gains. The results emphasize again the relevance of assessing the effect of CSP at the disaggregated level. In line with the work of Bouslah *et al.* (2013), these results indicate that two stocks with the same overall social score may have different relationships with FP.

The signs of the coefficients are robust within both upside potential metrics. The effect of CSP appears to gain statistical significance when passing from VoR to cVoR. Finally, the relationship between CSP and upside potential appears not to vary with the selected confidence level.

Table 5
Effect of CSP over Value of Return

Indep/Dep	$VoR_{0.1}$	$VoR_{0.05}$	$VoR_{0.01}$	$VoR_{0.1}$	$VoR_{0.05}$	$VoR_{0.01}$	$VoR_{0.1}$	$VoR_{0.05}$	$VoR_{0.01}$	$VoR_{0.1}$	$VoR_{0.05}$	$VoR_{0.01}$	$VoR_{0.1}$	$VoR_{0.05}$	$VoR_{0.01}$
CSP(ω)	−6.76e−06	−0.0003	−0.0010*												
	(0.0003)	(0.0002)	(0.0005)												
CSP(b)	−0.0020	−0.0024	−0.0034												
	(0.0012)	(0.0016)	(0.0023)												
Workforce(ω)				0.0001	−0.0001	−0.0006									
				(0.0002)	(0.0002)	(0.0004)									
Workforce(b)				−0.0015	−0.0019	−0.0030*									
				(0.0010)	(0.0012)	(0.0017)									
Human rights(ω)							0.0001	0.0000	−0.0002						
							(0.0002)	(0.0003)	(0.0004)						
Human rights(b)							−0.0021***	−0.0026***	−0.0037***						
							(0.0007)	(0.0009)	(0.0013)						
Community(ω)										−0.0003	−0.0004***	−0.0009***			
										(0.0002)	(0.0001)	(0.0002)			
Community (b)										−0.0010	−0.0014	−0.0025			
										(0.0009)	(0.0012)	(0.0019)			
Prod resp(ω)													0.0002	0.0000	−0.0005
													(0.0002)	(0.0002)	(0.0003)
Prod resp(b)													−0.0008	−0.0008	−0.0007
													(0.0007)	(0.0009)	(0.0013)
MV	8.2e−07**	6.7e−07	4.2e−07	6.8e−07*	5.10e−07	1.81e−07	08.8e−07**	7.1e−07	3.9e−07	8.5e−07**	7.1e−07*	4.7e−07	7.e−07*	5.2e−07	2e−07
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PER	−0.0003	−0.0003	−0.0004	−0.0003	−0.0003	−0.0004	−0.0003	−0.0003	−0.0004	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)
Divyield	−0.0003	−0.0004	−0.0006	−0.0004	−0.0005	−0.0006	−0.0002	−0.0003	−0.0003	−0.0002	−0.0002	0.0000	−0.0003	−0.0004	−0.0006
	(0.0027)	(0.0030)	(0.0036)	(0.0028)	(0.0031)	(0.0038)	(0.0027)	(0.0030)	(0.0036)	(0.0027)	(0.0030)	(0.0036)	(0.0028)	(0.0031)	(0.0039)
Beta	0.0004	0.0146	0.0419	−0.0001	0.0139	0.0407	−0.0004	0.0144	0.0427	−0.0006	0.0141	0.0429	0.0010	0.0139	0.0380
	(0.0267)	(0.0279)	(0.0314)	(0.0265)	(0.0281)	(0.0336)	(0.0264)	(0.0278)	(0.0332)	(0.0258)	(0.0268)	(0.0300)	(0.0267)	(0.0284)	(0.0334)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table reports the main results of CSP (i.e., columns 1, 2, and 3), workforce (i.e., columns 4, 5, and 6), human rights (i.e., columns 7, 8, and 9), community (i.e., columns 10, 11, and 12) and product responsibility (i.e., columns 13, 14, and 15) on Value of Return (VoR) at three different confidence levels (i.e., 0.90, 0.95, 0.99). Robust standard errors are displayed in parentheses. (ω) and (b) denote the within and between estimates respectively. ***p<0.01, **p<0.05, *0,1.

Source: Own elaboration.

Table 6
Effect of CSP over conditional Value of Return

Indep/Dep	**$cVoR_{0.1}$**	**$cVoR_{0.05}$**	**$cVoR_{0.01}$**	**$cVoR_{0.1}$**	**$cVoR_{0.05}$**	**$cVoR_{0.01}$**	**$cVoR_{0.1}$**	**$cVoR_{0.05}$**	**$cVoR_{0.01}$**	**$cVoR_{0.1}$**	**$cVoR_{0.05}$**	**$cVoR_{0.01}$**	**$cVoR_{0.1}$**	**$cVoR_{0.05}$**	**$cVoR_{0.01}$**
CSP(ω)	−0.0004	−0.0007**	−0.0015*												
	(0.0003)	(0.0004)	(0.0009)												
CSP(b)	−0.0026	−0.0030	−0.0041												
	(0.0017)	(0.0020)	(0.0028)												
Workforce(ω)				−0.0002	−0.0004	−0.0009									
				(0.0002)	(0.0003)	(0.0008)									
Workforce(b)				−0.0021	−0.0026*	−0.0036*									
				(0.0013)	(0.0015)	(0.0019)									
Human rights(ω)							0.0000	−0.0001	−0.0004						
							(0.0003)	(0.0003)	(0.0005)						
Human rights(b)							−0.0028***	−0.0033***	−0.0045***						
							(0.0010)	(0.0011)	(0.0016)						
Community(ω)										−0.0005***	−0.0007***	−0.0012***			
										(0.0001)	(0.0002)	(0.0004)			
Community (b)										−0.0017	−0.0021	−0.0033			
										(0.0013)	(0.0016)	(0.0024)			
Prod resp(ω)													−0.0001	−0.0003	−0.0008
													(0.0002)	(0.0003)	(0.0006)
Prod resp(b)													−0.0007	−0.0007	−0.0006
													(0.0010)	(0.0011)	(0.0015)
MV	6.4e−07	5.1e−07	2.6e−07	0.00	3e−07	−5.1e−08	6.6e−07	5e−07	1.7e−07	0.00	5.6e−07	3.0e−07	0.00	3.2e−07	−1.5e−08
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
PER	−0.0003	−0.0004	−0.0004	−0.0003	−0.0004	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003	−0.0003
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)
Divyield	−0.0003	−0.0004	−0.0003	−0.0005	−0.0005	−0.0004	−0.0002	−0.0002	0.0000	−0.0001	0.0000	0.0005	−0.0004	−0.0004	−0.0003
	(0.0031)	(0.0034)	(0.0040)	(0.0032)	(0.0035)	(0.0043)	(0.0031)	(0.0033)	(0.0039)	(0.0031)	(0.0034)	(0.0041)	(0.0032)	(0.0036)	(0.0044)
Beta	0.0193	0.0314	0.0587	0.0185	0.0304	0.0573	0.0193	0.0318	0.0602	0.0191	0.0318	0.0609*	0.0180	0.0287	0.0525
	(0.0280)	(0.0295)	(0.0368)	(0.0285)	(0.0309)	(0.0410)	(0.0281)	(0.0304)	(0.0413)	(0.0267)	(0.0281)	(0.0355)	(0.0288)	(0.0310)	(0.0400)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table reports the main results of CSP (i.e., columns 1, 2, and 3), workforce (i.e., columns 4, 5, and 6), human rights (i.e., columns 7, 8, and 9), community (i.e., columns 10, 11, and 12) and product responsibility (i.e., columns 13, 14, and 15) on conditional Value of Return (cVoR) at three different confidence levels (i.e., 0.90, 0.95, 0.99). Robust standard errors are displayed in parentheses. (ω) and (b) denote the within and between estimates respectively. ***p<0.01, **p<0.05, *0,1.

Source: Own elaboration.

6. CONCLUSIONS

The aim of this study was to analyse the effect of corporate social performance (CSP) and its subdimensions (i.e., workforce, human rights, community, and product responsibility) on tail risk and upside potential in the Spanish stock market for the period 2014-2021. The results show that an increase in overall CSP reduces tail risk in the short term but increases it in the long term. At the disaggregated level, product responsibility performance appears to display a similar pattern to that of the overall CSP score. Likewise, an increase in performance in terms of workforce appears to contribute to a lower tail risk in the short term, while an improvement in both community and human rights performance increases it in the long term. The existence of these specific effects highlights the relevance of assessing each subdimension individually. The results may also imply that the greater the maximum expected loss, the lower the ability of CSP to reduce tail risk, in the short term. Empirical evidence regarding the risk–return trade-off was not found. However, it may be relevant to monitor stocks with high human rights and community performance, since these dimensions appear to entail higher tail risk and to have lower upside potential.

The results of this study would entail implications for investors. ESG factors affect all the stages of the investment process from asset allocation to stock selection, given the rising complexity of SRI strategies. In this context, it appears relevant for investors to have updated information on how considering ESG factors affects the FP of their assets. They should be aware that investing on stocks with high CSP appear may lower exposure to tail risk in the short term, but that these assets may suffer greater extreme losses in the long term. The results also have implications for risk managers and policymakers. Tail risk plays a relevant role in the Basel III framework. Risk managers, under the Basel III framework, may be able to ease their capital requirements in the short term by investing in stocks with high CSP. Nevertheless, they should be prepared to bear higher tail risk in the long term. These findings may also help policymakers adapt regulatory frameworks (e.g., Basel III) to current market risk dynamics. Finally, the findings entail implications from a managerial perspective. Companies actively engage with their stakeholders to adapt to current business environment. Our findings suggest that managers should carefully consider additional investments. If social engagement is not perceived as genuine or if CSP is already high, the stocks of the company may be exposed to higher tail risk in the long term. Finally, it is relevant that these implications derive from an analysis at the stock level. At the portfolio level, other effects such as diversification mediate the relationship between CSP and the tail risk (upside potential) of the stocks.

The main limitation of this study would be the size of the sample used in the empirical analysis that restricts the generalisability of the findings to a wider context. The sample covers 83.17% of the IBEX35 market capitalization on 31 December 2023. Therefore, it could be considered as representative of the Spanish stock market, given the rising popularity of passive portfolio management strategies. Likewise, the aim of this paper was to focus on a single European market, as opposed to previous studies that analyse samples either from an international context or from an Anglo-Saxon market. Focusing on a single market restricts the generalisability of the findings to a wider context since, as pointed by previous studies, the effect of sustainability performance on tail risk (upside potential) appears to depend on the region under study. The results also highlight the relevance of design elements that future studies could consider such as the assessment of specific stakeholders and the employment of long-term tail risk (upside potential) metrics. There may also be limitations related to the method used to estimate tail risk and upside potential. In FHS, paths of standardized residuals are generated though random sampling with replacement (bootstrapping). According to Mancini and Trojani (2011), bootstrapping may bias tail risk estimations in the presence of outliers. Unusually high standardized residuals may enter the simulated path several times, leading to an overestimation of the tail risk. To cope with this potential limitation, an initial sample of ten years of earlier daily standardized residuals was employed to generate the bootstrapped paths; furthermore, 100,000 paths were generated.

Future studies may analyse the existence of a nonlinear relationship between tail risk/upside potential and CSP and its subdimensions. The assessment of the effect of environmental and governance pillars at the disaggregate level may also provide valuable insights. Likewise, it may be interesting to consider the effect of variables such as the perceived authenticity of CSP. However, to the best of our knowledge, there are not variables available, in secondary data sources (e.g., Thomson Reuters Refinitiv), that measure stakeholder perceptions. The measurement of stakeholder's perception would demand the generation of primary data through interviews or questionnaires. Finally, the effect of CSP and its subdimensions at the portfolio level could be analysed. As has been previously discussed, at portfolio level, effects such as diversification mediate this relationship.

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8. CREDIT AUTHOR STATEMENT

Julen Galarza-Maria: Conceptualization, Methodology, Formal Analysis and Investigation, Data curation, Validation, Visualization, Writing Original Draft Preparation; Eduardo Ortas: Methodology, Formal Analysis and Investigation, Data Curation, Validation, Writing- review and editing, Supervision, Project Administration; José M. Moneva: Conceptualization, Writing- review and editing, Resources, Funding Acquisition, Supervision, Project Administration

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The Impact of Quality of Financial Information on the Decline of Food Manufacturing Companies in the European Union

El Impacto de la Calidad de la Información Financiera en el Declive de las Empresas de Manufactura de Alimentos en la Unión Europea

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ABSTRACT

This study examines the relationship between quality of financial information (QFI) and the probability of corporate decline in the food manufacturing sector within the European Union (EU) controlled by a set of internal (age, size, liquidity, return on assets, and debt) and external (gross domestic product and unemployment rate) determinants. The study employs a logit regression model applied to a balanced panel dataset of 335 large food manufacturing firms in the EU from 2011 to 2021. Quality of financial information is estimated using discretionary accruals, based on the Jones model (1991), while corporate decline is measured by fluctuations in sales. The findings indicate that low-quality financial information (high discretionary accruals) is positively associated with corporate decline, highlighting the role of financial transparency in business sustainability. The results suggest that earnings management practices can increase business vulnerability, reinforcing the importance of accurate financial reporting in mitigating corporate failure. The study underscores the need for enhanced regulatory oversight and financial reporting transparency in the food manufacturing industry. Policymakers and stakeholders should strengthen financial disclosure requirements to curb earnings management practices and ensure better resource allocation for long-term sustainability. This research contributes to the limited literature on quality of financial information and corporate decline, particularly in the food manufacturing sector, which is crucial for economic stability and public welfare. By integrating financial reporting quality into corporate failure analysis, this study provides new insights into the role of earnings management in business deterioration.

Keywords: Quality of financial information, Business decline, Earnings management, Discretionary accruals, Food manufacturing industry, Corporate sustainability.

R E S U M E N

Este estudio analiza la relación entre la calidad de la información financiera (QFI) y la probabilidad de deterioro empresarial en el sector de fabricación de alimentos en la Unión Europea (UE), considerando determinantes internos como antigüedad, tamaño, liquidez, rentabilidad de los activos y nivel de endeudamiento, así como factores externos como el producto interior bruto y la tasa de desempleo. Se utiliza un modelo de regresión logística aplicado a un panel equilibrado de 335 grandes empresas del sector entre 2011 y 2021. La QFI se estima mediante devengos discrecionales basados en el modelo de Jones (1991), mientras que el deterioro empresarial se mide a través de fluctuaciones en las ventas. Los resultados muestran que una baja calidad de la información financiera, reflejada en mayores devengos discrecionales, se asocia positivamente con el declive corporativo. Esto resalta la importancia de la transparencia y la precisión de los informes financieros para la sostenibilidad empresarial. Asimismo, se evidencia que las prácticas de gestión de beneficios incrementan la vulnerabilidad de las empresas, lo que refuerza la necesidad de un mayor control regulatorio. El estudio sugiere fortalecer los requisitos de divulgación financiera para limitar estas prácticas y mejorar la asignación de recursos. Esta investigación contribuye a la escasa literatura sobre la relación entre la calidad de la información financiera y el deterioro empresarial, especialmente en el sector de la fabricación de alimentos, ofreciendo nuevas perspectivas sobre el impacto de la gestión de beneficios en el fracaso corporativo.

Palabras clave: Calidad de la información financiera, Deterioro corporativo, Gestión de ganancias, Devengos discrecionales, Industria de manufactura de alimentos, Sostenibilidad corporativa.

1. INTRODUCTION

Corporate decline represents a critical stage in the organizational lifecycle, marked by performance deterioration, revenue contraction, negative earnings, financial distress, asset depletion, and, in extreme cases, bankruptcy (Amankwah-Amoah, 2016; Hadrović & Lukić, 2015). The literature attributes this phenomenon to both external and internal factors. Externally, macroeconomic conditions such as Gross Domestic Product (GDP) growth and unemployment rates exert significant influence. Internally, the quality of financial information (QFI) emerges as a key determinant (Bampoky, 2013).

Adverse macroeconomic environments, such as low growth or recessions, tend to suppress aggregate demand, compress revenues, and jeopardize firms' sustainability. Similarly, high unemployment rates weaken consumer purchasing power and disrupt market dynamics, thereby increasing the likelihood of corporate decline (Hadrović & Lukić, 2015).

The analysis of QFI in competitive and cost-sensitive sectors, like the food sector, is highly relevant. This sector is crucial to the food supply chain and the global economy, providing essential products for population nutrition and well-being (Haessner *et al.*, 2024; Marchesano & Scavone, 2020). Recently, food companies have faced considerable challenges, including economic pressures, regulatory changes, and intensified competition. These factors have driven a concerning decline, characterized by business closures, profit reductions, and diminished competitiveness (Frick *et al.*, 2018).

The repercussions of decline extend beyond individual companies, affecting society by increasing unemployment, reducing purchasing power, creating food product shortages, driving price increases, and worsening food insecurity. In this context, high-quality financial information is crucial for the sector's sustainability and growth (Li *et al.*, 2020). Accurate, reliable, and timely financial reporting is essential for strategic decision-making to mitigate these adverse effects (Abed *et al.*, 2022).

Despite the recognized importance of QFI, a gap remains regarding its impact on the decline of food sector companies (Silva & Moreira, 2019). Identifying the factors contributing to this decline is critical for developing preventive measures that ensure business continuity and foster sustainable economic growth (Kozeniauskas *et al.*, 2022).

QFI assumes a preventive role. High-quality financial information, relevant, reliable, and timely, facilitates the efficient allocation of resources, mitigates information asymmetries, and strengthens stakeholder oversight (Abed *et al.*, 2022; Li *et al.*, 2020). Conversely, poor QFI may lead to suboptimal investment decisions, undermine risk management, and heighten the risk of organizational crisis (Sujarminto *et al.*, 2024; Frazer, 2020).

Recent empirical studies reinforce the importance of QFI for firm performance and value. Kumar *et al.* (2023) show that QFI enhances investment efficiency and firm value; Harjanto (2024) provides evidence of a positive association between accruals quality and firm value; and Ismail *et al.* (2024) highlight that effective ownership structures combined with high QFI foster transparency and reduce the risk of crisis.

Despite these contributions, research directly examining the relationship between QFI and the probability of corporate decline remains scarce, particularly from a causal inference perspective. Existing studies have primarily focused on the impact of QFI on performance metrics (e.g., ROA, ROE) or firm value, without addressing its role as a protective mechanism against decline (Abed *et al.*, 2022; Hadrović & Lukić, 2015).

This study aims to fill this gap by evaluating, through an inferential approach, the extent to which QFI influences the probability of corporate decline. Accordingly, the central research question is formulated as follows: *To what extent does the quality of financial information influence the probability of corporate decline?* To achieve this objective, we employ a logistic regression model using data from food manufacturing firms in the European Union. This methodological design not only identifies correlations but also estimates the direction and magnitude of QFI's effect on decline risk, offering a more rigorous empirical assessment.

This study is expected to contribute along three dimensions. Theoretically, it advances understanding of QFI as a protective factor against decline. Methodologically, it applies a panel data logistic modeling approach to European firm-level data, enhancing the precision of decline probability estimates in line with recent evidence from Nabil *et al.* (2025). Practically, the findings provide managers, investors, and regulators with insights into the importance of ensuring high levels of QFI as a preventive mechanism against organizational crises.

The remainder of this article is structured as follows: Section 2 presents a theoretical framework on business decline, quality of financial information, and the characteristics of the food production sector in Europe. Section 3 details the study's methodological approach, while Section 4 discusses the results. Finally, Section 5 outlines the main conclusions, potential future research directions, and the practical implications of the findings.

2. LITERATURE REVIEW

Quality of Financial Information refers to the extent to which financial statements provide an accurate and relevant representation of a company's economic and financial position, as well as its performance (IASB, 2018). In recent years, the concept of QFI has gained increasing prominence in accounting and corporate finance research, particularly following the European Union's adoption of international accounting standards (IAS/IFRS). As noted by Barth *et al.* (2008), the shift toward international standards stemmed from the demand for reporting that is more comparable, transparent, and of higher quality within an increasingly globalized business environment.

QFI plays a central role in decision-making by investors, creditors, managers, and regulators, and is therefore critical to firms' overall sustainability. Poor quality of financial information, as emphasized by Yang (2019), undermines investor confidence, weakens market credibility, and ultimately diminishes consumer trust. Francis *et al.* (2004) further argue that low-quality financial information leads to distorted evaluations of corporate performance, impedes access to financing, and constrains firms' ability to respond strategically to external shocks. When QFI is deficient, early warning signals of organizational deteri-

oration may go unnoticed, hampering the identification of risks and the adoption of timely corrective measures, thereby accelerating processes of decline (Hope *et al.*, 2017).

Empirical studies reinforce this concern. For instance, Jouali *et al.* (2024) and Holder-Webb and Cohen (2007) find that firms disclosing low-quality financial information struggle to attract investment, deliver consistent results, and thus become more susceptible to economic crises. This heightened vulnerability substantially increases the likelihood of corporate decline.

Conversely, high-quality financial information has been shown to play a crucial role in strengthening firms' stability, performance, and longevity. However, one of the most significant threats to QFI is the deliberate manipulation of reported results to serve particular interests, commonly referred to as earnings management. Research indicates that high levels of discretionary accruals, those not directly attributable to operational performance, are a strong indicator of poor quality of financial information (Kothari *et al.*, 2005).

Business decline refers to a gradual deterioration of an organization's health and viability, manifesting through indicators such as declining sales, reductions in investment and company size, and financial distress (Nyiwul & Iqbal, 2022). Theoretical explanations for decline often incorporate both traditional firm characteristics, such as size and age, and specific financial attributes, including internal financing, capital structure, liquidity, and profitability (Mateev & Anastasov, 2010). In advanced stages, decline may result in insolvency, bankruptcy, or even business closure (Bushe, 2019; Nyiwul & Iqbal, 2022). Managers must, therefore, identify early warning signs and implement corrective measures to mitigate adverse consequences. Business decline can stem from various internal and external factors. They include imprecise financial information, specific firm characteristics such as age, size, capital structure and macroeconomic conditions (Mahamid, 2012; Serrasqueiro *et al.*, 2010). The consequences of such decline extend beyond individual enterprises, exerting a significant impact on the broader economy (e.g., Pascoe *et al.*, 2023).

