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Aims and Scope / Objetivos y alcance

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Salesperson ambidexterity, firm capabilities, and value co-creation: Key factors in salespeople's innovative service behavior?

Ambidestreza del vendedor, capacidades de la empresa y co-creación de valor: ¿factores clave en el comportamiento innovador en servicio de los vendedores?

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ABSTRACT

This study examines how a firm's innovation capability and marketing capability, as well as salespeople's ambidexterity in sales and service, influence value co-creation with customers and how this co-creation and ambidexterity directly impact innovative service behavior in salespeople. The paper contributes to the literature by addressing certain aspects that have been relatively unexplored to date. A quantitative study is carried out using a sample consists of 91 sales professionals from the United Kingdom and the United States of America, spanning both consumer (B2C) and industrial market (B2B) salespeople, providing a diverse perspective. Using partial least squares (PLS-SEM) methodology, the findings reveal that (a) value co-creation, driven by the firm's innovation capability and marketing capability, positively affects salespeople's innovative service behavior, and (b) the development of ambidextrous sales and service skills among frontline employees also fosters innovative behaviors in service in the sales team. Based on service-dominant logic, this research provides novel insights into how value co-creation serves as a driver of innovative service behavior in salespeople. It further extends previous research by considering sales and service ambidexterity as a key factor in driving this innovative behavior. These findings highlight the need to co-create value with customers and enhance salespeople's individual competencies to drive their innovative behavior in service within the current competitive and evolving market context.

Keywords: Salespeople's Innovative Service Behavior, Marketing Capability, Innovation Capability, Value Co-creation, Sales-Service Ambidexterity.

R E S U M E N

Este estudio examina cómo la capacidad de innovación y la capacidad de marketing de una empresa, junto con la ambidestreza de los vendedores en ventas y servicio, influyen en la co-creación de valor con los clientes, y cómo esta co-creación y las dimensiones de la ambidestreza impactan directamente en el comportamiento innovador en servicio de los vendedores. El trabajo contribuye a la literatura de ventas abordando aspectos relativamente inexplorados hasta la fecha. Se desarrolla un estudio cuantitativo utilizando una muestra de 91 vendedores de Reino Unido y USA, que abarcan tanto el mercado de consumo (B2C) como industrial (B2B), lo que proporciona una perspectiva diversa. Utilizando la metodología PLS-SEM, los hallazgos revelan que (a) la co-creación de valor, impulsada por las capacidades de innovación y marketing de la empresa, afecta positivamente el comportamiento innovador en servicios de los vendedores, y (b) el desarrollo de habilidades ambidiestras de ventas y servicio entre los empleados de primera línea también fomenta comportamientos innovadores en el equipo de ventas. Basada en la lógica del servicio dominante, esta investigación proporciona nuevos conocimientos sobre la co-creación de valor como motor del comportamiento innovador en servicio de los vendedores y amplía investigaciones previas al considerar la ambidestreza en ventas y servicio como un factor clave para impulsar este comportamiento innovador. Estos hallazgos destacan la necesidad de co-crear valor con los clientes y mejorar las competencias individuales de los vendedores para impulsar su comportamiento innovador en servicio dentro del actual contexto de mercado competitivo y en constante evolución.

Palabras clave: Comportamiento Innovador en Servicio de los Vendedores, Capacidad de Marketing, Capacidad de Innovación, Co-creación de Valor, Ambidestreza de Venta y Sevicio.

1. INTRODUCTION

In a constantly evolving global landscape, the innovative behavior of organizational members is crucial for achieving and maintaining a sustainable competitive advantage (Bani-Melhem *et al.*, 2018). Innovation emerges when individuals identify problems and develop ideas or solutions (Alqhaiwi *et al.*, 2023), which emphasizes the relevance of value co-creation as an important process for the seller to identify and respond to specific customer needs (Vargo & Lusch, 2004), and thus improve their innovative behavior in providing services. In this context, the development of company's innovation and marketing capabilities generates the necessary conditions and business culture for workers in contact with customers to take on an active role in the development of initiatives that generate value *with* and not only *for* customers, facilitating company-customer engagement and interaction. On the one hand, effective management of innovation capability seeks to foster novel ideas and practices through shared and collaborative co-creation processes (Iddris, 2016). On the other hand, the company's marketing capability generates processes that help define, develop, communicate, and deliver value to customers through the combination, transformation, and deployment of its available resources (Bahadir *et al.*, 2008; Morgan *et al.*, 2022). In both capabilities, actively engaging customers creates opportunities for value co-creation by listening to their opinions and adapting offerings to meet their changing needs. In these processes, salespeople become a key resource for the company; as agents who channel market demands, they contribute to the development of innovation, especially through their innovative behavior in the services they themselves provide.