Çera *et al.* (2019) categorize the causes of business decline into three domains: managerial, financial, and external. Çera *et al.* (2019) further delineate the causes through two theoretical lenses: the deterministic and institutional perspectives. The deterministic view attributes business decline to external factors that constrain growth, such as market fluctuations, regulatory or technological constraints, and resource scarcity. According to this perspective, failure is primarily driven by external influences beyond managerial control. In contrast, the institutional perspective emphasizes internal factors, including corporate culture, social norms, and organizational structures. The institutional perspective advocates for internal restructuring to shift away from traditional growth-oriented paradigms toward alternative business success measures, such as sustainability, social equity, and employee well-being (Çera *et al.*, 2019). These two perspectives were also applied by Silva and Moreira (2019)

Signaling Theory posits that organizations leverage high-quality financial disclosures to communicate their financial health and potential to investors and other stakeholders (Putri *et al.*, 2023). Transparent, accurate, and relevant financial reporting enhances investor confidence, positively influencing perceptions of organizational stability and performance (Deng *et al.*, 2024). The theory further suggests a direct correlation between the quality of disclosed financial information and company sales performance, as financial data serve as critical indicators for stakeholders (Beatty *et al.*, 2010). As such, the quality of financial information is essential for sound business decision-making, facilitating performance assessment, operational control, and strategic planning (e.g., Frazer, 2020). Poor financial data quality adversely affects key corporate functions, including production, investments, mergers and acquisitions, research and development, advertising, and expansion (Feng *et al.*, 2009). Strategic initiatives, such as entering new markets or making capital investments, hinge on the accuracy and reliability of financial information (Paiva, 2018; Sujarminto *et al.*, 2024). When financial data integrity is compromised, misallocations of resources may lead to cuts in critical areas or investments in unviable projects, potentially accelerating business decline even in growth sectors (Remlein *et al.*, 2024). Furthermore, companies with poor financial data face heightened risks of decline, undermining both investor confidence and managerial decision-making (Putri, 2018).

Several studies emphasize that the QFI is strongly shaped by the legal, institutional, and regulatory framework in which firms operate (Ball *et al.*, 2000; Bushman & Piotroski, 2006; Leuz *et al.*, 2003). In the European context, supervisory bodies such as the European Securities and Markets Authority (ESMA) and the European Financial Reporting Advisory Group (EFRAG) stress that the reliability of financial information constitutes a cornerstone of sound corporate governance and of the efficient allocation of resources across the region (Leuz *et al.*, 2003). Within this framework, the mandatory application of International Financial Reporting Standards (IFRS) for listed companies, introduced through Regulation (EC) No. 1606/2002, sought to strengthen the comparability, consistency, and transparency of financial reporting among European Union Member States. Likewise, Directive 2013/34/EU harmonized financial disclosure requirements with the aim of enhancing uniformity and comparability (European Union, 2013).

Nevertheless, Capkun *et al.* (2016) caution that despite the formal adoption of IFRS, earnings management practices persist, which may compromise QFI and undermine the usefulness of reported information. Thus, even under a common regulatory framework, QFI varies according to country-specific institutional characteristics. In this regard, several studies, including Francis *et al.* (2004), employ discretionary accruals as a negative proxy for QFI, on the premise that higher levels are indicative of reduced reliability in financial reporting.

Francis *et al.* (2004) and Chen *et al.* (2011) argue that discretionary accruals serve as a negative proxy frequently associated with earnings manipulation, informational opacity, and increased information asymmetry-factors that constrain stakeholders' ability to accurately assess a firm's condition. Such limitations may heighten the risk of ineffective decision-making, agency conflicts, and operational losses. According to these authors, the deterioration of QFI should be interpreted as a warning signal of organizational vulnerability, thereby justifying its inclusion in analytical models as an explanatory variable of performance decline and business failure risk.

Earnings management, which encompasses accounting practices aimed at influencing financial results to align with market expectations or internal objectives, further complicates corporate financial transparency (Dechow & Skinner, 2000). While often legal, such practices raise ethical concerns and can distort a company's true financial performance (Jones, 1991). Manipulated earnings can create a misleading perception of financial stability, leading to uninformed investment decisions that ultimately undermine long-term organizational success (Tarighi *et al.*, 2022). The propensity for earnings management has been linked to executive demographics, such as CEO age, with younger CEOs exhibiting higher tendencies toward such practices; however, governance tools like clawback provisions can mitigate these effects (Davis & García-Cestona, 2023). Additionally, recent research also indicates that firms with strong CSR commitments are less prone to engage in earnings management, even during economic crises (El-Feel *et al.*, 2023).

Companies that practice earnings management may face greater difficulties in maintaining investors and creditors trust. This is because, by masking the real financial situation, management can distort performance assessments, compromising governance and strategic decision-making (Tarighi *et al.*, 2022). In addition, the long-term consequences of these practices include greater volatility in profits and company decline (Rad *et al.*, 2016).

Case studies, such as Enron and WorldCom, illustrate the devastating impact that earnings management practices can have on financial sustainability and corporate reputation. These cases demonstrate that while earnings management may appear advantageous in the short term, its detrimental consequences for transparency and optimal resource allocation are significant, often leading to organizational decline (Tarighi *et al.*, 2022). As such, detecting earnings management practices is essential to maintaining the quality of financial information.

Existing literature distinguishes various models for detecting earnings management, including models based on accruals. The main objective of accrual-based models is to differentiate between the discretionary component that is considered an earnings management instrument and the non-discretionary component Healy & Wahlen (1999).

The existing literature underscores the pivotal role of quality of financial information in corporate sustainability and performance. While high-quality financial reporting fosters transparency, enhances decision-making, and strengthens investor confidence, lower-quality financial information —often associated with earnings management— can distort financial reality and contribute to organizational decline. Empirical studies suggest that discretionary accruals serve as a key proxy for assessing the extent of earnings management and financial misreporting, both of which can have far-reaching implications for business stability. In the context of the food manufacturing sector, where firms operate under tight margins and are highly sensitive to economic and regulatory shifts, the ability to accurately assess financial health is critical. However, despite the well-established link between financial reporting quality and corporate performance, the extent to which QFI influences corporate decline, particularly in the food manufacturing industry, remains underexplored. This study seeks to fill this gap by empirically examining how quality of financial information, measured through discretionary accruals, affects the likelihood of business decline.

Based on the theoretical framework presented, the following hypotheses are formulated to support the empirical analysis. First, the literature shows that low QFI undermines the confidence of external stakeholders, restricts trade credit, increases the cost of financing, affects corporate reputation, and, particularly relevant in our context, may reduce the trust of customers and the consumer market. Even managers with access to detailed internal data remain subject to these external constraints and to contractual pressures grounded in published figures (Putri, 2018; Tarighi *et al.*, 2022; Yang, 2019). Accordingly, the following hypothesis is proposed:

H1: *Quality of Financial Information (QFI) is negatively related with the likelihood of firm decline*

Beyond QFI, the literature documents several firm-level control variables associated with firm decline. Among them, the literature suggests that younger firms, due to their limited operational experience and less consolidated networks, are more vulnerable to internal and external shocks, with the potential to impact firm decline (Çera *et al.*, 2019; Mateev & Anastasov, 2010). Additionally, firm size is also an important control variable. Small firms tend to have limited access to financial resources, lower market diversification, and weaker bargaining power with suppliers and customers, which makes them more susceptible to decline (Arditi *et al.*, 2000; Serrasqueira *et al.*, 2010). Liquidity is another critical control variable for firm decline. Firms with lower capacity to meet short-term obligations face greater operational difficulties, which may exacerbate their financial situation (Arslan *et al.*, 2006).

The link between low profitability and heightened risk of corporate decline is a well-documented phenomenon in finance and strategic management literature. Seminal models for predicting bankruptcy and financial distress, such as those by Altman *et al.* (2017) and Beaver (1966), explicitly incorporate profitability measures (like ROA) as key discriminators between healthy and failing firms. Low ROA is an indicator of inefficiency in utilizing the firm's asset base (Hambrick & D'Aveni, 1988). This inefficiency can stem from operational weaknesses, poor management, or an inability to compete effectively, ultimately leading to a higher vulnerability to decline (Sheppard & Chowdhury, 2005). The predictive power of profitability for distress risk continues to be validated in contemporary research (e.g., Campbell *et al.*, 2008), confirming that firms with lower ROA are statistically more likely to face decline.

Regarding capital structure, a high level of indebtedness may heighten a firm's vulnerability to fluctuations in interest rates or credit conditions. Firms with high leverage face greater financial pressure and a higher risk of insolvency, with the potential to impact firm decline (Mateev & Anastasov, 2010). Therefore, considering these firm-level control variables of firm decline, the following hypotheses are proposed:

H2a: *Age negatively influences the likelihood of firm decline.*

H2b: *Firm size negatively influences the likelihood of firm decline.*

H2c: *Firm liquidity negatively influences the likelihood of firm decline.*

H2d: *Firm profitability (ROA) negatively influences the likelihood of firm decline.*

H2e: *Firm indebtedness positively influences the likelihood of firm decline.*

In addition to firm-level factors, macroeconomic variables may also play a significant role. High unemployment rates may reduce demand for goods and services, negatively impacting sales volume and corporate sustainability (Mahamid, 2012). Additionally, economic growth is one of the main determinants of the business environment. When Gross Domestic Product (GDP) performance is weak, the likelihood of firm decline tends to increase, particularly in sectors more dependent on domestic demand (Kozeniauskas *et al.*, 2022). Thus, considering these country-level control variables of firm decline, we proposed the following hypotheses:

H3a: *Unemployment rate positively influences the likelihood of firm decline.*

H3b: *GDP growth rates are negatively associated with the likelihood of firm decline.*

3. DATA, MODEL SPECIFICATION AND METHODOLOGY

The food production sector plays a fundamental role in the European economy, serving as a pillar of the manufacturing industry and international trade (e.g., Lodorfos *et al.*, 2018). This sector encompasses a broad spectrum of activities, ranging from agriculture and animal breeding to the transformation of raw materials into consumable food products, such as dairy items, meats, breads, beverages, and processed foods. Notably, it contributes 14.6% to the Gross Domestic Product (GDP) of European nations and generates employment for 4.2 million people across 286,000 companies (Lodorfos *et al.*, 2018).

Given the intense competition among food manufacturers, the sector attracts investments from both domestic and foreign sources (Ditsiou *et al.*, 2023). The maintenance of high-quality financial information is imperative for sustaining investor confidence and securing capital to support growth. Conversely, poor-quality of financial information can hinder a company's ability to accurately forecast future trends, adjust market strategies, and respond effectively to economic fluctuations (Deng *et al.*, 2024). As such, in a dynamic and competitive business environment such as the food manufacturing sector, companies face numerous economic and business challenges that may lead to decline or closure (e.g., Frick *et al.*, 2018). The ramifications of such decline extend beyond individual enterprises, exerting a significant impact on the broader economy (e.g., Pascoe *et al.*, 2023). Consequently, the food manufacturing industry was chosen to closely examine this phenomenon.

To accomplish the objective of this research, to examine the relationship between quality of financial information and corporate decline, we have drawn data from Orbis Europe database covering a ten-year period from 2011 to 2021.

The study concentrates on the food industry given its significant role in the economic development of the EU. Any downturn in this sector could have adverse consequences for economic growth, employment, and the capacity to ensure safe and high-quality food for public welfare.

The focus was on large European companies justified by the accessibility of the necessary accounting data for analysis and the absence of critical financial elements in the statements of micro and small enterprises due to the flexibility of applicable accounting standards.

The criteria for classifying companies as large are those stipulated by the European Commission Directive 2003/361/EC. To collect the sample, the following inclusion and exclusion criteria were applied:

- Status: Active companies
- NACE Rev. 2 Primary Code: 10 - Food products industry
- Location: European Union
- Number of Employees: Minimum of 250 employees in all years of analysis
- Total Assets: Minimum of 43 million euros in all years of study
- Turnover: 50 million euros in all years of study

Uniform criteria for large companies were maintained throughout the study period for several reasons: to ensure consistency in company classification; to prevent results from being influenced by changes in classification criteria; and to preserve sample stability over time. This approach enhances comparability over time and facilitates trend analysis.

Companies with three or more years of missing data were excluded from the sample. In cases where data were missing for one or two years, different imputation methods were employed depending on the missing data's temporal position. If data were missing at the beginning of the period, the missing value was assigned the value of the subsequent year (t+1). If missing in the middle of the period, the average of the preceding and following years was used. All financial data obtained from Orbis were denominated in thousands of euros.

The final sample comprises 3,350 observations, representing 335 large companies in the food production sector across 20 European Union (EU) countries.

The extant literature identifies multiple variables that influence corporate decline. Among these, this study incorporates variables available in the Orbis Europe database, such as age, liquidity, debt, profitability, and size, as well as external factors, such as the unemployment rate and Gross Domestic Product derived from the World Development Indicators (WDI) database, and the quality of financial information, estimated using established specifications.

Regarding the measurement of corporate decline, the literature exhibits limited consensus on the appropriate metric. Empirical research has used various measures, including changes in sales value, employee count, investment, profit, and asset values (e.g., Davidsson & Wiklund, 2000; Ganchala *et al.*, 2022; Mateev & Anastasov, 2010). To estimate the relationship between QFI and the probability of firm decline, a panel data logit model was employed, incorporating fixed effects to control for unobserved heterogeneities. As in several other studies (e.g., Mellahi & Wilkinson, 2004), we measured decline through the growth of real sales. Accordingly, we defined the binary variable *Decline* as equal to 1 when a firm's real sales growth rate is negative, and 0 otherwise.

In addition, control variables were included at the firm level, namely size, debt, return on assets, liquidity, and age, as well as macroeconomic variables at the country level, such as GDP growth rate and unemployment rate. To capture institutional and legal heterogeneities across countries, country fixed effects were incorporated.

Real sales growth was estimated according to the following specification: Real $SG_{i,t}=(1+SG_{i,t})/(1+Inf_{j,t})-1$
where:

$$SG_{i,t}=(Sales_{i,t}-Sales_{i,t-1})/(Sales_{i,t-1})$$

with:

—Real $SG_{i,t}$: real sales growth of firm *i* at time *t*
—$Sales_{i,t}$: nominal sales growth of firm *i* at time *t* and *time t-1*
—$Inf_{j,t}$: inflation rate of country *j* at time *t*

Prior research (Chen *et al.*, 2011; Rad *et al.*, 2016) has highlighted the absence of a universally accepted measure for quality of financial information. Various proxies are employed, including discretionary accrual quality, disclosure timeliness, value relevance, and accounting conservatism (Costa *et al.*, 2022).

Discretionary accruals represent an accounting earnings management metric, reflecting adjustments that managers make to reported profits (Rad *et al.*, 2016). The magnitude of accruals indicates the extent to which managerial discretion affects earnings transparency (Bigus & Hillebrand, 2017). Higher accrual values may indicate earnings management practices, thereby reducing QFI (Rad *et al.*, 2016).

We employed the Jones model (1991) to estimate discretionary accruals by decomposing total accruals into discretionary and non-discretionary components. The total accruals of each firm-year were calculated as the difference between net income before extraordinary items and operating cash flow for the period, scaled by total assets at the beginning of the year. Following the Jones model (1991), we estimated the following regression for each firm and year:

$$NDA_{i,t}=\alpha_0\left(\frac{1}{A_{i,t-1}}\right)+\alpha_1\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right)+\alpha_2\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right)+\varepsilon_{i,t}$$

where

$NDA_{i,}$= non-discretionary accruals of firm *i* in year *t*;
$A_{i,t-1}$ = total assets at the beginning of the period;
$\Delta REV_{i,t}$ = change in revenues between *t-1* and *t*;
$PPE_{i,t}$ = tangible fixed assets in year *t*.

The α coefficients allow for the estimation of the expected non-discretionary accruals for each firm. Discretionary accruals were obtained as the difference between total accruals and the estimated non-discretionary accruals.

Beaver *et al.* (2012) assert that financial report attributes, particularly earnings quality measured via accruals, are relevant in forecasting corporate decline. Similarly, Nagar and Sen (2018) find that earnings and revenue management practices increase the likelihood of corporate decline. Accordingly, firms engaging in earnings management are expected to exhibit a higher probability of decline, leading to an anticipated inverse relationship between the quality of financial information and decline.

Prior research has demonstrated a positive correlation between debt levels and corporate decline (Arditi *et al.*, 2000; Mateev & Anastasov, 2010; Nusbantoro *et al.*, 2019). Increased debt levels elevate the probability of firm failure due to interest payment obligations, which impose financial constraints on cash flow and hinder growth. However, contrasting findings (Serrasqueiro *et al.*, 2010) suggest that debt may reduce the likelihood of corporate decline through enhanced creditor oversight. Consequently, the relationship between debt and corporate decline remains ambiguous, with prior studies reporting both positive and negative associations (Arditi *et al.*, 2000; Serrasqueiro *et al.*, 2010).

Regarding liquidity, existing literature indicates that cash flow difficulties significantly impact corporate growth (Costa *et al.*, 2022). Similarly, Bryan *et al.* (2002) emphasize that companies with lower liquidity levels are more susceptible to bankruptcy. Companies with reduced liquidity experience greater cash constraints and encounter difficulties in meeting obligations to suppliers, which may result in an inverse relationship between liquidity and corporate decline (Bryan *et al.*, 2022; Costa *et al.*, 2022; Ganchala *et al.*, 2022).

The relationship between corporate decline and company size has been examined by Levratto (2013) and Costa *et al.* (2022). These studies suggest that smaller companies possess fewer resources and are more vulnerable to financial difficulties, increasing their likelihood of decline. Larger companies exhibit a lower probability of decline, leading to an expected inverse relationship between these variables.

Younger firms are more prone to decline, as business failure among new companies can be attributed to a lack of business acumen, management expertise, and operational experience (Arditi *et al.*, 2000). Older organizations have accumulated knowledge regarding customer acquisition, supplier relationships, and distribution networks. They maintain robust alliances and favorable relationships with financial institutions, which provide them with greater resilience against decline (Arditi *et al.*, 2000). Consequently, a negative relationship between age and the probability of decline is expected. However, empirical evidence indicates that companies grow until they reach a minimum efficiency level that ensures survival. Beyond this phase, age negatively affects growth (Serrasqueiro *et al.*, 2010). Therefore, a negative relationship between age and the probability of decline is anticipated during the growth phase of a company's life cycle, while a positive relationship is expected in the post-maturity phase (Serrasqueiro *et al.*, 2010).

Regarding Profitability (ROA), Lisboa *et al.* (2021) report that companies with lower profitability are more susceptible to decline. Lower profitability increases the likelihood of corporate decline, as evidenced by Costa *et al.* (2022). An inverse relationship between profitability and decline is anticipated.

Following the established literature in corporate finance and industrial organization, we control for key macroeconomic conditions at the country level. We include the GDP growth rate to account for the overall state of the business cycle, as periods of economic expansion (contraction) are associated with higher (lower) aggregate demand, directly influencing a firm's sales growth (Opler & Titman, 1994; Fama & French, 1989). Furthermore, we include the unemployment rate to capture demand-side effects in the labor market that impact consumer purchasing power and, consequently, corporate revenues (Jensen *et al.*, 2001; Nickell *et al.*, 1997). The omission of these macroeconomic fac-

tors could lead to omitted-variable bias, as a firm's decline might be erroneously attributed to its financial reporting quality when, in fact, it is driven by an adverse economic environment.

To examine the impact of QFI on corporate decline we specified Model (1), based on prior studies and variables (e.g., Mateev & Anastasov, 2010):

$$Decline_{i,t} = \alpha_{i,t} + \beta_1 QFI_{i,t} + \beta_2 Prof_{i,t} + \beta_3 Size_{i,t} + \beta_4 Liquid_{i,t} + \beta_5 Debt_{i,t} + \beta_6 Age_{i,t} + \beta_7 GDP_{t+} \beta_8 Unemployment_t + \varepsilon_{i,t} \quad (model\ 1)$$

Complementarily, this study seeks to capture the effects of two major crises that occurred during the selected period (2012-2021): the sovereign debt crisis, and the COVID-19 pandemic. To assess the impact of these crises on corporate decline, the following model (2) was also specified:

$$Decline_{i,t} = \alpha_{i,t} + \beta_1 QFI_{i,t} + \beta_2 Prof_{i,t} + \beta_3 Size_{i,t} + \beta_4 Liquid_{i,t} + \beta_5 Debt_{i,t} + \beta_6 Age_{i,t} + \beta_7 CovidCrisis_t + \beta_8 SovereignDebtCrisis_t + \beta_9 GDP_t + \beta_{10} Unemployment_t + \varepsilon_{i,t} \quad (model\ 2)$$

Table 1
List of variables and their specification

Variables	Expected sign	Formulas	Measurement
Dependent			
Decline		$Real\ SG_{i,t} = \frac{1+SG_{i,t}}{1+Inf_{i,t}} - 1$ $SG_{i,t} = \frac{Sales_{i,t} - Sales_{i,t-1}}{Sales_{i,t-1}} - 1$ Decline=1 if Real $SG_{i,t}$ <0 and 0 otherwise	Real sales growth. Binary variable that assumes a value of 1 when the growth rate is negative and 0 otherwise.-
Independent			
Quality of Financial Information (QFI)	-	$NDA_{i,t} = \alpha_0\left(\frac{1}{A_{i,t-1}}\right) + \alpha_1\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \alpha_2\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$ DA = TA-NDA	Proxy based on discretionary accruals, estimated by the Jones (1991) model, in which higher values indicate lower QFI.
Control			-
Size	-	Ln (Total assets)	Total assets
Liquid	-	Current assets/Current liability	Liquidity ratio
Debt	+	Total Debt/Total Assets	Debt ratio
Prof	-	EBITDA/Total Assets	Profitability ROA
Age	-	Ln (year of analysis – year of incorporation)	Number of years since incorporation
CovidCrisis	+		Binary variable that assumes the value 1 for the Covid years (2020 and 2021) and 0 otherwise
SovereignDebtCrisis	+		Binary variable that assumes the value 1 for the Sovereign Debt Crisis years (2011 to 2015) and 0 otherwise
GDP	-		Real GDP growth rate of the country in year t.
Fixed Effects / Country			Dummies to control for institutional characteristics in each country.
Unemployment	+		Percentage of the active population that is unemployed.

Source: Own elaboration. Notes: This table presents the definition and construction of the variables employed in the study.

To explore the relationship between the quality of financial information (QFI) and the probability of corporate decline (binary variable), we estimate both fixed effects (FE) and random effects (RE) panel logit models. Each approach captures a different dimension of variation in the data: the FE model focuses on within-firm changes over time, controlling for time-invariant unobserved characteristics, while the RE model leverages both within- and between-firm variation. In our sample, the decomposition of variance in the QFI

proxy shows that approximately 62% of the total variation occurs between firms, with the remaining 38% occurring within firms over time. This suggests that much of the useful variation in QFI is cross-sectional in nature. As a result, the RE model is more sensitive to persistent differences in QFI across firms, while the FE model isolates the effect of firm-level changes in QFI over time. Together, these models provide complementary insights: the RE estimates reflect broader structural patterns across firms, whereas the FE results highlight the more conservative within-firm dynamics.

Descriptive statistics and analyses of the relationships among the variables were conducted using STATA 19.5, ensuring a rigorous and systematic approach to result interpretation.

4. DESCRIPTIVE STATISTICS

Table 2 presents the descriptive statistics for the variables used in the model. The dataset comprises 3,350 firm-year observations, ensuring sample consistency. Following winsorization, discretionary accruals display a mean of 0.20617 and a standard deviation of 0.18781.

Corporate debt is another critical factor. The mean debt level of 51.8 percent suggests that more than half of the companies' assets are financed through debt. The minimum value of 2.6 percent indicates a more conservative financial strategy in some firms, characterized by low debt levels. Profitability averages 10.1 percent, with a range spanning from –6.30 percent to 31.18 percent. The average company age is 46 years, with firms varying from newly established (1 year) to centuries old (maximum of 276 years). The average liquidity ratio is 1.64, reflecting these companies' ability to manage cash flows effectively and meet short-term liabilities.

Macroeconomic variables exhibit heterogeneous patterns: GDP records a mean of 0.039 (SD = 0.042), while the unemployment rate averages 11.1% (SD = 6.17). Overall, the evidence indicates a heterogeneous sample in terms of financial structure, profitability, liquidity, firm age, and macroeconomic context, enabling comprehensive analyses and robust comparisons of the Quality of Financial Information (QFI) and business decline.

Table 2
Descriptive statistics

Variable	Obs	Mean	Stad. Dev.	*Min*	*Max*
QFI	3,350	0.20617	0.18781	0.00329	1.03499
Debt	3,350	0.51858	0.20527	0.02598	0.99668
Prof	3,350	0.10109	0.06223	–0.06301	0.31181
Liquid	3,350	1.64218	1.08072	0.30794	6.74802
Size	3,350	5.37649	1.10647	3.17805	10.72371
Age	3,350	3.54092	0.81357	0.00000	5.62030
GDP	3,350	0.03840	0.04174	0.10249	0.12720
Unemployment	3,350	11.09667	6.17417	3.14000	27.69000

Source: Own elaboration. Notes: The table reports, for each variable, the number of observations (Obs), the mean (Mean), the standard deviation (Std. Dev), the minimum value (Min), and the maximum value (Max). Financial variables include: **QFI**: Quality of financial information, estimated using the Jones (1991) model and measured through discretionary accruals; **Debt**: debt ratio (proportion of liabilities-to-assets); **Prof**: return on assets; **Liquid**: current assets divided by current liabilities; **Size**: logarithm of total assets; and **Age**: logarithm of the number of years since the firm's establishment. Macroeconomic variables include **GDP**: gross domestic product, and the **Unemployment**: unemployment rate (%). The variables *QFI* and *Liquidity* were winsorized at the 5% and 99% levels to mitigate the influence of outliers.

The Pearson correlation matrix (Table 3) shows that most explanatory variables are weakly correlated (< 0.25), indicating limited multicollinearity concerns. A positive and statistically significant correlation emerges between discretionary accruals, a proxy for QFI, and the decline in real sales ($r \approx 0.0402$; $p < 0.0273$). This finding implies that higher discretionary accruals (lower QFI) are associated with reductions in real sales among food manufacturing firms. Such evidence aligns with recent literature, which indicates that low-quality financial information raises the cost of capital, constrains resource access, and erodes consumer confidence, ultimately leading to weaker operating performance and revenue contraction (Gao *et al.*, 2025).

Table 3
Pearson correlation matrix

	Decline	QFI	Debt	Liquid	Prof	Size	Age	GDP	Unemploy
Decline	1.0000								
QFI	0.0402**	1.0000							
Debt	–0.0233	0.0167	1.0000						
Liquid	0.0072	–0.0593***	–0.6698***	1.0000					
Prof	–0.0798***	0.2288***	–0.2295***	0.1401***	1.0000				
Size	0.0219	–0.0665***	–0.0606***	–0.0230	0.0597***	1.0000			
Age	0.0054	–0.0586***	–0.1235***	0.1508***	0.0581***	0.0862***	1.0000		
GDP	–0.0114	0.0088	0.0074	–0.0052	0.0079	0.0430***	0.0302*	1.0000	
Unemployment	–0.0009	0.0479	0.0277	–0.0198	0.0470***	–0.1817***	–0.0757	–0.1504***	1.0000

Source: Own elaboration. Notes: **QFI**: is estimated using the Jones (1991) model and measured through discretionary accruals; **Debt**: represents the ratio of total liabilities to total assets; **Prof**: denotes return on assets; **Liquidy**: is defined as current assets divided by current liabilities; **Size**: corresponds to the natural logarithm of total assets; **Age**: reflects the natural logarithm of the number of years since the firm's incorporation. The macroeconomic variables include **GDP** (Gross Domestic Product) and the **Unemployment** (% of the labor force). This table shows the Pearson correlation coefficients (and their statistical significance) between the independent variables. ***, **, * represent the significance of the coefficients at the 1%, 5% and 10% level, respectively.

Additionally, firm profitability correlates negatively and significantly with sales decline. Correlations with country dummies highlight institutional and regulatory heterogeneity across the sample, supporting the inclusion of country fixed effects in subsequent econometric specifications.

5. RESULTS

The results of the panel logit estimations reported in Table 4 (odds ratios) indicate that discretionary accruals, used as a proxy for the quality of financial information (QFI), are positively associated with the probability of corporate decline (logit coefficients are available in the appendix table). This relationship is statistically significant in the random effects (RE) specifications for both Model 1 and Model 2, with odds ratios of 2.04353 and 2.04298, respectively, supporting **H1**.

These estimates suggest that firms exhibiting higher levels of discretionary accruals face a substantially higher likelihood of experiencing a decline in sales, consistent with the interpretation that lower financial reporting quality increases firm vulnerability (in line with the findings of, e.g., Anton and Carp (2020) and Costa *et al.* (2022), who highlight the risks associated with poor financial reporting quality and risk of decline). Although the coefficients remain positive in the fixed effects (FE) models, they are not statistically significant, which may reflect the limited within-firm variation captured by this estimator.

While the model does not explicitly identify the channels through which lower QFI contributes to corporate decline, the observed association is consistent with information asymmetry and agency cost theories (Healy & Palepu, 2001; Jensen & Meckling, 1976). Weaknesses in financial reporting quality may increase uncertainty about firms' true economic conditions, thereby affecting stakeholders' perceptions and potentially constraining access to external resources. Importantly, these mechanisms are not empirically tested in this study and should be interpreted as theoretically grounded explanations rather than direct causal evidence.

Regarding firm-level control variables, leverage and profitability exhibit statistically significant effects in the RE specifications. Specifically, the odds ratios for debt are below unity and statistically significant, indicating that more leveraged firms are, on average, less likely to experience sales decline, in contrast with **H2e**. Similarly, profitability (ROA) displays a strong and negative association with decline probability across both estimators and model specifications, suggesting that more profitable firms are better positioned to sustain sales performance, supporting **H2d**. In contrast, liquidity exhibits an odds ratio below unity, showing a negative association with firm decline, as predicted by **H2c**, but does not show a statistically significant effect in any specification.

Firm size presents mixed results. The FE estimates indicate a statistically significant odds ratio below one, suggesting that larger firms are less likely to experience decline, supporting **H2b**, whereas the RE estimates are not statistically significant. Firm age exhibits a positive, though statistically insignificant, association with sales decline across all models. Although this finding runs counter to **H2a**, it may be interpreted in light of product and industry life-cycle theories, which suggest that mature firms operating in saturated markets may be more exposed to declining sales dynamics.

At the macroeconomic level, GDP growth displays a negative coefficient, although not statistically significant, indicating that adverse macroeconomic conditions increase the probability of sales decline, as predicted by **H3b**. Recent studies confirm that in essential sectors such as food manufacturing, macroeconomic shocks and global structural transformations exert influence on sales (Amankwah-Amoah, 2016; García-Sánchez *et al.*, 2022).

The unemployment rate did not exhibit a statistically significant effect, despite the reported positive effect (in line with **H3a**), which can be explained by the sector's characteristics. The food sector is regarded as non-cyclical, even under high unemployment, consumers continue to purchase food products. Hence, demand does not fall proportionally with unemployment, rendering its effect on firm decline insignificant.

Neither the COVID-19 crisis nor the sovereign debt crisis dummy variables (model 2) show statistically significant effects on the probability of decline, suggesting that firms in the food production sector were relatively resilient to these systemic shocks (e.g., Mira *et al.*, 2023). Similarly, Nathali *et al.* (2023) argue that the expansion of online sales and home deliveries helped these companies sustain a solid customer base and maintain sales. Nurseto *et al.* (2023) further concluded that, being classified as an essential sector, food companies were able to continue operations during lockdowns and restrictions. These combined factors contributed to the negligible impact of the COVID-19 pandemic on the decline of food manufacturing firms in the European Union.

Finally, the inclusion of country fixed effects reveals statistically significant cross-country differences, reinforcing the importance of controlling for institutional and structural heterogeneity when assessing the impact of QFI on corporate decline. Such evidence is consistent with the conclusions of Beynon *et al.* (2020), who argue that different combinations of regulatory, normative, and cultural–cognitive institutional conditions significantly influence firm exit rates, which may also be related with the probability of business decline. Nevertheless, the primary purpose of including country fixed effects is not to compare nations but to control structural differences, ensuring that the estimated effect of QFI on decline can be interpreted as an incremental impact independent of each economy's particular conditions.

Regarding model fit, the results in Table 4 are in line with theoretical expectations and previous findings (e.g., Bryan *et al.*, 2002; Costa *et al.*, 2022; Ganchala *et al.*, 2022; Nagar & Sen, 2018). To validate the model, we conducted the likelihood ratio test and the Wald Chi-Square test. The likelihood ratio test yielded a chi-square of -2041.157 with a p-value of 0.000, confirming the model's joint significance. The Wald Chi-Square test reported a statistic of 53.08 with a p-value of 0.0148, indicating no evidence against the model's fit. To assess the collinearity between variables, the variance inflation factor (VIF) was computed for each explanatory variable. Following Paiva (2018) and Rad *et al.* (2016), a VIF exceeding 10 would indicate multicollinearity. However, all calculated VIFs fall below this threshold, confirming the absence of multicollinearity and ensuring the validity of the model's regression coefficients.

Table 4
Results of the Logit model

Variables	Odds Ratio (OR) Model 1 FE	Odds Ratio (OR) Model 1 RE	Odds Ratio (OR) Model 2 FE	Odds Ratio (OR) Model 2 RE	VIF
QFI	1.18996	2.04353***	1.19154	2.04298***	1.07
	Firm-level Control				
Debt	0.77163	0.41115***	0.78182	0.41172***	1.94
Prof	0.00458***	0.01239***	0.00463***	0.01236***	1.13
Liquid	0.99035	0.95119	0.98939	0.95106	1.88
Size	0.45538***	0.98439	0.45711***	0.98458	1.06
Age	0.90528	1.03251	0.90957	1.03272	
	Macroeconomics-level Control				
GDP	0.18827	0.20259	0.18609	0.20133	1.01
Unemployment	1.01022	1.00306	1.00987	1.00273	1.05
SovereignDebtCrisis			0.91028	0.90659	1.09
CovidCrisis			1.04583	1.04611	1.09
Country dummies	Yes	Yes	Yes	Yes	Ok
N.º Observations	2, 979	3,015	2,979	3,015	
			Goodness of fit adjustment tests		
Log likelihood	–1372.74700	–2041.15700	–1371.95300	–2040.303	
Wald χ^2	30.72000**	53.08000**	32.31000**	54,680**	

Source: Own elaboration. **Notes:** The table reports the results of the panel logistic regression (logit) used to examine the influence of QFI on the probability of corporate decline. The estimator employed is the FE and RE panel logit model. The reported coefficients correspond to odds ratios. **Decline** (dependent variable): defined as a dummy equal to 1 when the firm experiences a reduction in sales volume, and 0 otherwise. **QFI**: discretionary accruals estimated using the Jones (1991) model; **Prof**: net income/total assets; **Size**: natural logarithm of total assets; **Liquid**: current assets/current liabilities; **Debt**: total debt/total assets; **GDP**: constant values, obtained from the WDI; **CovidCrisis**: Binary variable that assumes the value 1 for the Covid years (2020 and 2021) and 0 otherwise; **SovereignDebtCrisis**: Binary variable that assumes the value 1 for the Sovereign Debt Crisis years (2011 to 2015) and 0 otherwise; and Unemployment: percentage of the labor force officially classified as unemployed, WDI. In addition, the table presents key diagnostic tests: the Wald test for joint significance, the Hosmer–Lemeshow test for model fit, and VIF statistics to assess multicollinearity. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Robustness checks

To assess the robustness of the main findings, we re-estimate the model using an alternative definition of business decline. Specifically, the original decline indicator based on real sales variation is replaced with a dummy constructed from changes in nominal sales. This alternative specification allows us to verify whether the results are sensitive to the measurement of sales performance, which may capture both quantity and price effects.

The results reported in Table 5 confirm the robustness of the main findings concerning the quality of financial information. Discretionary accruals remain positively associated with the probability of firm decline and are statistically significant in the random effects (RE) specification, with an odds ratio of 2.49070 (p-value = 0.004). This magnitude is even larger than that observed in the baseline estimations, reinforcing the conclusion that lower financial reporting quality substantially increases the likelihood of sales decline. Although the coefficient remains positive in the fixed effects (FE) model, it is not statistically significant, consistent with the baseline results and likely reflecting limited within-firm variation.

The firm-level control variables do not exhibit statistically significant effects under this alternative specification. Leverage, profitability, liquidity, firm size, and firm age all display odds ratios that are not significantly different from unity in both FE and RE models. This suggests that when business decline is defined using nominal sales changes, internal financial characteristics play a more limited role in explaining sales contractions.

At the macroeconomic level, GDP growth does not show a statistically significant effect in either specification. The unemployment rate, however, becomes marginally significant in the RE model, with an odds ratio slightly above 1, indicating that higher unemployment rates are associated with a higher probability of a firm-level sales decline. This result is consistent with the notion that nominal sales measures may be more sensitive to broader labor-market conditions that affect aggregate demand.

Overall, these robustness checks indicate that while the relative importance of control variables varies depending on how business decline is measured, the effect of discretionary accruals remains stable in both direction and statistical significance. This consistency provides strong support for the paper's central argument, namely that lower-quality financial information is

systematically associated with a higher probability of corporate decline, regardless of the specific operationalization of sales performance.

Table 5
Robustness checks

Variables	Odds Ratio (OR) Model 1 FE	Odds Ratio (OR) Model 1 RE	VIF
QFI	1.15077	2.49070***	1.07
Firm-level Control			
Debt	0.79586	0.67693	1.94
Prof	0.24853	0.27935	1.13
Liquid	0.90054	0.99210	1.88
Size	1.05675	0.98924	1.06
Age	0.77235	0.95425	1.04
Macroeconomics-level Control			
GDP	1.60602	3.74571	1.01
Unemployment	1.06829	1.04915*	1.05
SovereignDebtCrisis			1.09
CovidCrisis			1.09
Country dummies	Yes	Yes	Ok
N.º Observations	3,015	3,015	
Goodness of fit adjustment tests			
Log likelihood	–618.665	–1013.073	
LR chi2	1821,87***	920,59***	

Source: Own elaboration. Notes: The table reports the results of the panel logistic regression (logit) used to examine the influence of QFI on the probability of corporate decline. The estimator employed is the FE and RE panel logit model. The reported coefficients correspond to odds ratios. **Decline**: the dependent variable, defined as a dummy equal to 1 when the firm shows a reduction in real sales and 0 otherwise. **QFI**: discretionary accruals estimated from the Jones model; **Prof**: net income/total assets; **Size**: natural logarithm of total assets; **Liquid**: current assets/current liabilities; **Debt**: total debt/total assets; **GDP**: in constant terms, obtained from WDI; **CovidCrisis**: Binary variable that assumes the value 1 for the Covid years (2020 and 2021) and 0 otherwise; **SovereignDebtCrisis**: Binary variable that assumes the value 1 for the Sovereign Debt Crisis years (2011 to 2015) and 0 otherwise; and **Unemployment**: % of the active population officially classified as unemployed, WDI. The main diagnostic tests are also presented: LR chi2, Loglikehood and VIF statistics to assess multicollinearity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6. CONCLUSIONS

This study examines the relationship between the quality of financial information and the probability of business decline in the European food manufacturing sector. Using a logistic regression framework applied to a large panel of firms, the analysis evaluates how internal firm characteristics and external macroeconomic conditions interact with financial reporting quality to influence the likelihood of sales decline. By focusing on discretionary accruals as a proxy for QFI, the study contributes to the literature on business decline by shifting attention from traditional financial distress indicators toward informational and governance-related dimensions.

The empirical results provide consistent evidence that lower financial reporting quality, proxied by discretionary accruals, is associated with a significantly higher probability of firm decline. This relationship remains robust across alternative model specifications and an alternative definition of decline based on nominal sales variation, thereby reinforcing the central role of QFI as a determinant of firms' resilience. These findings contribute to the literature by shifting attention away from traditional financial distress predictors and toward governance- and information-related factors as early indicators of vulnerability.

Implications within the food manufacturing sector

The sectoral focus of this study is particularly relevant. Food manufacturing is generally considered a non-cyclical and relatively stable industry, characterized by persistent demand and resilience to short-term shocks. However, the results indicate that even in such a context, weaknesses in the quality of financial reporting increase the likelihood of sales decline. This suggests that firm vulnerability in the food sector is not driven solely by market demand or operational efficiency, but also by informational frictions that affect stakeholder confidence. Poor QFI may amplify perceived risk among investors, creditors, and commercial partners, thereby constraining firms' strategic flexibility precisely when adaptation is required to address changing consumer preferences, cost pressures, or competitive dynamics.

Importantly, the limited explanatory power of traditional financial indicators, such as leverage, profitability, liquidity, and firm size, reinforces the notion that a decline in this sector reflects broader governance and informational challenges rather than purely balance-sheet weaknesses. This finding is consistent with the idea that sales decline represents an early-stage manifestation of firm vulnerability, preceding more conventional signs of financial distress.

Managerial implications

From a managerial perspective, the findings highlight the strategic value of high-quality financial reporting as a risk management tool rather than a mere compliance exercise. Managers operating in the EU food manufacturing sector should recognize that transparent and reliable financial information can reduce uncertainty, preserve access to external financing, and stabilize relationships with suppliers and customers. Investments in robust internal controls, accounting systems, and reporting practices may therefore contribute directly to firm resilience by mitigating informational risk and supporting more effective stakeholder engagement.

Policy and regulatory implications in the EU context

At the policy level, the findings carry important implications for regulators and standard-setters within the European Union.

The strong association between QFI and firm decline supports regulatory initiatives to enhance transparency, harmonize, and enforce financial reporting standards. In sectors deemed strategically important, such as food manufacturing, regulatory oversight that promotes high reporting quality may indirectly contribute to economic stability by reducing firm-level vulnerability and improving capital allocation.

Furthermore, the results suggest that policies focused exclusively on firms' financial ratios or capital adequacy may overlook critical informational dimensions of risk. Supervisory frameworks that incorporate indicators of financial reporting quality could improve early-warning systems and support more proactive interventions, particularly during periods of macroeconomic stress.

Limitations and avenues for future research

Despite its contributions, this study has several limitations. First, due to data constraints, QFI is measured solely through discretionary accruals, which may not fully capture other relevant dimensions of reporting quality, such as timeliness, conservatism, or disclosure clarity. Second, the analysis is confined to large food manufacturing firms in the European Union, limiting the generalizability of the findings to other industries, smaller firms, or different institutional settings. Third, while macroeconomic variables are included, other external factors, such as technological change or shifts in consumer behavior, are not explicitly modeled.

Future research could address these limitations by incorporating alternative and multidimensional measures of QFI, extending the analysis to small and medium-sized enterprises, or comparing results across industries with different competitive and demand structures. Further work could also examine the interactions among financial reporting quality, innovation strategies, and sustainability practices, thereby deepening our understanding of how informational governance shapes firm resilience over time.

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9. AUTHORSHIP

All authors contributed substantially to several stages of the research. Masidivinga Landu: [Conceptualization; Methodology; Formal analysis and investigation; Writing - original draft preparation; Writing - review and editing], Jorge H. Mota: [Conceptualization; Methodology; Formal analysis and investigation; Writing - review and editing; Supervision], Ana Maria Bandeira: [Conceptualization; Methodology; Formal analysis and investigation; Writing - review and editing; Supervision], António Carrizo Moreira: [Conceptualization; Methodology: Formal analysis and investigation; Writing - review and editing; Supervision].

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APPENDIX

Table A.1

Variables	Coefficients Model 1 FE	Coefficients Model 1 RE	Coefficients Model 2 FE	Coefficients Model 2 RE	VIF
QFI	0.17392	0.71468***	0.17525	0.71441***	1,07
	Firm–level Control				
Debt	–0.25925	–0.88880***	–0.24614	–0.88741***	1.94
Prof	–5.38512***	–4.39058***	–5.37638***	–4.39331***	1.13
Liquid	–0.00970	–0.05004	–0.01067	–0.05018	1.88
Size	–0.78662***	–0.01573	–0.78284***	–0.01554	1.06
Age	–0.09951	0.03199	–0.09478	0.03219	1.04
	Macroeconomics–level Control				
GDP	–1.66990	–1.59655	–1.68151	–1.60282	1.01
Unemployment	0.01017	0.00306	0.00982	0.00273	1.05
SovereignDebtCrisis			0.04482	0.04507	1.09
CovidCrisis			–0.09400	–0.09807	1.09
Country dummies	Yes	Yes	Yes	Yes	Ok
Nº Observations	3,350	3,015	2,979	3,015	
	Goodness of fit adjustment tests				
Log likelihood	–1372.747	–2041.157	–1371.953	–2040.303	
LR chi2	30.720**	53,08**	32,310**	54.680**	

Source: Own elaboration. **Notes:** The table reports the results of the panel logistic regression (logit) used to examine the influence of QFI on the probability of corporate decline. The estimator employed is the panel logit model, with the inclusion of country fixed effects. **Decline** (dependent variable): defined as a dummy equal to 1 when the firm experiences a reduction in current sales volume, and 0 otherwise. **QFI**: discretionary accruals estimated using the Jones (1991) model; **Prof**: net income/total assets; **Size**: natural logarithm of total assets; **Liquid**: current assets/current liabilities; **Debt**: total debt/total assets; **GDP**: constant values, obtained from the WDI; **CovidCrisis**: Binary variable that assumes the value 1 for the Covid years (2020 and 2021) and 0 otherwise; **SovereignDebtCrisis**: Binary variable that assumes the value 1 for the Sovereign Debt Crisis years (2011 to 2015) and 0 otherwise; and Unemployment: percentage of the labor force officially classified as unemployed, WDI. In addition, the table presents key diagnostic tests: LR chi2, log likehood and VIF statistics to assess multicollinearity. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

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Analysis of forgotten incidences on knowledge transfer and management skills in Tunja SME's

Análisis de incidencias olvidadas sobre transferencia de conocimiento y habilidades gerenciales en pymes de Tunja

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ABSTRACT

The main objective of this research is to examine the forgotten incidences in knowledge transfer and management skills within small and medium-sized enterprises (SMEs) in Tunja. The study employs the Experton method, distance measures, and forgotten effects theory to identify secondary-generation relationships between knowledge transfer (causes) and management skills (effects). The population consisted of 142 SMEs registered and active in the Chamber of Commerce of Tunja, operating in the secondary sector and with more than five years of existence. A convenience sample of 41 companies was selected. The findings show that forgotten effects are linked to the quality of knowledge transfer, highlighting the importance of formal mechanisms, communication clarity, and the ability to set priorities as factors that enhance productivity and mentoring. The originality of this study lies in uncovering hidden phenomena in knowledge transfer, particularly those arising from implicit and tacit knowledge exchanges, using fuzzy methodologies that allow for managing subjectivity. Limitations are related to the sample size and restricted access to confidential information. This research contributes to academic and business development by promoting SME strengthening, regional economic growth, and job creation in the capital of Boyacá.

Keywords: Knowledge transfer, Management skills, Forgotten effects, Incidences, SME's.

R E S U M E N

El objetivo principal de esta investigación es examinar las incidencias olvidadas en la transferencia de conocimiento y las habilidades de gestión en pequeñas y medianas empresas (PYMES) de Tunja. Para ello, se utilizó el método Experton, medidas de distancia y la teoría de los efectos olvidados, con el fin de identificar relaciones de segunda generación entre la transferencia de conocimiento (causas) y las habilidades de gestión (efectos). La población estuvo compuesta por 142 PYMES del sector secundario registradas y activas en la Cámara de Comercio de Tunja, con más de cinco años de funcionamiento. La muestra, seleccionada por conveniencia, incluyó 41 empresas. Los resultados muestran que los efectos olvidados están asociados a la calidad en la transferencia, destacándose el papel de los mecanismos formales, la claridad en la comunicación y la capacidad para establecer prioridades como factores que fortalecen la productividad y los procesos de mentoría. La originalidad del estudio radica en la identificación de fenómenos ocultos en la transferencia de conocimiento, especialmente en transacciones implícitas y tácitas, mediante el uso de metodologías difusas que permiten gestionar la subjetividad. Las principales limitaciones se relacionan con el tamaño muestral y las restricciones de acceso a información confidencial. Esta investigación aporta al fortalecimiento académico y empresarial, promoviendo el desarrollo de las PYMES, el crecimiento económico regional y la generación de empleo en la capital de Boyacá.

Palabras clave: Transferencia de conocimiento, Habilidades de gestión, Efectos olvidados, Incidencias, PYMES.

1. INTRODUCTION

Based on the uncertainty and complexity of contemporary markets, knowledge management (KM) is identified as a primary component for organizations to achieve favorable long-term performance (Anand *et al.*, 2021; Durst *et al.*, 2024). This theme has been the subject of extensive research, with studies focusing on various aspects including context, processes, and utilization (Sergeeva & Andreeva, 2016). Research has been predominantly conducted within large organizations (Serenko, 2013), which is noteworthy given the prevailing perspective that small and medium-sized enterprises (SMEs) are pivotal to economic growth. Indeed, in almost all countries, over 90% of companies fall into this category (Massaro *et al.*, 2016). Within the context of SMEs, it has been observed that their decision-making processes deviate from those employed by large corporations (Hauser *et al.*, 2020). Thus, SMEs are distinguished by their greater adaptability, flexibility, efficiency, and speed in decision-making processes (Branicki *et al.*, 2017).

Indeed, KM has been demonstrated to facilitate the enhancement of such processes (Durst *et al.*, 2024; Rao *et al.*, 2023). It provides a vital support system for companies of this nature, thereby engendering greater competitiveness in the face of mounting uncertainty on a global scale and enabling them to face these challenges. In this sense, companies that can manage their knowledge will demonstrate enhanced performance in their projects (Landaeta, 2008) and will establish greater resilience and superior competitive advantages, which must be incorporated into the organization's growth and expansion plans (Oranga, 2023; Suppiah & Singh Sandhu, 2011). Transferring accumulated knowledge is essential for sustaining competitiveness and fostering organizational learning.

Effective knowledge transfer (KT) depends on the dissemination, adaptation, and absorption of knowledge, requiring strategies that promote collaboration, mentoring, and coaching. The success of KT varies with organizational structures, processes, activities, and the capabilities of the actors involved (Modi & Mabert, 2007; R. Zhou *et al.*, 2025). Thus, organizations must articulate clear mechanisms and robust evaluation systems to consolidate knowledge assets and transform KT into a sustained source of competitive advantage (Boudreau, 2003).

Among the multiple challenges faced by KT processes is the development of managerial skills, which, according to Katz (1974) encompass technical, human, and conceptual dimensions, with leadership emerging as a critical component. A persistent difficulty in KT lies in accurately measuring its effectiveness, given its complexity and the broad array of interconnected elements that must be articulated, evaluated, and reinforced to align with the organization's competitive advantage (Boudreau, 2003). This complexity often leads to the omission of key factors in KT initiatives, undermining their impact. Consequently, conducting specific local or regional studies becomes essential to gain a deeper understanding of how KT processes unfold within diverse organizational contexts.

In this sense, the primary objective is to examine the instances of knowledge transfer and management skills in Tunja's SMEs that have been overlooked. The experton method is utilized for this purpose, employing distance measures and forgotten effects theory. This enables the generation of matrices of secondary relationships between the various elements, thereby facilitating the identification of second-order effects with the potential to generate a more substantial impact on the relationships between the variables (Kaufmann & Gil-Aluja, 1988). In a similar manner, two dimensions have been identified: knowledge transfer and management skills. These are the results of a literature review, the purpose of which was to identify forgotten incidents. The findings indicate that instances of transfer of knowledge and managerial skills being overlooked are associated with the quality of transfer. The utilization of formal transfer mechanisms, effective communication, and the capacity to establish priorities can enhance productivity and mentoring outcomes. It is imperative to emphasize that the dissemination of knowledge is predominantly facilitated by practice, the caliber of information, and mentorship. These elements constitute the primary conduit for the internalization of knowledge, thereby fostering the development of competencies and skills that are instrumental in enhancing productivity and ensuring the sustained viability of the organization.

Finally, the article is organized as follows: Section 2 presents the theoretical framework related to knowledge transfer and management skills and explains fuzzy methods and forgotten effects theory. Section 3 discusses the methodology and method used in the research. Section 4 presents the main results, while Section 6 discusses the second-order relationships obtained. Finally, Section 7 summarizes the main conclusions of the article.

2. THEORETICAL FRAMEWORK

2.1. Knowledge management

Knowledge Management (KM) is a strategic process focused on capturing, organizing, and leveraging organizational knowledge to sustain competitive advantage (Ferreira *et al.*, 2022). It involves managing two types of knowledge: tacit, embedded in individuals' experiences, and explicit, codified in systems and documents (Ferreira *et al.*, 2022; Parente *et al.*, 2022). Effective KM requires integrated processes of knowledge creation, storage, sharing, and application (de Castro *et al.*, 2022).

The SECI model (Socialization, Externalization, Combination, and Internalization) is a foundational framework for understanding the dynamic interplay between tacit and explicit knowledge (Nonaka *et al.*, 2000). It offers a comprehensive perspective on the reciprocal relationship between these two forms of knowledge (Guo *et al.*, 2020). It provides a valuable reference point for understanding how they transform and interact within complex knowledge systems (Nakash & Bouhnik, 2023). Socialization involves sharing experiences between individuals, allowing tacit knowledge to be acquired in a social context (Abubakar *et al.*, 2019). Externalization transforms this tacit knowledge into explicit knowledge using diagrams and documentation (Guo *et al.*, 2020). Combining these factors enables the organization of this explicit knowledge into coherent systems, while internalization ensures that individuals absorb it and integrate it into their routines (Nakash & Bouhnik, 2023).

Utilizing information and communication technologies (ICT), including artificial intelligence and big data systems, has

led to substantial advancements in knowledge processing and application capabilities (Di Vaio *et al.*, 2020). The utilization of these tools has been demonstrated to facilitate rapid access to information and contribute to the automation of processes, thereby enabling more efficient distribution (Ramadan *et al.*, 2017). However, organizations must confront challenges such as the fragmentation of knowledge into silos, employee resistance to change, and the rapid obsolescence of information (Wu *et al.*, 2023).

A strategic approach to addressing these challenges involves fostering an organizational culture that values continuous learning and interdisciplinary collaboration (Azeem *et al.*, 2021). Training programs, internal knowledge networks, and reward systems can be key tools that encourage the use and creation of knowledge in organizations (Upadhyay & Kumar, 2020). Furthermore, it is imperative to assess the efficacy of knowledge management by evaluating indicators such as the agility with which problems are resolved, the extent to which innovations are implemented, and the level of employee satisfaction with the available tools (Azeem *et al.*, 2021).

2.1.1. Knowledge Transfer

Knowledge transfer is a critical process for ensuring the dissemination and adaptation of knowledge to different organizational contexts. This exchange involves not only the transmission of information but also the assurance of comprehension and application of that knowledge in the recipient's context (Q. Zhou *et al.*, 2022). The knowledge transfer process can be structured in various ways. Linear models, in which the flow of information is unidirectional, and interactive models, in which bidirectional and collaborative communication are promoted, are two examples of such structures (Liu *et al.*, 2022).

The absorptive capacity of the recipient is a pivotal factor in the transfer of knowledge. This capacity depends on the recipient's prior training, experience, and motivation (Silva *et al.*, 2024). The organizational context exerts a substantial influence, for example, a culture that fosters trust, open communication, and teamwork can markedly facilitate the exchange (Ortiz *et al.*, 2023).

The advent of technological tools such as collaborative platforms, learning management systems (LMS), and instant communication applications has precipitated a paradigm shift in how organizations disseminate knowledge (Rabiman *et al.*, 2020). These platforms facilitate the expeditious transmission of knowledge across diverse departments and geographical locations, thereby attenuating temporal and spatial constraints(Hsu *et al.*, 2021). Nevertheless, the efficacy of these technologies is contingent upon implementing effective strategies to optimize their impact.

According to Cox and Overbey (2023), strategies such as the structured documentation of processes, the implementation of mentoring and coaching programs, and the creation of communities of practice can strengthen knowledge transfer. These communities, which consist of individuals who share common interests and goals, function as forums for collaborative learning and problem-solving (Napathorn, 2022). Constant feedback and adaptation to the organization's changing needs are essential for the success of these strategies (Martínez *et al.*, 2019)

In knowledge transfer, leaders assume a pivotal role by fostering an environment prioritizing transparency and trust, and exchanging ideas (Civera *et al.*, 2020). Effective leadership has been demonstrated to supersede cultural and organizational impediments that impede knowledge transfer (Q. Zhou *et al.*, 2023). In addition, the regular evaluation of the effectiveness of transfer mechanisms is imperative. Such evaluations should utilize metrics such as the level of application of the knowledge received, the time required for its integration, and the results obtained (Rashid *et al.*, 2021).

2.1.2. Management Skills

Management skills are essential enablers of effective KM and KT within organizations. Katz (1974) identifies three primary categories of skills: technical, referring to task-specific knowledge; human, emphasizing interpersonal effectiveness; and conceptual, relating to strategic thinking and systemic understanding. Mastery of these skills allows managers to coordinate teams, promote learning environments, and align individual actions with broader organizational goals (Boudreau, 2003).

Leadership plays a pivotal role in strengthening KM processes (Gürlek & Çemberci, 2020). Transformational leadership, in particular, fosters an atmosphere of trust, collaboration, and shared vision, crucial for promoting knowledge sharing and innovation (Rahimi *et al.*, 2022). Transformational leaders empower employees to engage actively with knowledge processes, thereby enhancing organizational agility and resilience (Kaur Bagga *et al.*, 2023).

The technological evolution of organizations has made digital literacy a fundamental competency for managers (Bitkowska *et al.*, 2023). Efficient use of knowledge management systems, collaborative platforms, and artificial intelligence tools optimize knowledge flows and accelerate decision-making processes (Boccoli *et al.*, 2024). Managers must not only adopt these technologies but also drive their integration into everyday organizational practices (Gu *et al.*, 2024).

Another essential skill for managers is the ability to solve complex problems (Myszkowski *et al.*, 2015). Managers must be able to analyze data, identify patterns, and propose practical solutions that integrate available knowledge (Yeadon-Lee & Hall, 2013). Effective communication skills must complement this analytical approach, allowing managers to convey ideas clearly and persuasively to different audiences within the organization (Afsar & Umrani, 2019).

Future-oriented analyses emphasize that competencies such as analytical thinking, creativity, technological design, critical evaluation, complex problem solving, and emotional intelligence will define the managerial profiles needed to sustain competitiveness (Konopik *et al.*, 2022; Mele *et al.*, 2024). Managers will be required not only to master these skills but also to foster dynamic learning ecosystems that continuously promote innovation and strategic adaptability (Rabelo Neto *et al.*, 2024)

2.2. *Fuzzy methods*

Fuzzy methodology is a mathematical approach based on the theory of fuzzy sets developed by Zadeh, (1965) that allows

modeling problems in which uncertainty and subjectivity play a determining role (Blanco-Mesa & León-Castro, 2024). Using fuzzy logic in such contexts enables the management of information characterized by ambiguity, imprecision, or incompleteness, thereby facilitating enhanced decision-making processes in scenarios where traditional models prove to be inadequate (García-Orozco *et al.*, 2022; Yager, 2003).

One of the primary advantages of fuzzy logic is its capacity to furnish analytical frameworks for evaluating problems characterized by non-deterministic relationships between variables (Türk *et al.*, 2021). This approach has been extensively applied in multicriteria decision making (MCDM), in which various alternatives are considered without clear delineation of exact values (Amoozad Mahdiraji *et al.*, 2024; Jahangiri *et al.*, 2020). This classification encompasses multi-attribute decision making (MADM), multiple objectives (MODM), and uncertain multi-attribute decision making (UMADM) (Hendukolaie *et al.*, 2011; Keshavarz Ghorabaee *et al.*, 2017), which enables the incorporation of subjectivity in the evaluation of variables (Nazari *et al.*, 2012).

Another salient feature of fuzzy methodology is its capacity to curtail errors in data modeling and enhance the precision of information evaluation (Piltan & Kim, 2023). This is particularly salient as it enables the incorporation of subjective data into decision-making processes and cultivates the formulation of adaptive organizational strategies (Banaeian *et al.*, 2018).

Additionally, fuzzy logic has emerged as a foundational instrument in discerning the interrelationships among disparate organizational factors (Azadnia *et al.*, 2015). Its capacity to interpret information with enhanced flexibility mitigates modeling errors and optimizes the efficacy of the criteria employed to evaluate critical data (Dorokhova *et al.*, 2024).

Furthermore, fuzzy logic facilitates the resolution of decision-making challenges in highly dynamic systems characterized by multiple interdependent variables (Shahmohammad *et al.*, 2024). At the organizational level, this capacity enables the modeling of uncertainty, thereby providing mathematical tools to optimize information transfer and enhance operational efficiency (Misnik & Shalukhova, 2024), while its aptitude for multicriteria analysis enables the mitigation of biases in decision-making processes, thereby ensuring that business strategies are more robust and better grounded in complex and uncertain data (Wang *et al.*, 2015).

Different levels of truth are proposed from this perspective, and the interpretation of reality is from different perspectives with varying degrees of acceptance (Kaufmann & Gil-Aluja, 1988). This suggests that information may be fragmentary or incomplete, requiring analytical tools that facilitate the evaluation of the interdependence between factors (Alfaro-Calderón *et al.*, 2019). In this context, the concept of incidence is pivotal, as it enables the identification of direct and indirect relationships between phenomena, providing an analytical framework that is largely free of significant errors (Kaufmann & Gil-Aluja, 1988). Incidence, understood as the interaction between entities within a system, facilitates the visualization of how variables influence each other (González-Morcillo *et al.*, 2023).

Despite the complexity of measurement due to its subjective nature, analysis of this phenomenon contributes to improved informed decision making (Martorell-Cunill *et al.*, 2013). It also recognizes the existence of effects that, although not immediately evident, can generate relevant impacts over time (Olazabal-Lugo *et al.*, 2019). Consequently, reality comprises interconnected systems wherein each activity is subject to a cause-and-effect relationship (Gil-Lafuente *et al.*, 2012). The intensity and gradualness of these incidences are influenced by human subjectivity, which is affected by risk perception, experience, intuition, and attitude (Kaufmann & Gil-Aluja, 1988). Fuzzy methodology, founded on heuristics and experiential learning, facilitates enhanced comprehension of phenomena and the development of more precise strategies, thereby reducing uncertainty in organizational decision making (Blanco-Mesa & León-Castro, 2024).

2.2.1. Forgotten effects theory

The forgotten effects method, developed by Kaufmann and Gil-Aluja (1988) is a theoretical framework that identifies non-obvious causal relationships within an organizational system. This approach utilizes incidence matrices to detect the indirect influence of certain variables on the dynamics of knowledge management and strategic decision-making (García-Orozco *et al.*, 2021; Ruiz *et al.*, 2022). The forgotten effects analysis is predicated on constructing matrices representing direct and indirect relationships between causes and effects (Alfaro-Calderón *et al.*, 2019). By employing maximum-minimum convolutions, hidden patterns in the interaction of variables can be uncovered, allowing for improved formulation of business strategies (Kaufmann & Gil-Aluja, 1988). Detecting neglected effects facilitates improved planning by ensuring that all influential factors are considered in decision-making (Velazquez-Cazares *et al.*, 2021). This is especially relevant within MSMEs, where the lack of recognition of certain effects can generate inefficiencies in learning and training processes (Blanco-Mesa *et al.*, 2021). Furthermore, it fosters a more comprehensive understanding of the organizational impact, thereby enabling the development of precise interventions that enhance the efficiency and sustainability of the company (Maqueda-Lafuente *et al.*, 2013).

The forgotten effects method has been a staple in business management, particularly in strategic decision-making and uncertainty reduction (Cisneros Quintanilla *et al.*, 2023). Its integration into financial analysis has enabled the identification of factors influencing the economic stability of organizations, offering a more nuanced perspective on how certain decisions can generate indirect effects that are not immediately apparent (Flores-Romero & González-Santoyo, 2020). This approach has been particularly impactful in studies examining business competitiveness, where the intricate interplay between financial planning, cost structure, and competitive position has been thoroughly investigated by identifying these latent variables (Patel *et al.*, 2023). Moreover, recent research has employed the theory of forgotten effects in the tourism sector to assess how various variables, such as infrastructure, complementary services, and accessibility, influence competitiveness and tourism gross domestic product (GDP) growth in emerging destinations (González-Morcillo *et al.*, 2023). It has been demonstrated that there are multiple incidence factors that, although not immediately considered, have a significant impact on the economic

performance of a region (Velazquez-Cazares *et al.*, 2021). The application of this method has been expanded to various fields, including economics, sociology, and management, to identify latent relationships between variables in complex systems (Mulet-Forteza *et al.*, 2024). The method's capacity to analyze interdependencies across diverse domains enables the anticipation of secondary effects that would otherwise remain unperceived (Patel *et al.*, 2023). This approach provides analytical tools in a dynamic environment to improve decision-making and increase efficiency in formulating business policies and strategies (Linares-Mustarós *et al.*, 2020).

3. METHODOLOGY

This study on knowledge transfer and managerial skills in Tunja SMEs is developed using a methodology that combines subjective data collection with advanced methods of analysis, such as the application of the Experton Method (Kaufmann & Gil-Aluja, 1993), Hamming's distance (1950) and the method of the Theory of Forgotten Effects (Kaufmann & Gil-Aluja, 1988).

3.1. Model to find the forgotten effects

The development of the model was informed by the theoretical foundations represented by the dimensions, variables, and methods to be applied (Figure 1). A logical sequence was established for the treatment process, to identify neglected effects. In this process, data collection (opinions and subjective criteria) related to the dimensions defined for the study was considered. The treatment process was then presented based on cause-and-effect conditions that allowed for establishing intermediate relationships until the forgotten effects were found. This process culminates in identifying novel relationships between knowledge transfer and managerial skills. The methods employed facilitate the calculation of semantic scales, which are transformed into representative numerical values. These numerical values establish approximate relationships and relative explanations, yielding vast possibilities (Blanco-Mesa *et al.*, 2021).

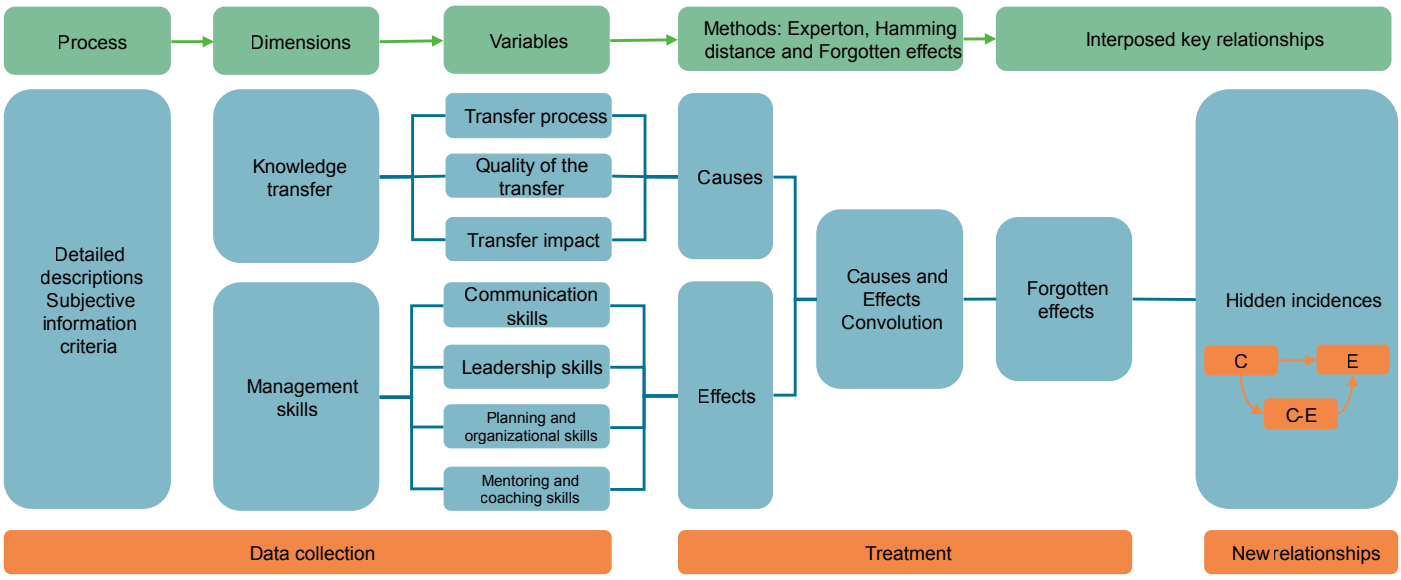

Figure 1
Model to find the forgotten effects between knowledge transfer and managerial skills in SMEs
Source: Own elaboration based on the studies of Blanco-Mesa *et al.*, (2021).

These relationships indicate the significance of the information by their incidence (Blanco-Mesa *et al.*, 2021). The intensity and linkage of relationships are pivotal in determining their occurrence. According to (Blanco-Mesa *et al.*, 2018) intensity pertains to the presence of a connecting agent within the relationship. This enables analysis of convergence, boundary, periodicity, and non-standard situations represented in potential connections. Linkage, conversely, demonstrates the direct and indirect connections of relationships. This facilitates the examination of variations in the intensity and strength of relationships and the observation of behavior.

3.2. Case study

The population consisted of 142 small and medium-sized enterprises (SMEs) registered and active in the Chamber of Commerce of Tunja, operating within the secondary sector and founded more than five years ago, according to official records. The sample is selected through a purposive sampling approach (Sharp, 2003) and convenience criteria (Mackiewicz, 2018) resulting in 41 participating companies, where managers were asked to answer the questionnaire. This selection aimed to ensure that the organizations had sufficient operational maturity and stability to provide

reliable insights into knowledge transfer processes. Although the study sample is small, the data obtained are sufficient to carry out the treatments using the proposed techniques, such as the expert method, which allows the opinions and degree of belief of small samples to be aggregated to obtain a single representative value.

3.3. Data collection

For data collection, a survey was developed that focused on the transfer of knowledge and managerial skills. This survey was based on a theoretical review, which facilitated the identification of the key dimensions and variables for the study. The following dimensions and variables are shown below: Table 1 delineates the pivotal variables in evaluating knowledge transfer. These variables are derived from the SECI model (Hoe, 2006; Nonaka, 2007; Nonaka *et al.*, 1996, 2000; Nonaka & Konno, 1998; Nonaka & von Krogh, 2009) and from Knowledge Creation Theory (Nonaka & Toyama, 2005), as well as the phases of knowledge transfer (Szulanski, 1996, 2000) and the theory of the Nature of Knowledge and Organizational Context (Argote & Ingram, 2000). Table 2 delineates the fundamental variables of managerial skills. These variables were identified using the following models: the managerial competencies model (Boyatzis, 2002), the managerial competencies model (Rahimi *et al.*, 2022), the 360-degree feedback managerial skills model (Atkins & Wood, 2002) and the model of managerial skills in organizations (Katz, 1974).

Table 1
Knowledge Transfer Dimension

Dimension 1	Variables	Indicators	Identifier
Knowledge transfer (Argote & Ingram, 2000; Hoe, 2006; Nonaka, 1994, 2007; Nonaka *et al.*, 1996, 2000; Nonaka & Konno, 1998; Ruth *et al.*, 2017; Szulanski, 1996, 2000)	Transfer process	Existence of formal transfer mechanisms.	TP1
		Frequency of knowledge transfer.	TP2
	Quality of the transfer	Clarity of transferred knowledge.	QT1
		Relevance of transferred knowledge.	QT2
	Transfer impact	Applicability of acquired knowledge.	TI1
		Improvement in efficiency or productivity.	TI2

Source: Own elaboration.

Table2
Management Skills Dimension

Dimension 2	Variables	Indicators	Identifier
Management skills (Atkins & Wood, 2002; Boyatzis, 2002; Katz, 1974; Rahimi *et al.*, 2022)	Communication skills	Clarity of communication.	CS1
		Frequency and quality of feedback	CS2
	Leadership skills	Ability to inspire and motivate.	LS1
		Ability to make decisions.	LS2
	Planning and organizational skills	Ability to set goals and priorities.	POS1
		Time and resource management.	POS2
	Mentoring and coaching skills	Availability and effectiveness of the mentor.	MCS1
		Development of competencies and skills	MCS2

Source: Own elaboration.

A consideration of the variables reveals that the inquiries within Dimension 1 pertain to knowledge transfer within the organizational context, encompassing formal mechanisms and the relevance of the transferred knowledge. Dimension 2 encompasses inquiries about the managerial competencies deemed indispensable for knowledge transfer, including leadership, planning, mentoring, and coaching skills. The data collection instrument employs a semantic scale to assess the cause-and-effect relationship between knowledge transfer and managerial skills in businesses (see Table 3).

Table 3
Semantic scale

SS	TD	SD	I	SA	TA
NC	0.00	0.25	0.50	0.75	1

Source: Own elaboration. SS: semantic scale, NC: numerical criteria, SD: Total disagree, SD: strongly disagree, I: indifferent, SA: strongly agree, TA: Total agree.

A reliability test is also performed (Hernández *et al.*, 2014) using Cronbach's coefficient, the results of which yielded 0.87, located in the range of strong reliability. This indicates that the instrument presents good internal consistency. Finally, the FuzzyLog© (Gil-Lafuente, 2012) was used to process the collected data. This software utilizes mathematical models to demonstrate second-order incidence relationships and the degree of oblivion in initial estimates. Additionally, it provides the results of the incidence matrix calculation in both graphic and numerical formats (Barragán & Marquez, 2012).

3.4. Methods

The present research employed a variety of methodologies for data analysis, including the entropy method, Hamming's distance, and the theory of forgotten effects. These approaches facilitate the prioritization of understanding and interpretation of information based on its meaning (Blanco-Mesa *et al.*, 2023).

3.4.1. Experton method

Kaufmann's method is a mathematical approach grounded in fuzzy set theory and the aggregation of expert opinions (Kaufmann & Gil-Aluja, 1993). The presentation of expert opinions is in the form of a probability interval, representing their degree of belief about an event, the α-corte, is defined as follows:

$$\forall a \in E : \left[a_j^*(a)\right], \left[a_j^*(a)\right] \subset [0,1], \tag{1}$$

where ⊂ means the inclusion set and j means the expert.

According to Blanco-Mesa *et al.* (2023) experton is characterized by 1) non-strict horizontal increasing monotonicity property[1] and 2) non-strict vertical increasing monotonicity property, except at level 0 which always takes the value 1. Then:

$$\forall \alpha \in [0,1] : \alpha_1(a) \leq \alpha_2(a) en\ \alpha_1\left[\alpha_1(a), \alpha_2(a)\right], \tag{2}$$

$$\forall \alpha\alpha' \in [0,1] : a' > a \Rightarrow \left(\alpha_1(a)\right) \leq \alpha_1 a', \alpha_2(a) < a_2(a'), \tag{3}$$

$$(a = 0) \Rightarrow \left(a_1(a) = 1, a_2(a) = 1\right). \tag{4}$$

The variables are evaluated using a number $\alpha \in [0, 1]$ or confidence intervals.

3.4.2. Hamming's Distance

The Hamming (1950) distance allows us to estimate the comparison between two arguments x_i and y_i. It can be defined as follows.

Definition 1. A Hamming distance of dimension n is a mapping d_H: $R^n x R^n \rightarrow R$, such as:

$$d_H\left(\langle x_1, y_1\rangle, \ldots, \langle x_n, y_n\rangle\right) = \sum_{j=1}^{n} \left|x_i - y_i\right|, \tag{5}$$

where x_i and y_i are the ith arguments of the sets X and Y.

3.4.3. Forgotten effects method

The use of the forgotten effects method allows the identification of hidden causal relationships between factors through incidence matrices (García-Huerta & Kido-Cruz, 2022; Gil-Lafuente *et al.*, 2020; Ruiz *et al.*, 2022).

The incidence matrices are represented in the relationships between causes (A) and effects (B), where there is an incidence a_i sobre b_j. The values of the characteristic function of the pair (a_i, b_j) are evaluated between [0,1]:

$$\forall\left(a_i, b_j\right)\right) \Rightarrow \mathcal{M}\left(a_i, b_j\right)\right) \in [0,1]. \tag{6}$$

Then the direct incidence matrix is defined by the set of valued pairs of elements:

$$\tilde{M} = \begin{array}{c|cccc} & b_1 & b_2 & \cdots & b_j \\ a_1 & u_{a_1b_1} & u_{a_1b_2} & \cdots & u_{a_1b_j} \\ a_2 & u_{a_2b_1} & u_{a_1b_2} & \cdots & u_{a_2b_j} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ a_i & u_{a_ib_1} & u_{a_ib_2} & \cdots & u_{a_ib_j} \end{array} \tag{7}$$

Therefore, the direct relationship matrices are given by:

$$[\tilde{M}] = \left\{Ma_ib_j \in [0,1] / i = 1,2,\ldots,n; j = 1,2,\ldots,m\right\} \tag{8}$$

According to M_{aibj}, the characteristic function of the permanence of the elements of the matrix $[\tilde{M}]$, where $\tilde{M}$ is formed by the effects that the elements of set A have on set B. Indirect relations are given by:

$$[\tilde{A}] = \left\{Ma_ib_j \in [0,1] i, j = 1,2,\ldots,n\right\} \tag{9}$$

$$[\tilde{B}] = \left\{Ma_ib_j \in [0,1] i, j = 1,2,\ldots,m\right\} \tag{10}$$

where $[\tilde{A}]$ collects the occurrence relations between the causes and $[\tilde{B}]$ does so for the effects. Both matrices are reflexive, and it is satisfied that $M_{aibj} = 1 \forall i = 1, 2..., n$ y que $M_{bibj} = 1 \forall i = 1, 2..., m.$, and both matrices will be symmetrical. The incidences of the second generation are given by:

$$[\tilde{A}] \circ [\tilde{M}] \circ [\tilde{B}] = [\tilde{M}^*] \tag{11}$$

Thus, with the three matrices defined, causal relationships are established through maximum-minimum composition:

[1] This means that the membership characteristic function of the positively sloping function is less than or equal to the characteristic function of the negative slope function (Blanco-Mesa *et al.*, 2023).

$$\begin{array}{ccccccc}
\rightarrow & a_1 & a_2 & \cdots & a_n \\
a_1 & 1 & u_{a_1a_2} & \cdots & u_{a_1a_n} \\
a_2 & u_{a_2a_1} & 1 & \cdots & u_{a_2a_n} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
a_n & u_{a_na_1} & u_{a_na_2} & \cdots & a_n
\end{array}
\underset{[\tilde{A}]}{}
\circ
\begin{array}{ccccccc}
\rightarrow & b_1 & b_2 & \cdots & b_m \\
a_1 & 1 & u_{a_1b_2} & \cdots & u_{a_1b_m} \\
a_2 & u_{a_2b_1} & 1 & \cdots & u_{a_2b_m} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
a_n & u_{a_nb_1} & u_{a_nb_2} & \cdots & 1
\end{array}
\underset{[\tilde{M}]}{}
\circ
\begin{array}{ccccccc}
\rightarrow & b_1 & b_2 & \cdots & b_n \\
b_1 & 1 & u_{b_1b_2} & \cdots & u_{b_1b_m} \\
b_2 & u_{b_2b_1} & 1 & \cdots & u_{b_2b_m} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
b_m & u_{b_mb_1} & u_{b_mb_2} & \cdots & 1
\end{array}
\underset{[\tilde{B}]}{}$$

$$= \begin{array}{ccccc}
\rightarrow & b_1 & b_2 & \cdots & b_m \\
a_1 & u_{a_1b_1} & u_{a_1b_2} & \cdots & u_{a_1b_m} \\
a_2 & u_{a_2b_1} & u_{a_2b_2} & \cdots & u_{a_2b_m} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
a_n & u_{a_nb_1} & u_{a_nb_2} & \cdots & u_{a_nb_m}
\end{array}
\underset{[\tilde{M}^*]}{} \qquad (12)$$

To find the degree of oblivion of some causal relationships is given by:

$$[\tilde{O}] = [\tilde{M}^*] - [\tilde{M}] \qquad (13)$$

Therefore, if the value of the characteristic function of the matrix elements $[\tilde{O}]$ is high, the degree of forgetting in the initial incidence ratio is the highest.

$$[\tilde{O}] = \begin{array}{ccccc}
\rightarrow & b_1 & b_2 & \cdots & b_m \\
a_1 & u^*_{a_1b_1} - u_{a_1b_1} & u^*_{a_1b_2} - u_{a_1b_2} & \cdots & u^*_{a_1b_m} - u_{a_1b_m} \\
a_2 & u^*_{a_2b_1} - u_{a_2b_1} & u^*_{a_2b_2} - u_{a_2b_2} & \cdots & u^*_{a_2b_m} - u_{a_2b_m} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
a_m & u^*_{a_nb_1} - u_{a_nb_1} & u^*_{a_nb_2} - u_{a_nb_2} & \cdots & u^*_{a_nb_m} - u_{a_nb_m}
\end{array}
\underset{[\tilde{A}]}{} \qquad (14)$$

4. RESULTS

The results of the proposed methods are presented below. First, the results of the experton method are presented, and then those of the neglected effects are presented, using Hamming's distance to construct the cause-and-effect matrices.

4.1. Experton method results

This method uses a cumulative distribution function to facilitate the grouping of the data from the 41 managers that answered the questionnaire, which gives the following results in the following tables, organized according to the dimensions presented in the methodology. It is worth noting that the opinions of the experts are aggregated using a probability interval to obtain a single value that is representative of the opinions. Table 4 shows the results of the experton method per item of knowledge transfer, where 4 causes are represented by the letter C and 2 effects are represented by the letter E, of which the lowest is C_1 (existence of formal transfer mechanisms). This result is the compilation of the 41 subjective opinions leading to a general opinion calculated by the experton method.

Table 4
Knowledge Transfer Dimension experton results

Item	Type	Identifier	Experton
TP1	Cause	C_1	0.52
TP2	Cause	C_2	0.84
QT1	Cause	C_3	0.86
QT2	Cause	C_4	0.85
TI1	Effect	E_1	0.88
TI2	Effect	E_2	0.85

Source: Own elaboration.

Table 5 shows the items related to the Management Skills dimension, where all 10 items are identified as effects, with the effect with the lowest overall opinion being E_{10} (development of competencies).

Table 5
Management Skills Dimension experton results

Item	Type	Identifier	Experton
CS1	Effect	E_3	0.94
CS2	Effect	E_4	0.93
LS1	Effect	E_5	0.93
LS2	Effect	E_6	0.91
POS1	Effect	E_7	0.94
POS2	Effect	E_8	0.95
MCS1	Effect	E_9	0.89
MCS2	Effect	E_{10}	0.77

Source: Own elaboration.

4.2. Forgotten effects method results

To analyze the incidence of the forgotten factors of knowledge transfer on the managerial skills of Tunja SMEs, the variables of dimension 1 knowledge transfer and the variables of dimension 2 managerial skills are taken from the results of the experton method. Using Hamming's distance, the direct chance matrix $[\tilde{A}]$ and $[\tilde{B}]$ is presented (see tables 6 and 7). Additionally, the matrices $[\tilde{M}]$, $[\tilde{M}^*]$ and $[\tilde{O}]$ are presented in Tables 8, 9, and 10, respectively.

Table 6
Direct Cause-Cause Matrix $[\tilde{A}]$

↱	C_1	C_2	C_3	C_4
C_1	0.00	0.32	0.34	0.33
C_2	0.32	0.00	0.02	0.01
C_3	0.34	0.02	0.00	0.01
C_4	0.33	0.01	0.01	0.00

Source: Own elaboration using FuzzyLog.

Table 7
Direct Effect-Effect Matrix $[\tilde{B}]$

↱	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
E_1	0.00	0.03	0.06	0.05	0.05	0.02	0.06	0.06	0.01	0.11
E_2	0.03	0.00	0.09	0.08	0.08	0.05	0.09	0.09	0.04	0.08
E_3	0.06	0.09	0.00	0.01	0.01	0.03	0.00	0.01	0.05	0.17
E_4	0.05	0.08	0.01	0.00	0.00	0.02	0.01	0.02	0.04	0.16
E_5	0.05	0.08	0.01	0.00	0.00	0.02	0.01	0.02	0.04	0.16
E_6	0.02	0.05	0.03	0.02	0.02	0.00	0.03	0.04	0.02	0.13
E_7	0.06	0.09	0.00	0.01	0.01	0.03	0.00	0.01	0.05	0.17
E_8	0.06	0.09	0.01	0.02	0.02	0.04	0.01	0.00	0.06	0.17
E_9	0.01	0.04	0.05	0.04	0.04	0.02	0.05	0.06	0.00	0.12
E_{10}	0.11	0.08	0.17	0.16	0.16	0.13	0.17	0.17	0.12	0.00

Source: Own elaboration using FuzzyLog.

Table 8
Direct Cause-Effect Matrix $[\tilde{M}]$

↱	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
C_1	0.36	0.33	0.42	0.41	0.41	0.39	0.42	0.43	0.37	0.25
C_2	0.04	0.02	0.10	0.09	0.09	0.07	0.1	0.11	0.05	0.07
C_3	0.02	0.00	0.08	0.07	0.07	0.05	0.08	0.09	0.03	0.09
C_4	0.03	0.00	0.09	0.08	0.08	0.06	0.09	0.10	0.04	0.08

Source: Own elaboration using FuzzyLog.

Table 9
Convolution matrix $[\tilde{A}] \circ [\tilde{M}] \circ [\tilde{B}] = [\tilde{M}^*]$

↱	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
C_1	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.11
C_2	0.11	0.09	0.17	0.16	0.16	0.13	0.17	0.17	0.12	0.17
C_3	0.11	0.09	0.17	0.16	0.16	0.13	0.17	0.17	0.12	0.17
C_4	0.11	0.09	0.17	0.16	0.16	0.13	0.17	0.17	0.12	0.17

Source: Own elaboration using FuzzyLog.

Table 10
Forgotten effects matrix [$\tilde{O}$]

↱	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
C_1	–0.27	–0.24	–0.33	–0.32	–0.32	–0.3	–0.33	–0.34	–0.28	–0.14
C_2	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.06	0.07	0.10
C_3	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.08
C_4	0.08	0.09	0.08	0.08	0.08	0.07	0.08	0.07	0.08	0.09

Source: Own elaboration using FuzzyLog.

The matrix of forgotten effects demonstrates varying degrees of forgetting among causes C_2, C_3, and C_4 encompassing all effects from E_1 to E_{10}. Additionally, it is noted that C_1 exhibits negative values across all effects, indicating an absence of forgetting. All negative values are represented as zero to prevent ambiguity in interpreting the results. The matrix of neglected effects [$\tilde{O}$] is presented in Table 11.

Table 11
Forgotten effects matrix [$\tilde{O}$]

↱	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
C_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_2	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.06	0.07	0.10
C_3	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.08
C_4	0.08	0.09	0.08	0.08	0.08	0.07	0.08	0.07	0.08	0.09

Source: Own elaboration.

The program identified potential solutions to the previously unaddressed effects (see Table 12). An alternative approach exists to enhance the cause-effect relationship for causes C2, C3, and C4, associated with effects E1, E2–E9. However, it is noteworthy that these same causes, which are associated with effects E_2 and E_{10}, augment the number of potential solutions by a factor of three. Considering these observations, it is imperative to accord these two effects a heightened level of significance, given their capacity to engender many avenues for enhancing knowledge transfer and management skills.

Table 12
List of incidents of the Forgotten Effects

	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
C_1	0	0	0	0	0	0	0	0	0	0
C_2	1	3	1	1	1	1	1	1	1	3
C_3	1	3	1	1	1	1	1	1	1	3
C_4	1	3	1	1	1	1	1	1	1	3

Source: Own elaboration. Transfer process: C_2: Frequency of knowledge transfer. Quality of the transfer: C_3: Clarity of the knowledge transferred. C_4: Relevance of the knowledge transferred. Impact of the transfer: E_2 Improvement in efficiency or productivity. Mentoring and coaching skills: E_{10} Development of competencies and skills.

When inquiring into the key relationships interposed between causes C_2, C_3 and C_4 and effects E_2 and E_{10}, it is found that they all coincide with the intermediate paths to be taken such as sequences $C_1 \rightarrow E_3$, $C_1 \rightarrow E_7$, $C_1 \rightarrow E_8$ (see Table 13).

Table 13
Interpose relevant key relationships

	E_2: E_2: Improved efficiency or productivity	**E_{10}: E_{10}: Development of competencies and skills**
C_2: Frequency of knowledge transfer	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$
C_3: Clarity of transferred knowledge	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$
C_4: Relevance of transferred knowledge	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$	$C_1 \rightarrow E_3$ $C_1 \rightarrow E_7$ $C_1 \rightarrow E_8$

Source: Own elaboration. C_1: Existence of formal transfer mechanisms; E_3: Clarity in communication; E_7: Ability to establish goals and priorities; E_8: Time and resource management.

This suggests that to improve efficiency or productivity (E_2) and to develop competencies and skills (E_{10}), these sequences must be worked with continuity, highlighting the existence of formal transfer mechanisms (C_1) by being present as the main intervening key. Likewise, the aspects Clarity in communication (E_3), Ability to establish goals and priority (E_7), and Time and resource management (E_8), become relevant for improvement according to their effect. Their analysis is expanded in the discussion to better understand the results.

5. DISCUSSION

Knowledge transfer in companies is important, particularly in SMEs, where stability and longevity are at stake. This research aimed to analyze the incidence of the forgotten factors of knowledge transfer in the managerial skills of SMEs in Tunja. Utilizing mathematical tools grounded in fuzzy models, the present study identified and evaluated the intensity of the incidence relationships between knowledge transfer and managerial skills in Tunja's SMEs. Additionally, it examined the forgotten effect present in these relationships (see Figure 2).

In the initial stage of the investigation, a close relationship was identified between the causes and effects evaluated. This finding suggests that Tunja's SMEs can transfer knowledge to a considerable extent. The investigation further revealed a direct relationship between the frequency of knowledge transfer and the development of competencies and skills. The planned knowledge transfer should be frequent in tasks and mentoring processes, as well as being clear and relevant (quality of knowledge). This is essential for the application of knowledge, the improvement of processes, and the making of decisions. As Katz (1974) noted, clarity is paramount to avoid misunderstandings and ensure all team members are aligned with organizational objectives.

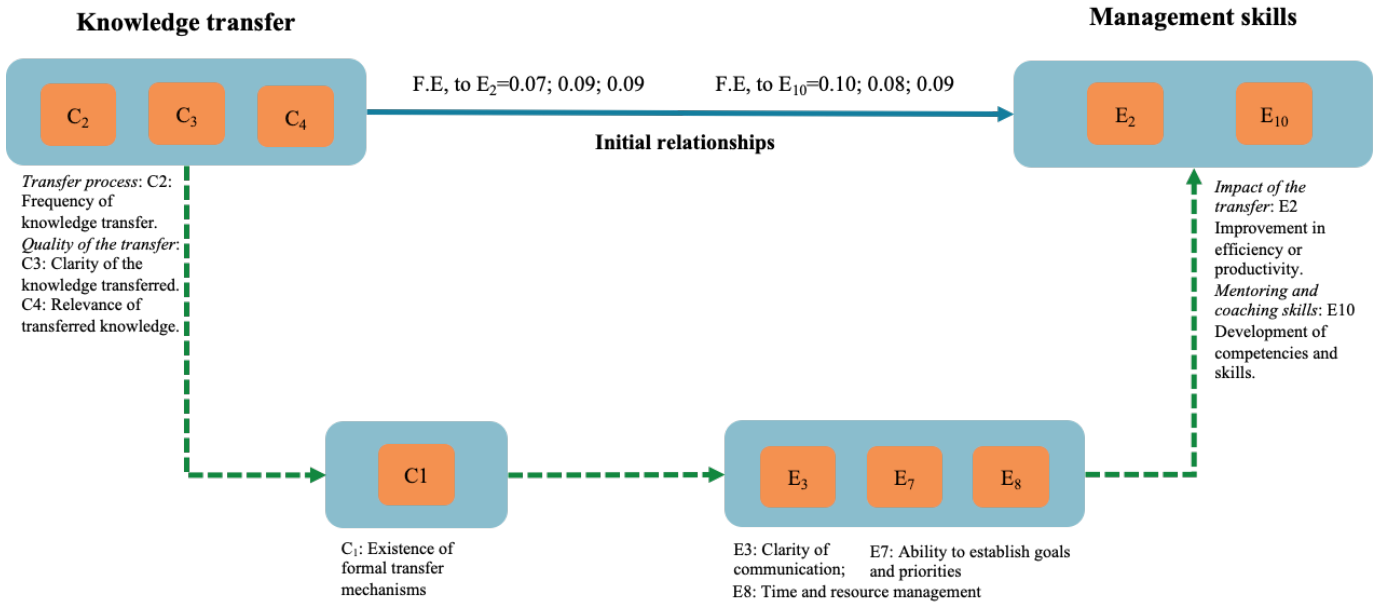

Figure 2
Forgotten effects between knowledge transfer and managerial skills in SMEs
Source: Own elaboration.

Additionally, clarity is crucial when applying knowledge, as internalization is contingent on it to develop competencies and skills aligned with the company's needs. In this regard, tacit knowledge is pivotal, predominantly transmitted from predecessors to successors. Cultivating positive relationships is paramount, as it facilitates the frequent and effective transfer of knowledge (Lozano-Posso, 2008). Indeed, in cultivating competencies through mentorship and coaching, a direct emphasis on transforming tacit knowledge into explicit knowledge is imperative for efficacious transfer (Szulanski, 1996). This approach facilitates the identification of strengths, cultivating essential skills in the learner, and assimilating knowledge (clarity and relevance of knowledge) from 360-degree feedback (Atkins & Wood, 2002). Finally, the applicability of transferred knowledge is contingent upon its frequency and clarity. It is futile to transfer knowledge that is not frequently utilized in the company and that does not generate value, as is misapplying knowledge because it was not transferred with clarity (Atkins & Wood, 2002).

A relevant result can be observed in Table 3, where we see that C2, C3, and C4 have high forgotten effects with E2 and E10, which means a high relationship between the frequency, clarity, and content of knowledge transfer has a significant impact on the increase in efficiency and/or productivity and the development of competencies and skills. The above becomes relevant to an analysis by entrepreneurs since this shows that knowledge transfer has an indirect effect on the daily processes of the organization, which can initially make it difficult for companies to see clearly how this benefits their results. However, as can be seen, if having an adequate transfer of knowledge increases efficiency, productivity, competencies, and skills then it becomes a vital resource to develop internally. In this sense, the organization must generate spaces where formal mechanisms for knowledge transfer can be created that are appropriate to the needs and realities of the company, thus generating a constant system of collaboration between actors and constantly improving workers' skills and knowledge.

6. CONCLUSIONS

Knowledge management in companies is essential in a world that changes in seconds, where knowledge retention is a challenge for companies' productivity, sustainability and longevity. In addition, the challenge of knowledge transfer is more complex when most of the knowledge is in tacit form, a main characteristic of MSMEs (Ferreira *et al.*, 2022). When employees leave their role, they take with them all their knowledge acquired through experience and practice, which implies costs for the company (Manzano-Santana & Mul-Encalada, 2021), even carrying risks of leakage of their "know-how" since the competitive advantage of MSMEs is found in their resources (knowledge as intellectual capital) and in their capabilities (acquired skills) to survive (Ferreira *et al.*, 2022). A comprehensive view of an individual's competencies (Atkins & Wood, 2002), the "Ba" is a dynamic and continuous process in which individuals actively participate and where the transfer of knowledge is facilitated. Strategic and operational knowledge (Nonaka *et al.*, 2000), a solid ramp-up (Szulanski, 1996) for learning through ongoing training and mentoring, ensures successful integration where knowledge becomes an integral part of the organizational culture, a company identity, and also transforms into skills and competencies conducive to business management and administration (Azeem *et al.*, 2021; Suppiah & Singh Sandhu, 2011)

Information collected from MSMEs in Tunja and analyzed using the FuzzyLog© program found that the forgotten factor is the development of competencies and skills (mentoring and coaching variable), which impacts the process and quality variables in knowledge transfer. The implicit nature of tacit knowledge, with its challenges in formalization, expression, and communication, introduces barriers that are not present in explicit knowledge, hence the fundamental nature of the transfer process, since knowledge must be clear, precise, and relevant to develop competencies and skills that provide value and stability to companies (Abubakar *et al.*, 2019). For this reason, MSMEs in Tunja must take practice and mentoring as the main source of knowledge transfer since these experiences allow them to internalize knowledge and develop competencies and skills focused on the productivity and longevity of the company. This research is of great value to Tunja's business community, as it demonstrates the importance of experience, practice, and mentoring to transfer knowledge and develop unique competencies and skills for Tunja's MSMEs. This research also contributes greatly to academia and the scientific community, as little academic research focused on this city has been found when searching for related research. It is important to be able to conduct this type of research in the capital of Boyacá, as sharing it with the business community can boost the growth of MSMEs, strengthen the region's GDP, and mitigate the personal drain due to a lack of job opportunities. Finally, it is important to emphasize the strengthening that must be generated between academia and the city's business community, as one of the limitations of the research was access to information from several companies due to confidentiality and information security issues.

It is evident from the research that there are limitations associated with the sample size, given that the characteristics of the population under study result in a limited number of observations. Likewise, access to information from several companies is difficult for confidentiality and information security issues. Nevertheless, the results obtained are mathematically valid insofar as they enable the assessment and relationship of the subjective experiences of the subjects under study. Also, it is important to note that the results cannot be replicated or can change drastically based on the experts that are used in the study. This limitation is also one of the benefits of the fuzzy methodologies used in the study, because the results are specifically for Tunja and based on the reality that the companies of that city are experiencing and, because of that, when the sample changes, it will present specific results based on the cultural and specific characteristics of the companies surveyed.

For future lines of research, it is proposed to collect a more significant amount of information through the same instrument to be able to generate a broader analysis of the Boyacá Region and later to be able to create comparative studies between the cities and the regions, initially in Colombia and then continue with other countries. At the same time, the design of a new instrument that can use analysis of linguistic variables is proposed, which would allow better capture of the responses of the most

subjective cohort (Torrens-Urrutia *et al.*, 2022), as well as multicriteria methodologies for decision making that allow knowledge transfer (Martínez *et al.*, 2019; Sangaiah *et al.*, 2017) or managerial skills (Kaufmann & Gil-Aluja, 1993; Mumcu & Gök, 2021) to be adequately measured. In professional contexts, knowledge must be formalized for effective knowledge transfer, ensuring its preservation, replication, and enhancement. In a similar vein, formal communication must be clear and precise. This, in turn, contributes to improved time and resource management, as well as the achievement of organizational objectives. Finally, with the data of more regions and cities of Colombia different hypotheses and objectives can be validated with complementary techniques, for example, the use of Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) that is a useful technique to empirically test hypothesized relationships between variables, that will help to understand the relations obtained by the Forgotten Effects method (Fauzi, 2022; Hair *et al.*, 2021).

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Systematic literature review on the impact of multifunctional training on organizational resilience

Impacto de la formación multifuncional en la resiliencia organizacional: una revisión sistemática de la literatura

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ABSTRACT

This systematic literature review examines how multifunctional training (MT) contributes to organisational resilience (OR) and how this relationship has been modelled and measured. Following PRISMA procedures, 87 studies were synthesised through descriptive analysis and a structured qualitative coding framework addressing three research questions. First, we map the methodological approaches used to study the MT–OR relationship and assess the extent to which uncertainty and human and organisational aspects are explicitly incorporated. Second, we synthesise the enablers and barriers affecting MT implementation and operationalisation, coding only mechanisms that are modelled, measured, or empirically reported. Third, we consolidate the metric families used to evaluate MT's contribution to organisational resilience. Results show that the literature predominantly operationalises MT as a skill-coverage architecture and assesses resilience through operational performance proxies under variability (e.g., flow time, work in progress, tardiness, service level, utilisation). Explicit barriers most frequently relate to cost and feasibility frictions (training cost, productivity loss, robustness–cost trade-offs), while coordination mechanisms, organisational conditions, and competence dynamics are less consistently formalised. Overall, the evidence highlights a measurement gap: resilience benefits are widely reported but rarely quantified end-to-end under uncertainty with deployability and human dynamics. The review proposes an agenda for integrating uncertainty-aware modelling with organisational and behavioural realism to enable comparable, decision-relevant evaluation of MT as a resilience strategy.

Keywords: Organizational resilience; Multifunctional training; Cross-training; Workforce flexibility; Uncertainty; Demand variability.

R E S U M E N

Esta revisión sistemática analiza cómo la formación multifuncional (FM) contribuye a la resiliencia organizacional (RO) y cómo se ha modelizado y medido esta relación. Siguiendo PRISMA, se sintetizan 87 estudios mediante análisis descriptivo y codificación cualitativa estructurada en torno a tres preguntas. Primero, se revisan los enfoques metodológicos sobre la relación FM-RO y el grado en que incorporan explícitamente incertidumbre y dimensiones humanas y organizativas. Segundo, se sintetizan facilitadores y barreras para implantar y operacionalizar la FM, codificando solo mecanismos modelizados, medidos o reportados empíricamente. Tercero, se integran las familias de métricas empleadas para evaluar la contribución de la FM a la RO. Los resultados muestran que la literatura operacionaliza mayoritariamente la FM como arquitectura de cobertura de competencias y evalúa la resiliencia con indicadores indirectos de desempeño operativo bajo variabilidad (p. ej., tiempo de flujo, WIP, retrasos, nivel de servicio). Las barreras explícitas se vinculan sobre todo a fricciones de coste y factibilidad (coste de formación, pérdida de productividad, compromisos robustez-coste…), mientras que mecanismos de coordinación, condiciones organizativas y dinámicas de competencias se formalizan de forma irregular. La evidencia apunta a una brecha de medición: los beneficios en resiliencia se reportan ampliamente, pero rara vez se cuantifican bajo incertidumbre incorporando capacidad de despliegue y dinámicas humanas. Se propone una agenda para integrar modelización sensible a la incertidumbre con realismo organizativo y conductual, habilitando evaluaciones comparables y relevantes para la toma de decisiones sobre la FM como estrategia de resiliencia.

Palabras clave: Resiliencia organizacional; Formación multifuncional; Cross-training; Flexibilidad laboral; Incertidumbre; Variabilidad de la demanda.

1. INTRODUCTION

Resilience can be defined as an organization's ability to adapt and recover from shocks, ensuring operational continuity and the effective delivery of products and services (Adrian, 2014; de Carvalho *et al.*, 2018). In recent years, the concept of organizational resilience (OR) has gained relevance across multiple sectors, from healthcare to manufacturing, driven by the increasing frequency and intensity of natural disasters, economic crises, and unforeseen events affecting organizations as a whole (Talab *et al.*, 2024).

Multifunctional training (MT) defined as the acquisition of multiple skills that enables employees to perform different roles within the organization, has been identified as a promising approach to strengthen OR because it enhances flexibility and the capacity to adapt to sudden changes in demand or adverse operational conditions (Day, 2022; Su *et al.*, 2023). Wise *et al.* (2020) further suggest that continuous employee training improves organizational flexibility and may support profitability by enabling faster and more efficient responses to market fluctuations.

Throughout this article, we adopt an inclusive notion of "operational disruption" to cover the heterogeneous conditions studied in the literature, ranging from stochastic demand fluctuations and variability to broader sources of uncertainty such as capacity losses, shortages, crises, or externally driven shocks. Terms such as deterministic and stochastic demand, volatility, variability, uncertainty, and crisis-related disruptions are therefore used to reflect the terminology of the original studies, without implying that these concepts are equivalent or interchangeable.

Although the positive impact of MT on OR is widely acknowledged, a critical gap remains. Its contribution has rarely been objectively measured or modelled, particularly under real-world scenarios of operational volatility. This gap reflects not only limited empirical evidence, but also a methodological divide between human resource management (HRM) and operations-oriented modelling. While management research often frames multifunctionality as a qualitative enabler of resilience, technical modelling studies rarely incorporate human dynamics such as learning curves, adaptability, or job rotation into stochastic optimisation or workforce planning models. As a result, organizations still lack clear guidance on how much multifunctionality is needed to absorb demand uncertainty and variability, or broader resource disruptions, and lack robust metrics to evaluate the return on investment of MT as a resilience asset.

To consolidate the knowledge, this paper presents a systematic literature review that aims to characterise how MT contributes to improving OR across sectors and operational contexts where organisations face demand fluctuations or other disruptions in dynamic, uncertain environments. Based on the review results, we discuss the limitations and challenges that shape the extent to which MT enhances resilience. Beyond synthesising prior work, this review offers a conceptual contribution by explaining how and under what conditions MT fosters OR. We identify the mechanisms linking MT to OR and analyse boundary conditions that amplify or dampen this effect, thereby setting out a theory-driven agenda for future research. In the context of this review, we treat MT and polyvalence training as equivalent concepts, referring to training workers in multiple skills or functions within the organization (González, 2006).

The specific research questions guiding this review are:

- RQ1: What methodological approaches are used to examine the MT-OR relationship, and to what extent do they incorporate uncertainty and human factors?
- RQ2: What organizational enablers or barriers have been reported as relevant for the implementation and operationalization of MT as a resilience strategy?
- RQ3: What metrics, indicators, and evaluation outputs have been used to objectively assess the contribution of MT to organisational resilience?

The paper is structured as follows. Section 2 presents basic background on MT and OR, highlighting key studies and previous literature reviews in these areas. Section 3 details the methodology, including the research protocol and the PRISMA flowchart. Section 4 offers a bibliometric analysis of the systematic literature review (SLR) results. Section 5 classifies and discusses the SLR results and answers research questions RQ1 to RQ3. Finally, Section 6 summarises the main findings and Section 7 proposes avenues for future research.

2. BACKGROUND

This section presents some background and definitions of OR and MT and briefly reviews prior literature linking them.

OR is the capability to maintain continuity while adapting to disruption (Vogus & Sutcliffe, 2007). Beyond disasters such as natural crises or cyberattacks (Talab *et al.*, 2024), OR also covers adaptation to demand variability and other less visible fluctuations that challenge day-to-day operations (Henao *et al.*, 2022; Sawhney, 2013). In the context of this SLR, OR is treated as an operational property that can be observed through the ability of an organisation to sustain service or production performance under variability (e.g., demand uncertainty, capacity loss, and short-notice disruptions).

MT (also termed cross-training, multiskilling, skill chaining, or polyvalent/on-the-job training) refers to developing a workforce that can be redeployed across roles to sustain service or production performance under variability, thereby improving operational flexibility and efficiency (Beltrán-Martín & Roca-Puig, 2013; Hopp & Oyen, 2004; Sawhney, 2013). In this review, we focus on objective, decision-relevant evidence and therefore prioritise studies that operationalise MT through explicit skill structures (e.g., chaining/closed chains), assignment rules, and staffing policies, and that quantify performance consequences under variability; this focus is reflected in the eligibility criteria and screening rules in Section 3 (METHODOLOGY). MT's effectiveness depends on how personnel are allocated and how learning/forgetting dynamics are managed (McCreery & Krajewski, 1999). Accordingly, the review distinguishes between MT as a capability-building investment (who is trained for what) and the operationalisation of that capability (how multiskilled workers are scheduled, rotated, and coordinated).

Evidence in the topic is heterogeneous across sectors and methodological traditions. In healthcare, the research on MT focuses mainly on redeployment and rapid upskilling during major events, often emphasising implementation constraints and limited formal evaluation (Coates *et al.*, 2021). In manufacturing and service operations, a large technical stream uses simulation and optimisation to study how multiskilling structures and coordination policies af-

fect robustness to uncertainty, including the presence of learning/forgetting and other human-related dynamics (Felan & Fry, 2001; Henao *et al.*, 2022; Hopp & Oyen, 2004; McCreery & Krajewski, 1999; Slomp & Suresh, 2005). Some work considers crises or resilience more generally without focusing on workforce training, which limits its ability to inform decisions about MT intensity and design.

Integrating MT within an OR framework requires enabling conditions: leadership support for continuous learning, work design that enables redeployment, and coordination routines that translate skill breadth into effective allocation decisions (Coates *et al.*, 2021; Hopp & Oyen, 2004; Sawhney, 2013). From a modelling perspective, integration also requires representing the constraints that govern real redeployment, skill coverage, training costs, coordination rules, and time-dependent proficiency, so that the contribution of MT can be estimated rather than assumed (Hopp & Oyen, 2004; Slomp & Suresh, 2005).

Existing research suggests broad support for MT and role breadth as levers for resilience, while also pointing to gaps in how practices are adapted across contexts and sectors (Coates *et al.*, 2021; Hopp & Oyen, 2004). Crucially, the literature remains fragmented across qualitative and policy-oriented works that identify flexibility actions without quantifying their effects, and technical models that quantify performance but often simplify human and organisational conditions. Accordingly, we treat adaptability (strategic reorientation), flexibility (operational reconfiguration), and resilience (persistence of core functions under disruption) as analytically distinct yet interrelated constructs.

Previous systematic literature reviews

A search for recent reviews indicates that the closest systematic-type evidence directly related to the MT–OR intersection is the rapid scoping review by Coates *et al.*, (2021). In addition, an earlier and influential synthesis by Hopp and Oyen, (2004) provides a structured evaluation framework for cross-training and an explicit survey of the relevant operations literature, but it is not a systematic review (i.e., it does not follow a PRISMA-style search and screening protocol). Together, these works are relevant precursors because they summarise prior knowledge on workforce flexibility while leaving key limitations that motivate the present review.

Coates *et al.* (2021) conducted a rapid scoping review of workforce strategies used during major health emergencies (natural disasters, extreme weather events, and infectious disease outbreaks), using a time-bounded search (2000-2020) in MEDLINE, Embase, and CINAHL and a multi-stage screening process, resulting in 37 included studies. They organise strategies into three levers: increasing participation (numbers), increasing scope/flexibility, and increasing support/sustainability. For the MT-OR gap, this review is useful because it documents real-world flexibility interventions under crisis conditions and reports barriers and facilitators; however, it explicitly excluded purely theoretical and simulation studies and provides limited quantitative modelling of how much MT is needed under volatility. The authors also highlight limited robust evaluation of impact and effectiveness as a recurring weakness in the evidence base.

Hopp and Oyen (2004) propose the Agile Workforce Evaluation (AWE) framework, outlining when and how cross-trained workers should be deployed through a strategic assessment view, a tactical design perspective (architectures and coordination choices), and a structured survey of worker-coordination policies and workforce agility research. This synthesis aligns closely with the operations-research side of our gap, yet it is not systematic and it does not treat resilience as an explicitly measured outcome under stochastic disruptions (e.g., demand volatility, absenteeism shocks), nor does it quantify the resilience return of MT investments through objective, uncertainty-aware metrics.

3. METHODOLOGY

This paper proposes a systematic literature review (SLR) that follows the PRISMA methodology (Page *et al.*, 2021) to identify and analyse relevant studies on MT and OR under conditions of fluctuating demand and operational uncertainty. The sources' selection process is illustrated in the PRISMA flowchart, which details each stage of the process, from initial paper identification to final inclusion, providing transparency and reproducibility. This SLR was guided by previous studies that used similar review methods (Alvarez-Gallo & Maheut, 2023; Badakhshan *et al.*, 2024; Marin-Garcia, 2021).

To ensure the quality and relevance of the selected studies, explicit inclusion and exclusion criteria were established.

Inclusion criteria concerning the format of the papers

— Language: papers published in English or Spanish.
— Publication period: searches were last updated in January 2026.
— Database source: Web of Science (WoS) and Scopus.
— Publication type: peer-reviewed journal papers only.

Inclusion criteria concerning the content of the papers

In the context of this work, we theorise MT as a driver of flexibility and adaptive capacity that, in turn, enables organisational resilience. Eligibility did not require that studies explicitly incorporate uncertainty or human and organisational factors. Instead, these aspects were examined during the analysis stage, based strictly on what each study modelled, measured, or empirically reported. We also extracted the metrics used to evaluate MT's contribution to resilient performance under variability (e.g., demand volatility, absenteeism, failures) (Coates *et al.*, 2021; Henao *et al.*, 2022; McCreery & Krajewski, 1999; Slomp & Suresh, 2005).

— Multifunctional Training (MT): papers addressing MT or polyvalent training of employees, understood as the acquisition of skills to perform multiple organisational functions, specifically through on-the-job training or role rotation.
— Organisational resilience (OR): papers addressing the ability of an organisation to adapt, remain flexible, or recover from operational disruptions, especially in response to demand volatility or uncertainty.
— Organisational context: studies conducted within a business/industrial organisational environment.

Exclusion Criteria

— Type of publications: non-peer-reviewed documents, book chapters, editorials, opinion pieces, technical reports, and documents not indexed in academic databases.

— Training context: studies focusing on online training, e-learning, or off-the-job training programs.
— Thematic misalignment: papers focusing exclusively on psychological, mental health, or personal coping strategies (e.g., burnout, mindfulness, workplace bullying) without a direct link to MT and OR in organizational settings.
— Emerging contexts without clear relevance: studies addressing pandemics, natural disasters, or emergency contexts were excluded only if they did not include an analysis of MT or OR as a strategic organizational response.
— Technological skills focus: papers on training for the implementation of advanced technologies (e.g., augmented reality, Artificial Intelligence) without a focus on polyvalent skill acquisition.

3.1. Search strategy and filters

The search strategy was designed to capture studies at the intersection of organisational resilience (OR) and multifunctional training (MT) in real organisational settings. We built a Boolean query structured into three concept blocks: (1) organisational setting, (2) resilience/adaptability, and (3) MT/cross-training terms. The organisational-setting block was adapted from the methodological search filters published by the Centre for Evidence-Based Management (CEBMa, n.d.). The full search strings, including the complete synonym lists and database-specific syntax (Web of Science and Scopus), are reported in Appendix 1 in the Supplementary file.

The three blocks were combined as:

TI-ABS-KEY (Block 1) AND TI-ABS-KEY (Block 2) AND TI-ABS-KEY (Block 3)

— Block 1 (organisational setting): terms capturing organisational and workforce contexts (e.g., work*, organization*, firm*, business*, workforce*, staff*, team*).
— Block 2 (resilience/adaptability): terms capturing resilience and operational adaptability (e.g., resilien*, robust*, adaptabil*, flexibil*, agilit*, including "organizational resilience" and related expressions).
— Block 3 (MT/cross-training): terms capturing MT and related practices (e.g., cross-training, multiskill*, job rotation, polyvalen*, upskill*, reskill*, workforce scheduling).

Applied to Web of Science and Scopus, this query returned 1988 records in WoS and 424 records in Scopus (2412 total).

3.2. Study selection (PRISMA flow)

The search returned 2,412 records across Web of Science (n = 1,988) and Scopus (n = 424). After applying standard automated filters (peer-reviewed journal articles; language restrictions) and removing duplicates, the remaining records were screened by title/abstract/keywords. To reduce false positives from adjacent psychological and online-learning streams, an additional negative filter was applied (see Appendix 1 in the Supplementary file). Full-text assessment was then performed for the shortlisted papers; 12 full texts could not be retrieved. The final dataset comprised 87 studies (76 from Web of Science and 11 from Scopus). A full quantitative breakdown of each step is provided in Figure 1 (PRISMA flowchart) and the full list of the 87 references used is provided in Appendix 4 of the Supplementary file.

3.3. Eligibility criteria

Eligibility was assessed using the inclusion/exclusion criteria reported above; full-text screening retained only records that met the MT, OR, and organisational-context criteria. Details of exclusions are reported in Figure 1 (PRISMA flowchart).

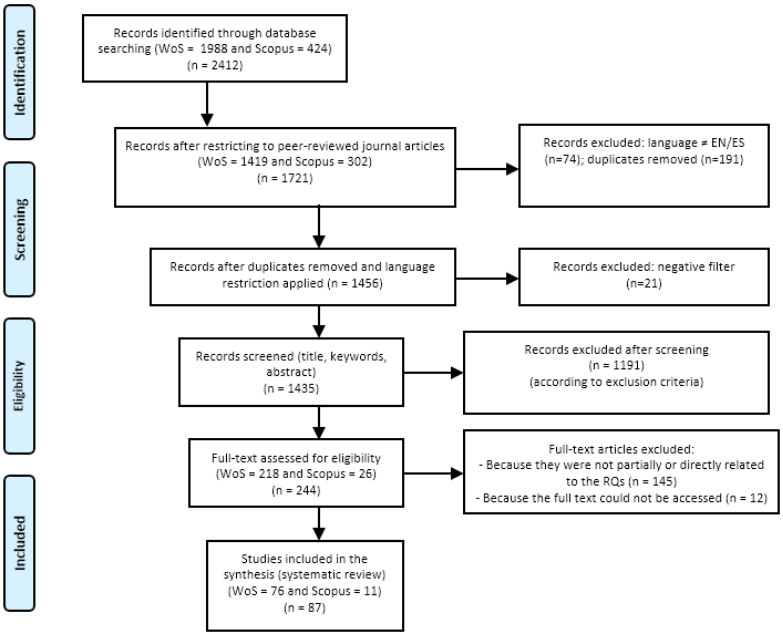

Figure 1
PRISMA flowchart
Source: Own elaboration.

4. DESCRIPTIVE ANALYSIS OF THE RESULTS

We first provide bibliometric information on the final set of papers that resulted from the search and filtering processes.

4.1. Annual scientific production and most frequent journals

The annual publication profile shows a long early period of sporadic contributions, with only isolated papers appearing between 1976 and 2000 (8 studies in total across those years). Research activity becomes more visible from the early 2000s onwards, with a first clear concentration in 2004 (8 articles) and 2005 (6 articles), suggesting that MT-related flexibility began to consolidate as a modelling topic within production and service systems during that period. After a relatively steady but moderate output throughout the 2010s, publication increases again in the most recent years: 2021 and 2022 each contribute 6 articles, followed by sustained activity in 2023 (3), 2024 (5), 2025 (6), and an initial presence in 2026 (1). Overall, the data indicates that the topic has shifted from occasional early contributions to a more continuous stream of publications, with a noticeable recent concentration in the 2021-2025 period.

Publications are concentrated in a small number of core journals. The seven most frequent outlets (International Journal of Production Research (14), Computers & Industrial Engineering (8), IIE Transactions (7), European Journal of Operational Research (5), International Journal of Production Economics (5), Journal of Operations Management (3), and Management Science (3) account for 45 out of 87 articles (51.7%), i.e., just over half of the entire corpus. This concentration highlights the strong anchoring of the MT-OR research stream in production/operations and industrial engineering venues, while the remaining publications are dispersed across a wide range of journals, reflecting the topic's methodological and sectoral breadth beyond its core OR and production-systems foundations.

4.2. Keywords

An analysis of the keywords extracted from the selected papers resulted in the word cloud presented in Figure 2, which illustrates the most prevalent concepts identified across the reviewed literature.

Figure 2
Most popular keywords
Source: Own elaboration.

The keyword cloud highlights a strong concentration around the operations/quantitative core of the MT-OR literature. The most frequent terms relate to cross-training/multiskilling and workforce/labor flexibility, accompanied by typical production and service-systems keywords such as scheduling, simulation, and optimization, as well as structural settings like CONWIP and cellular manufacturing. Keywords linked to uncertainty-aware approaches (e.g., stochastic programming, robust optimization, demand uncertainty) also appear prominently, suggesting that a relevant share of studies explicitly examines MT under operational variability. In parallel, a smaller but visible cluster of health and crisis-related terms (e.g., COVID-19, surge capacity, health workforce) reflects the recent extension of this research stream into healthcare resilience contexts. Overall, the pattern reinforces that the field is primarily organised around workforce flexibility as a mechanism for operational continuity, with secondary emphasis on sector-specific and organisational themes.

Figure 3 presents the keyword co-occurrence network generated with VOSviewer to explore the conceptual structure of the reviewed papers. After applying a minimum total link-strength threshold, 39 keywords met the inclusion criterion and

were organised into 27 clusters. Node size reflects the relative prominence of a keyword in the selected set, while link thickness indicates how frequently two keywords co-occur across papers. The resulting map reveals a highly connected thematic core alongside several more specialised or sector-specific pockets of terminology.

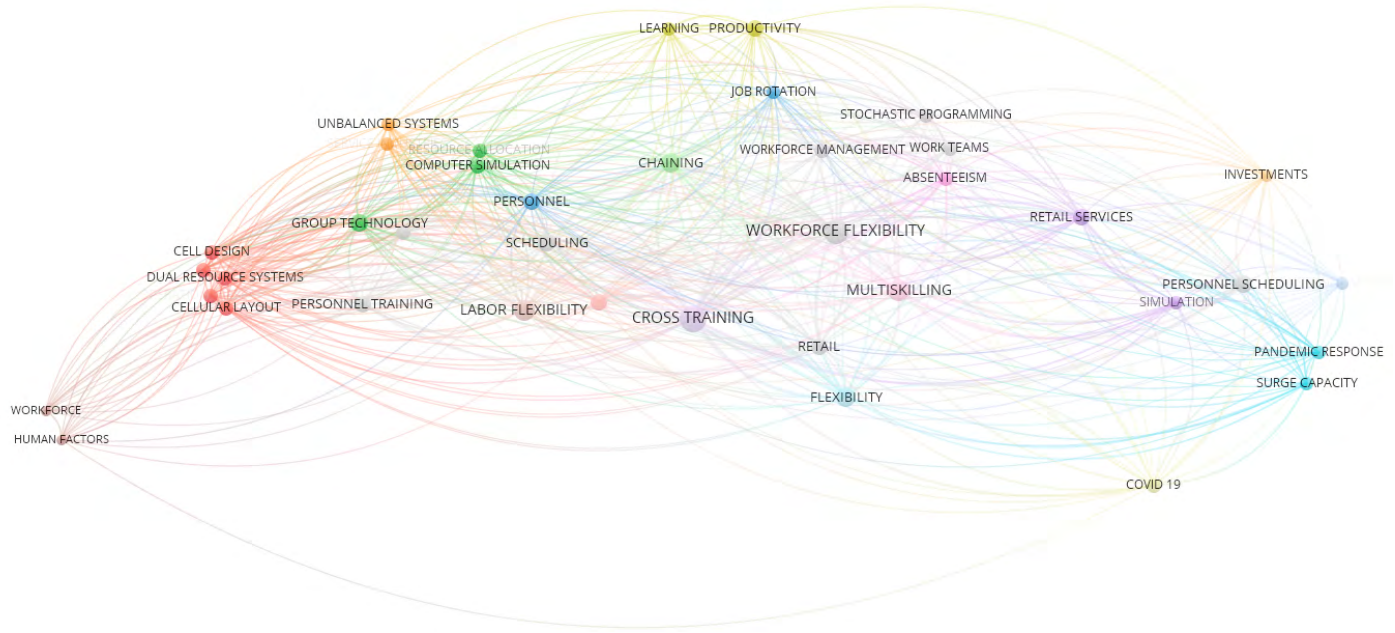

Figure 3
Co-occurrence map
Source: Own elaboration (VOSviewer output).

Overall, the network is anchored by a small set of integrative concepts, most notably cross training, workforce flexibility, labor flexibility, and multiskilling, which function as bridging terms connecting otherwise distinct research strands. Around this core, the map highlights a strong operations/industrial-engineering backbone characterised by manufacturing system design and modelling keywords (e.g., cell design, cellular layout, dual resource systems, operations research, virtual cellular manufacturing) and computation-oriented terms (e.g., computer simulation, group technology, resource allocation, simulation, scheduling). This pattern is consistent with a large portion of studies framing MT primarily as a mechanism for improving operational performance through flexible staffing and assignment decisions.

In parallel, the co-occurrence structure also surfaces a smaller but clearly identifiable set of human- and disruption-oriented themes. Human-centred dynamics appear through keywords such as learning, job rotation, absenteeism, and human factors, indicating that part of the literature explicitly links workforce flexibility to competence evolution, deployment practices, and behavioural constraints. Disruption and crisis-related terminology emerges through a cluster containing pandemic response, surge capacity, and COVID 19/COVID-19, signalling the extension of MT-related flexibility research into healthcare surge capacity and crisis resilience contexts. Finally, sector-driven applications are visible through retail/service scheduling terms (e.g., retail, retail services, personnel scheduling, WORKFORCE management, service industries) and uncertainty-aware modelling terms (e.g., stochastic programming, stochastic program, investments), which connect MT to planning and decision-making under variability.

Taken together, the network suggests that the MT-OR field is structured around a dominant modelling-oriented core (manufacturing/service operations, scheduling, simulation, optimisation) complemented by smaller clusters that capture explicit human dynamics (learning, rotation, absenteeism) and disruption-specific contexts (pandemic response and surge capacity). This provides an additional bibliometric indication, aligned with the methodological findings discussed later, that research attention has been concentrated on operational flexibility mechanisms, while human-factor and crisis-resilience perspectives remain more fragmented and frequently expressed through more specialised keywords.

5. ANALYSIS OF THE INFORMATION OBTAINED FROM THE SELECTED PUBLICATIONS

This section aims to analyze and evaluate how, and to what extent, the reviewed papers address the research questions that underpin this review.

5.1. Methodological approaches used to examine the relationship between MT-OR, and to what extent uncertainty and human factors are incorporated (RQ1)

This review characterises how the MT–OR relationship is examined in the literature by focusing on two methodological dimensions that determine what "resilience effects" can be credibly quantified. First, we examine how studies represent operational volatility through uncertainty modelling (U). Second, we examine whether the workforce is treated as more than a static skill set through human-factor modelling (H). Because prior work spans simulation/optimisation models and empirical/practice accounts, results are often not directly comparable: studies may stress-test MT under disruption without modelling human dynamics, or describe rich human mechanisms without formalising volatility. To make these differences explicit and reproducible, we apply two four-level ordinal coding scales (U0–U3 and H0–H3) based strictly on what each study models, measures, or reports. The aim is not to rank methods, but to clarify what each study is effectively able to quantify: whether MT is tested under operational variability and whether deployability-relevant human mechanisms (e.g., learning/forgetting, fatigue, acceptability constraints) are explicitly incorporated. Across the 87 included studies with complete U/H coding, results reveal a pronounced segmentation between operations-oriented quantitative modelling and practice-oriented empirical accounts. The full classification of all 87 studies (sector, method, U/H codes, and resilience proxies) is provided in Appendix 2 in the Supplementary file.

To ensure a transparent and reproducible interpretation of codes, both dimensions were coded using four-level ordinal scales. Table 1 summarises the coding logic used in this review.

Table 1
Coding framework for uncertainty (U) and human factors (H)

Dimension	Code	Operational meaning	Typical implementation in the reviewed studies
Uncertainty modelling (U)	**U0**	Deterministic; no explicit uncertainty	Fixed inputs; single-point estimates; no variability modelled
	U1	Uncertainty acknowledged but handled deterministically	Scenario/sensitivity analyses; parametric variation; "stress tests" without probability-aware decisions
	U2	Stochastic variability embedded in system evolution (process dynamics)	Discrete-event simulation; stochastic arrivals/processing times; Markov/queueing process assumptions; absenteeism and failure processes
	U3	Formal uncertainty-aware optimisation/valuation	Stochastic programming; robust optimisation; distributionally robust optimisation (DRO); real options valuation; explicit uncertainty sets and/or probability structures
Human-factor modelling (H)	**H0**	MT as a static skill matrix ("who can do what")	Eligibility/coverage only; no heterogeneity or behavioural dynamics
	H1	Limited human realism via parameters	Efficiency/proficiency differences; coordination effort as parameter; collaboration mode assumptions
	H2	Explicit human dynamics affecting feasibility/performance	Learning/forgetting; fatigue; rotation decisions; dissatisfaction costs; evolving coordination burdens
	H3	Rich organisational/behavioural constructs	Well-being/psychosocial indicators; HR strategies; workforce governance/sustainability mechanisms

Source: Own elaboration.

This framework makes the core methodological trade-off visible: studies may be strong in modelling disruption (high U) while simplifying workforce adaptation (low H), or they may describe human mechanisms in depth (high H) while remaining non-probabilistic in the treatment of volatility (low U).

The corpus is heavily skewed toward quantitative modelling and decision-analytic approaches. Out of the 87 coded studies, 71 (81.6%) rely primarily on simulation, analytical queueing / Markov modelling, optimisation (including robust/stochastic/DRO), simulation–optimisation, metaheuristics, computational/AI decision frameworks, or economic evaluation. In contrast, 12 studies (13.8%) are empirical/practice contributions (case studies, mixed-methods, action research, descriptive implementation reports), and 4 (4.6%) are conceptual or review-type contributions. This methodological split is not merely descriptive; it determines which dimensions of "resilience" become measurable and comparable across studies. Quantitative models tend to operationalise resilience through performance proxies under volatility, whereas empirical/practice accounts more often describe resilience as organisational continuity and adaptive capacity, often without a single standardised indicator.

Uncertainty incorporation is heterogeneous. Across the 87 studies, 14 (16.1%) are fully deterministic (U0), 29 (33.3%) handle volatility via deterministic scenarios (U1), 26 (29.9%) embed stochastic variability through simulation or stochastic process assumptions (U2), and 18 (20.7%) adopt formal uncertainty-aware frameworks (U3). Taken together, 44/87 (50.6%) incorporate uncertainty at a relatively high level (U2–U3), yet

only 18/87 (20.7%) reach U3, where uncertainty is not merely tested but explicitly embedded in decision-making through robust/stochastic/DRO (or real-options) logic.

A key pattern is the prevalence of U1. Many papers explicitly acknowledge volatility (demand variability, congestion, shortages, absenteeism) but translate it into scenario comparisons rather than probability-aware or robustness-aware decision modelling. This creates an interpretability gap: scenario-based studies can show that MT performs better under "stressful conditions", but they typically do not quantify risk exposure, tail outcomes, or provide guarantees about performance under uncertainty. By contrast, U3 studies directly translate volatility into actionable decision rules, for instance by producing training and allocation plans that remain feasible and cost-effective across uncertain demand realisations.

Human-factor integration is generally weaker. Within the full set of 87 studies, 32 (36.8%) remain at H0, representing MT as a static eligibility structure; 29 (33.3%) fall into H1, introducing heterogeneity or coordination only through parameters; 21 (24.1%) reach H2, explicitly modelling human dynamics such as learning/forgetting, fatigue, or rotation-related acceptability costs; and only 5 (5.7%) reach H3, where richer organisational and behavioural constructs are central. Overall, 61/87 (70.1%) remain at H0–H1, meaning that multifunctionality is primarily modelled as structural capacity, who can cover which tasks, sometimes with proficiency differences, but usually without representing learning, fatigue, resistance to redeployment, governance requirements for rotation, or coordination burdens that intensify under disruption.

This is precisely where a measurement gap emerges. A large share of models can demonstrate that "more skills help" in principle, but do not intend to quantify whether that flexibility remains deployable when disruptions occur and workforce constraints become binding. The small H3 subset is mainly practice-oriented and healthcare-focused, where MT is tied to role redesign, scope-of-practice extension, surge capacity strategies, and workforce sustainability mechanisms. These contributions often provide strong explanatory richness on how MT interventions work in reality but rarely embed formal uncertainty optimisation.

A central finding for RQ1 is that very few papers jointly model operational uncertainty and human dynamics. Only 10/87 studies (11.5%) lie in the "high-high" quadrant ($U \geq 2$ and $H \geq 2$). These include approaches such as simulation studies incorporating learning/forgetting under stochastic shop-floor dynamics; simulation–optimisation formulations with fatigue; real-time recovery scheduling frameworks that internalise dissatisfaction costs; robust job-rotation approaches modelling competence evolution; and a Markovian workforce-planning study that represents uncertain human-caused events alongside behavioural tendencies.

To make this joint coding more visible within the modelling literature, Table 2 provides a U×H distribution for quantitative/Operations-Research modelling studies only (n = 71), excluding empirical/practice and review/conceptual contributions.

Table 2
U×H distribution for quantitative/ Operations Research-oriented studies (n = 71)

H \ U	U0	U1	U2	U3
H0	4	6	14	8
H1	6	4	5	7
H2	2	5	7	2
H3	0	0	0	1

Source: Own elaboration.

The distribution confirms a structural pattern: uncertainty is more frequently modelled formally in Operations Research studies than human dynamics, while richer human modelling remains concentrated in a minority of contributions. As a result, organisations are left with limited guidance on how much MT is "enough," and under which disruption regimes MT remains operationally deployable once learning, fatigue, coordination costs, and workforce acceptability constraints are considered.

A second major finding concerns how organisational resilience is operationalised in the reviewed studies. Resilience is rarely defined and measured as a standalone construct; instead, papers typically rely on proxy metrics that represent performance preservation under variability or disruption. These proxies cluster into a small number of families: responsiveness metrics (lead time, waiting time, WIP, cycle time and variability), delivery reliability (tardiness, % tardy jobs, schedule adherence, downtime), service coverage (unmet demand, coverage ratios, order fulfilment, retail market impacts), productivity measures (throughput, labour utilisation, labour efficiency), economic indicators (labour costs, training and productivity-loss costs, surplus/shortage penalties, lost profit, ROI/break-even time), robustness indicators (workload dispersion, performance variance under stress, comparison against deterministic baselines), and, less frequently, human sustainability and acceptance measures (fatigue, dissatisfaction costs, job satisfaction, burnout/role conflict/ambiguity).

A key implication is that the practical meaning of "resilience" differs by method family. Operations research models often equate resilience with operational continuity and efficiency under disruption, while empirical studies tie resilience more strongly to feasibility of role redesign, organisational adaptability, and workforce sustainability. Without greater alignment across proxy families, it remains difficult to compare effect sizes or build cumulative evidence on MT as a resilience asset across sectors.

Taken together, three conclusions emerge robustly from the coded evidence. First, the MT–OR literature remains methodologically fragmented: quantitative studies dominate and quantify performance under variability but frequently operationalise MT as a static coverage structure; empirical/practice studies provide richer organisational mechanisms and behavioural realism but rarely quantify uncertainty exposure or resilience trade-offs. Second, formal uncertainty-aware modelling exists but is not yet the norm. Only around one-fifth of the coded studies adopt U3 approaches, which limits the translation of research findings into decision rules for training investment under risk and volatility.

Third, and most importantly, joint modelling of uncertainty and human dynamics remains rare. The small high–high subset (≈11.5%) indicates that the methodological bridge between HR/organisational realism and uncertainty-aware operations modelling is still underdeveloped. This directly explains why organisations struggle to quantify MT's ROI as a resilience investment under real-world volatility: most models omit the human dynamics that determine whether multifunctionality remains deployable when disruptions occur.

These results define a clear agenda for future work: integrate uncertainty-aware workforce planning (stochastic/robust/DRO) with competence evolution (learning/forgetting), fatigue, coordination burdens, and rotation/acceptance mechanisms, while moving toward a more standardised mapping between resilience proxy families and MT design decisions so that evidence becomes comparable across sectors.

5.2. Enablers or barriers that have been reported as relevant for the implementation and operationalization of MT as a resilience strategy (RQ2)

While much of the literature models MT as an operational lever, the organisational conditions that make MT implementable and deployable during disruptions are often less visible or unevenly integrated across approaches.

To answer RQ2, we used a structured qualitative synthesis grounded strictly in explicit evidence, supported by a two-step coding logic. First, we defined an a priori coding framework to capture the organisational conditions that enable or constrain MT as a resilience strategy (Table 3). The framework was informed by the MT-operations research tradition (skills architectures, coordination policies, and feasibility/cost trade-offs) and by implementation-focused work emphasising team/organisational conditions and human dynamics. Second, we pilot-tested and refined the framework through iterative reading and reconciliation on a subset of studies before applying it to the full corpus.

A study feature was coded as an enabler or barrier only when it was explicitly represented as: a model element (decision variable, constraint, objective, parameter), a measured construct (e.g., survey scale, observed mechanism), or a reported empirical practice directly operationalising the factor (e.g., measured coordination effort, modelled dissatisfaction, learning/forgetting dynamics, explicit training or productivity-loss costs). If a factor is not coded for a paper, it is treated as not explicitly addressed (not as absent in real organisations). The full extraction table and complete evidence synthesis matrix are provided in Appendix 3 in the Supplementary file.

We also coded whether each paper addresses MT primarily as an implementation issue (I: design/roll-out feasibility, training/rotation plans, team formation), as an operationalisation issue (O: redeployment and allocation during volatility/disruptions), or both (I-O). This distinction separates "building" multifunctionality from "activating" it under disruption.

Table 3
RQ2 coding framework used in this review

Dimension	Values / codes	Operational meaning (coded only when explicit)
Stage	I, O, I–O	**Implementation (I):** MT design/roll-out feasibility (training plans, staffing formation, rotation planning). **Operationalization (O):** MT use during volatility/disruptions (reassignment, recovery, real-time allocation). **I-O**: both.
Enablers / Barriers codes	SKILLS	Skill architecture / MT design (skill matrix, chaining/closed chains, hierarchical cross-training, structured multiskilling).
	COORD	Coordination and decision rules for deploying MT (dispatch/redeployment rules, measurable coordination effort, real-time recovery actions).
	HUM-DYN	Human competence dynamics (learning/forgetting, fatigue, productivity heterogeneity, worker performance).
	COST/FEAS	Cost and feasibility frictions (training cost, productivity loss, overtime/contract feasibility, robustness–cost trade-offs, feasibility constraints).
	TEAM/ORG	Team and organizational conditions (implementation sophistication, collaboration, priorities, job rotation as practice, satisfaction/dissatisfaction, role redesign/scope expansion, crisis governance principles).
Resilience framing	R-explicit, R-proxy, R-none	**R-explicit:** resilience/robustness is explicitly framed. **R-proxy:** resilience assessed via operational proxies under variability/disruption (e.g., service level, unmet demand, tardiness, WIP, downtime, continuity). **R-none:** no clear resilience framing and/or only weak indirect proxies.

Source: Own elaboration.

Based on the coding defined in Table 3, the results are synthesised in Table 4:

Table 4
RQ2 evidence synthesis matrix (explicit enablers and barriers)

Code	What the literature explicitly uses as an enabler	What the literature explicitly reports/models as a barrier	Where it appears most (Stage)
SKILLS	MT operationalized as skill architecture (matrices; chaining/closed chains; hierarchical skills; multiskilled staffing structures). This is the dominant "enabler" construct across methods.	Rarely coded as barrier in the corpus; the limiting factors are usually expressed through costs/feasibility rather than "skills are bad".	Mostly O and I–O
COST/ FEAS	Sometimes appears as enabler when feasibility levers expand deployability (e.g., overtime/annualized hours; integrated sizing with feasibility).	Most frequent explicit barrier family: training cost and productivity loss, robustness–cost conservatism, penalties for under/overcoverage, overtime cost, inventory–flexibility trade-offs, downtime vs staffing costs, ROI/break-even constraints.	Strong in I–O (design under constraints) and O (recovery trade-offs)
COORD	MT becomes deployable via explicit coordination mechanisms: real-time allocation policies, recovery actions, task reassignment logic, decision rules; in one case coordination effort is explicitly measured.	Coordination appears as barrier when explicitly modelled/measured as burden or when changes generate acceptance costs (e.g., dissatisfaction from schedule modifications).	Mainly O and I–O
HUM-DYN	MT effectiveness depends on competence dynamics explicitly modelled: learning/forgetting; fatigue; productivity effects; heterogeneity; worker performance.	Explicit barriers arise when dynamics represent degradation/limits, e.g., forgetting and fatigue as performance-degrading mechanisms.	Mostly I–O and O
TEAM/ ORG	MT is enabled by organizational implementation capability and team conditions: implementation sophistication, collaboration/shared priorities, role redesign/scope expansion, governance principles for crisis redeployment, job rotation as practice to build redundancy.	Explicit TEAM/ORG barriers include implementation frictions, psychosocial risks (burnout/role conflict/ambiguity), and dissatisfaction/acceptability costs when schedules are modified.	Concentrated in I–O (empirical/ practice)

Source: Own elaboration.

Across the reviewed studies, the most consistent explicit enabler is SKILLS, with MT operationalised as structural coverage capacity (e.g., skill matrices, hierarchical cross-training, chaining/closed chains, structured multiskilled staffing). This pattern dominates simulation and analytical/optimisation work in job shops, flow lines, warehousing, and retail/service scheduling, where resilience is predominantly assessed via operational proxies under variability (R-proxy), such as tardiness, WIP, throughput, unmet demand, or service level. However, many technical studies treat redeployability as implicit once skills exist, leaving the organisational and decision conditions that make skills actionable in real time inconsistently formalised.

Where barriers are explicitly modelled, they most often appear as COST/FEAS constraints, reinforcing that MT-enabled resilience is rarely "free". Common frictions include training costs, productivity losses due to skill acquisition or switching, robustness–cost conservatism in stochastic/robust formulations, overtime/contract feasibility limits, and under/overcoverage penalties. Economic valuation studies strengthen this boundary-condition framing by treating cross-training as an investment under uncertainty: flexibility value depends on uncertainty, irreversibility, and workforce/task heterogeneity, and "more MT" can become suboptimal (e.g., overtraining or diminishing marginal value). Operational evidence also shows that feasibility frictions depend on the structure of uncertainty, for instance, flexibility may buffer random variability more effectively than systematic bias in forecasting, which matters for implementation decisions.

The synthesis also highlights COORD as the mechanism that converts "available skills" into "implemented flexibility". Coordination becomes explicit when studies operationalise assignment and redeployment rules (e.g., job release mechanisms, dispatching logic, worker-selection policies, real-time recovery actions). Several studies indicate that outcomes can hinge on who is assigned when multiple workers are eligible and on interactions between release and assignment rules under tight due dates and congestion. Coordination is also modelled as a friction when it is measured as effort or when recovery actions induce acceptance costs (e.g., dissatisfaction due to schedule modifications). Overall, MT's resilience contribution is not only a function of skill breadth, but also of how redeployment decisions are designed and governed under time pressure.

A meaningful subset of studies incorporates HUM-DYN explicitly, showing that MT effectiveness depends on competence dynamics such as learning/forgetting, fatigue, productivity differentials, and heterogeneity. In this subset, heterogeneity appears both as an operational reality shaping assignment performance (e.g., proficiency differences relevant to worker-selection rules) and as a determinant of flexibility value in investment-based formulations. Importantly, barriers in this category are mechanistic: forgetting, fatigue, and switching-related efficiency loss are modelled as performance-degrading processes that limit how far MT can be stretched without erosion of gains.

Finally, TEAM/ORG conditions, implementation capability, collaboration and shared priorities, role redesign and scope expansion, and governance principles for redeployment, are most visible in empirical and practice-oriented studies. These studies emphasise that MT is enabled not only by skill acquisition but also by organisational readiness (implementation sophistication, cross-functional cooperation, partner alignment, institutional integration). Barriers at this layer include implementation frictions, institutional

silos, compliance/administrative burdens, and psychosocial risks or acceptability constraints (e.g., dissatisfaction with re-rostering). Union/contract constraints also appear as explicit organisational limits on deployability, illustrating that real-world feasibility may be constrained even when skill coverage exists.

Focusing strictly on what studies explicitly model or measure as enabling or constraining MT helps explain why end-to-end quantification of MT as a resilience investment remains limited. Across the corpus, operations-research-oriented studies often operationalise MT mainly as skill coverage and evaluate outcomes through operational proxies under variability, while treating activation frictions (coordination burden, acceptability, competence decay, organisational readiness) as implicit. In contrast, empirical and practice-oriented studies foreground implementation sophistication and organisational constraints but less frequently translate these frictions into uncertainty-aware decision models. This "acquired vs. deployable flexibility" gap has been noted in prior work and is also visible in our coded evidence base (Coates *et al.*, 2021; Graham & Rosenthal, 1986; Hopp & Oyen, 2004; Sawhney, 2013). By consolidating explicit evidence across 87 studies (Appendix 3 in the Supplementary file), this review identifies organisational boundary conditions already present, especially COST/FEAS trade-offs, coordination rules and burdens, dissatisfaction/acceptability costs, and competence degradation, and highlights that these are still rarely integrated jointly within uncertainty-aware formulations. This provides a targeted agenda for bridging HR/management insights with operations research models that can quantify MT under realistic constraints and disruption regimes.

5.3. *Metrics, indicators, and evaluation outputs used to assess the contribution of MT to organisational resilience (RQ3)*

RQ3 examines how both MT and organisational resilience are operationalised and quantified in the reviewed literature. The key issue is not whether MT is conceptually associated with resilience, but how MT is measured as an input/capability (e.g., skill coverage, redeployment rules, training intensity/cost) and how resilience is measured as an outcome under disruption (e.g., service continuity, flow stability, robustness, cost and feasibility trade-offs), in ways that are comparable across studies and informative across disruption contexts. Resilience is rarely expected to be captured by a single index because it is inherently multi-dimensional; accordingly, most studies operationalise resilience through families of indicators that reflect different dimensions (e.g., buffering, reconfiguration, and feasibility under stress). In practice, MT is therefore evaluated through operational and economic performance indicators under variability or disruption conditions (e.g., demand/mix uncertainty, worker absence, machine failures, forecast errors, schedule recovery), with only a smaller subset using explicit resilience/robustness terminology.

To synthesise this evidence, we extracted the explicit metrics, indicators, and evaluation outputs reported in each study and grouped them into recurring metric families. A metric family was coded only when it was explicitly used as an outcome, an objective function, or a measured indicator in the study (e.g., flow time/WIP; service level; unmet demand; total cost decomposition; downtime; coordination effort; dissatisfaction; learning/forgetting or fatigue measures; ROI/break-even outputs).

Table 5 summarises the dominant metric families used to quantify MT as a resilience-relevant capability, together with illustrative indicators drawn from the included studies and the main resilience dimension each family captures.

To interpret these metric families, we use a four-dimension resilience lens: preparedness (pre-shock readiness), absorptive (buffering under shock), adaptive (reconfiguration), and restorative (recovery). This mapping is used as an interpretive device to clarify what each metric family captures, rather than as an additional inclusion or coding requirement.

Table 5
RQ3 metric families used to assess MT's contribution to OR

Metric family (code)	What is assessed (objective outcome)	Examples of indicators used in the included studies	How it captures MT → OR	Primary resilience dimension captured*
TIME/FLOW	Congestion and time stability under volatility	Flow time / time-in-system; cycle time (mean/variance); lead time; response time; makespan; WIP/inventory	MT reduces bottleneck congestion by enabling task reallocation, limiting delay accumulation during shocks	**Absorptive** (shock buffering)
SERVICE/ RELIABILITY	Continuity of delivery/service under disruption	Service level; % jobs tardy; mean tardiness; unmet demand/shortage; coverage shortfalls; order-fulfilment tardiness	MT acts as redundancy to maintain service performance when demand spikes or resources/ skills are temporarily unavailable	**Absorptive** + **Adaptive**
CAPACITY/ UTILISATION	Effective capacity conversion and workload balancing	Throughput; labour utilisation; bottleneck-worker load; workload distribution variability; minimum staffing level to meet output targets	MT increases effective capacity and reduces overload by enabling cross-support across stations/roles	**Adaptive**
COST/FEAS	Economic and feasibility boundary conditions of MT-based resilience	Training cost; productivity-loss cost; overtime cost; total labour cost; penalty costs (under/overcoverage); downtime vs staffing cost; lost profit	Quantifies the trade-off that makes MT deployable (or not) under resource and cost constraints	**Preparedness** + **Adaptive**

Metric family (code)	What is assessed (objective outcome)	Examples of indicators used in the included studies	How it captures MT → OR	Primary resilience dimension captured*
ROBUSTNESS/ RISK	Performance stability under uncertainty-aware formulations	Robust vs deterministic gap; scenario-based performance/cost stability; uncertainty-penalised objectives (shortage/ coverage/cost)	MT is evaluated as a hedge against uncertainty, improving stability rather than only average performance	**Absorptive** (stability)
COORD/ DEPLOYABILITY	Real-time usability of MT through decision rules	Real-time allocation/recovery actions; dispatching/assignment logic (including worker-selection rules); coordination effort (when measured); number/impact of schedule changes	Shows that skills deliver resilience only when deployable via explicit redeployment rules and coordination capacity	**Adaptive**
HUM-DYN	Human competence dynamics and performance limits	Learning/forgetting effects; fatigue measures; productivity heterogeneity; efficiency loss due to switching	Captures that MT benefits depend on competence accumulation/ decay and human constraints under stress	**Adaptive** (bounded)
TEAM/ORG	Organisational readiness and sustainability of implementation	Team processes (communication, conflict handling); collaboration/shared priorities; implementation sophistication; job satisfaction; burnout/role conflict/ ambiguity; union/contract constraints (when explicit)	Identifies organisational conditions that enable MT to function during disruption without unacceptable frictions	**Preparedness** + **Adaptive**

Note: Resilience dimensions are used as an interpretive lens: preparedness (readiness), absorptive (buffering), adaptive (reconfiguration), and restorative (recovery). Most indicators in the corpus capture absorptive/adaptive dimensions; restorative outcomes are less often operationalised explicitly (e.g., time-to-recovery).

Source: Own elaboration.

Table 5 shows that time-and-flow metrics (TIME/FLOW) and service continuity metrics (SERVICE/RELIABILITY) form the backbone of objective assessment in the corpus, especially in manufacturing/job-shop and retail/service scheduling contexts. These measures operationalise resilience primarily as the ability to avoid congestion collapse and preserve delivery/service performance under operational shocks. Capacity conversion indicators (CAPACITY/UTILISATION) are also common, capturing whether cross-trained capacity can be converted into throughput and whether bottlenecks can be relieved through reassignment.

Beyond operational performance proxies, a substantial subset of studies evaluates MT through explicit economic and feasibility metrics (COST/FEAS), including training cost, productivity-loss, overtime, shortage/coverage penalties, downtime, staffing trade-offs, and lost-profit outputs, reflecting that MT-enabled resilience is constrained by investment and deployability frictions, not simply by the existence of skills (Azizi & Liang, 2013; Iravani & Krishnamurthy, 2007; Porto *et al.*, 2022). In the uncertainty-aware stream, robustness-oriented evaluations (ROBUSTNESS/RISK) quantify MT's contribution as performance stability under demand/absence uncertainty, rather than only improved averages, aligning the resilience framing more explicitly with volatility (Henao *et al.*, 2016; Porto *et al.*, 2025).

Importantly, the metrics that capture MT's deployability and degradation mechanisms are less consistently reported than standard operational proxies. Coordination- and deployability-related indicators (COORD/DEPLOYABILITY), such as explicit redeployment rules, worker-selection logic, and recovery actions, appear in a subset of studies, and only rarely is coordination operationalised as an explicit measurable burden (e.g., "coordination effort"). Similarly, competence dynamics metrics (HUM-DYN) such as learning/forgetting and fatigue are present in a meaningful but smaller subset, showing that MT's benefits may degrade over time or be bounded by human performance limits. Finally, empirical and practice-oriented studies contribute TEAM/ORG indicators (e.g., implementation sophistication, team processes, satisfaction and psychosocial risks), which are essential to understanding whether MT remains sustainable during disruptions, yet they are less frequently translated into uncertainty-aware operational metrics.

Across the reviewed studies, objective assessment is implemented mainly through: simulation-based stress testing under disruption scenarios, analytical/queueing formulations capturing congestion mechanisms, optimisation models for staffing/ scheduling/assignment design, and stochastic/robust formulations that explicitly incorporate uncertainty. These approaches naturally prioritise TIME/FLOW, SERVICE/RELIABILITY, and COST/FEAS metrics. In contrast, empirical and practice-based designs are better suited to expose TEAM/ORG and COORD realities, but often provide fewer directly comparable, scenario-based resilience outputs.

Taken together, the RQ3 synthesis suggests that end-to-end quantification of MT as a resilience investment remains limited despite extensive modelling. The literature is strongest at measuring structural skill capacity and operational proxies under volatility, but less consistent in measuring the coordination, human dynamics, and organisational feasibility mechanisms that determine whether MT can be reliably deployed during disruptions. Therefore, the most actionable measurement agenda emerging from the included evidence is not to replace operational prox-

ies, but to complement them with deployability- and feasibility-aware indicators that already appear explicitly in subsets of the corpus (e.g., coordination effort, dissatisfaction/acceptability costs, learning/forgetting/fatigue, productivity-loss and ROI metrics). This integration provides a concrete bridge between the methodological emphasis of RQ1 (uncertainty and modelling approaches), the organisational enabling conditions identified in RQ2, and the objective performance measurement focus consolidated in RQ3.

6. DISCUSSION

Rather than reiterating the RQ-level findings, this discussion interprets them through an implementability lens. Taken together, Sections 5.1–5.3 show that MT is consistently associated with improved continuity under volatility, yet the evidence base remains difficult to cumulate because MT is not evaluated as the same "capability" across methodological traditions. A central integrative insight emerging from the synthesis is that MT behaves as a contingent resilience asset: its value depends not only on skill coverage, but on whether multifunctionality can be activated and sustained under disruption regimes.

This helps reconcile the apparent fragmentation in the literature. A dominant operations/operations research stream typically models MT as structural coverage and measures resilience via operational performance proxies under variability. In doing so, deployability is often treated as frictionless once skills exist. However, when studies make activation frictions explicit, such as redeployment rules, coordination burdens, acceptability constraints, learning/forgetting or fatigue, and productivity-loss during upskilling, the resilience contribution becomes conditional and strongly context-dependent. The synthesis therefore points to a "deployability wedge" between having multifunctional capacity and being able to use it reliably when disruptions occur. This wedge is precisely what prevents organisations from translating MT into decision-relevant ROI under real volatility: the mechanisms that govern activation and degradation are unevenly represented and rarely co-modelled with uncertainty.

From a measurement standpoint, the review suggests that future comparability will require treating MT-enabled resilience as a layered construct with capacity (skill coverage), activation (rules, coordination, decision rights), and sustainability (competence dynamics and workforce acceptance). This layered view does not replace operational proxies; it clarifies when those proxies are informative and when they are likely to overstate resilience by omitting activation and degradation mechanisms. This interpretation also supports actionable implications for training design and governance under risk.

For practitioners, the synthesis suggests that MT should be treated as a layered resilience capability rather than a simple upskilling initiative. Skill coverage (SKILLS) is a foundational requirement, but resilience value depends on: whether MT can be deployed through operational decision rules and coordination structures (COORD), whether training investments are justified within cost and feasibility boundaries (COST/FEAS), and whether competence dynamics and workforce acceptance constraints are managed over time (HUM-DYN and TEAM/ORG). In practice, this implies that organisations should complement training plans with explicit redeployment protocols, governance arrangements, and monitoring of performance degradation risks (e.g., fatigue, forgetting, efficiency loss under frequent switching).

7. CONCLUSIONS

This review synthesised 87 studies to clarify how MT is conceptualised, implemented, and evaluated as a contributor to OR. The evidence confirms that MT is consistently associated with improved operational adaptability and continuity under volatility, but it also demonstrates that MT's resilience value is rarely quantified "end-to-end". Instead, most studies operationalise MT as structural skill coverage and evaluate resilience via operational proxies (time/flow stability, service reliability, throughput and utilisation), while fewer explicitly incorporate the organisational and behavioural mechanisms that condition deployability under disruption.

Across the three research questions, three conclusions emerge. First, the MT–OR field remains methodologically segmented: quantitative/Operations Research approaches dominate and quantify performance under variability but often simplify workforce dynamics; empirical and practice-oriented work offers richer organisational realism but less frequently formalises uncertainty and resilience trade-offs. Second, uncertainty-aware optimisation exists but is not yet the norm, limiting decision relevance for training investment under risk. Third, explicit integration of uncertainty and human dynamics remains rare, directly explaining why organisations still lack robust, comparable metrics to justify MT strategically as a resilience asset.

By consolidating explicit evidence on enablers, barriers, and metric families, this review provides both a structured interpretation of the existing literature and a concrete agenda for future work: to bridge HR and organisational insights with uncertainty-aware operations modelling, and to move toward standardised resilience-relevant measurement architectures.

Taken together, the findings across RQ1–RQ3 define a concrete agenda for advancing the field. Future work should prioritise "end-to-end" formulations that integrate uncertainty-aware workforce planning (stochastic/robust/DRO and real-options valuation), competence evolution and behavioural realism (learning/forgetting, fatigue, heterogeneity, acceptability constraints), and deployability mechanisms (coordination rules, decision rights, governance, and implementation sophistication). Such integration would directly address the current evidence gap: models that quantify resilience gains under volatility but omit the organisational frictions that determine whether MT remains implementable when disruptions occur.

This review is subject to several limitations. First, the included evidence base is methodologically heterogeneous, with strong dominance of OR modelling and sector concentration in manufacturing/service operations and healthcare-related contexts, which may limit generalisability to other organisational settings. Second, although the review applies explicit coding rules to avoid inferring unreported mechanisms, this approach necessarily underrepresents enablers/barriers that may exist in practice but are not explicitly modelled or measured. Finally, despite synthesis-

ing metric families, the lack of standardised indicators for MT intensity and resilience outcomes limits the possibility of aggregating results quantitatively. These limitations reinforce the need for more consistent measurement frameworks and cross-sector empirical validation.

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9. CONFLICT OF INTEREST AND AUTHORSHIP

The authors declare no conflicts of interest related to this study.

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