This collaborative salesperson–customer dynamic is even more necessary due to the current transformation of markets, which has caused certain traditional product and service development methods to become obsolete (Cooper & Sommer, 2018; Jörling *et al.*, 2019). Sales teams, acting as knowledge managers and key links in service ecosystems, can enhance and maintain relationships both within the company and with customers, thus strengthening strategic differentiation (Plouffe *et al.*, 2024). In this sense, service-based competition can represent a highly useful complementary response strategy to generate competitive advantages that are more difficult to imitate (Grawe *et al.*, 2009). Furthermore, co-creation in the B2B environment and service management allows firms to strengthen their competitive capabilities by integrating and collaborating with various ecosystem actors, facilitating a differentiating and sustainable advantage (Chowdhury *et al.*, 2023). In the B2C domain, value co-creation, driven by consumers' need for differentiation, enables firms to connect deeply with individual customer needs, building a competitive advantage based on this connection and strengthening their market positioning (Sahi *et al.*, 2022).

In this regard, rethinking the approaches and processes used to nurture salespeople's innovative service behavior is a challenge in which co-creation plays a notable role. Witell *et al.* (2011, p. 89) state that co-creation for the purpose of innovation requires "customers who actively participate in the early phases of the [product] development process by contributing information about their own needs and/or suggesting ideas for future services that they would value being able to use." For Gegužytė and Bagdonienė (2021), this participation of customers as co-creators in innovation improves the success rate of new services. By working closely with customers to design services tailored to their specific needs, salespeople can stand out in a saturated market by offering unique and highly relevant solutions. From this perspective, the information exchanges between customers and employees are positively linked to innovative behavior in employees engaged in services (Li & Hsu, 2018).

In this context, the sales force plays a crucial role in connecting with markets, as it identifies new customer needs and enables the company to adapt and co-create value through customized solutions (Sarmento *et al.*, 2024). To achieve that necessary umbilical cord between the markets and the company, it is advisable to develop dynamic approaches in sales, and understand flexibility in sales approaches as a fundamental work tool. In this sense, sales-service (S-S) ambidexterity implies the dynamic ability of employees to perform both sales and service activities by integrating these dual roles (Mom *et al.*, 2009). A salesperson has S-S ambidexterity when they can find synergies between sales and service activities, and exploit these synergistic opportunities by reconfiguring resources accordingly (Shiue, *et al.*, 2021). Thanks to this flexibility, ambidextrous employees can better respond to customer expectations, generating authentic interactions that drive shared value (Tremblay, 2023). In this process, they share knowledge and collaborate with the customer because participation is the tool needed to create joint value (Hartmann *et al.*, 2018). Ahmad *et al.* (2022b) consider that salespeople involved in providing new customer services and generating cross-/up-selling opportunities will be able to generate a high level of innovative performance in services.

In light of these reflections, this research focuses on innovative service behavior in salespeople, seeking to provide knowledge on how to promote this phenomenon through both value co-creation and sales-service ambidexterity. Notably, the aim is to analyze the role of the dimensions (sales and services) of salesperson ambidexterity as drivers of value co-creation and innovative service behavior in their professional field, all with an understanding of the crucial role that the perception of the company's marketing and innovation capability will play so that the salesperson can carry out value co-creation.

This study follows recent research highlighting the importance of value co-creation and ambidexterity in salespeople's innovative service behavior. However, it contributes to the literature by addressing certain aspects that have been relatively unexplored to date. Specifically, while previous studies have focused on value co-creation as a driver of organizational performance (Alnakhli *et al.*, 2021; Erhardt *et al.*, 2019; Gegužytė & Bagdonienė, 2021; Inyang *et al.*, 2023; Melton & Hartline, 2015; Sarmento *et al.*, 2024) or customer outcomes (Liu & Zhao, 2021; Plouffe *et al.*, 2024), this study introduces the role of value co-creation as a driver of innovative behavior, particularly among salespeople. It builds on the proposal by Saha *et al.* (2022), who recommended exploring the impact of co-creation on behavioral outcomes and highlighted the importance of investigating its role within innovative contexts. On the other hand, unlike studies that emphasize how the capabilities or characteristics of salespeople contribute to ambidexterity (Ahmad *et al.*, 2024; Batt-Rawden

et al., 2019; Hughes & Ogilvie, 2020), this study considers ambidexterity, specifically in sales and service, as a driving construct for salespeople's innovative service behavior. It is also aligned with Ahmad *et al.*'s (2022b) suggestion that future research consider both dimensions (service provision and cross-/up-selling) as exogenous constructs to examine their individual impact on salespeople's innovative service behavior. Furthermore, the inclusion of B2B and B2C environments in the sample offers a broader perspective that complements previous literature on S-S ambidexterity (Ahmad *et al.*, 2024; Ahmad *et al.*, 2022a; Ahmad *et al.*, 2022b; Ahmad *et al.*, 2022c).

This new model, based on service-dominant logic (Vargo & Lusch, 2004), illustrates how the right context enhances value co-creation, while ambidexterity in sales and service enables salespeople to anticipate and adapt effectively to customer demands. It also examines how this co-creation and S-S ambidexterity directly influence the ability of salespeople to innovate in services.

Firstly, a literature review is carried out on the variables retained in the proposed theoretical model. The hypotheses are then contrasted using the partial least squares method (PLS-SEM). Finally, the conclusions, implications, and management recommendations derived from the results are defined.

2. LITERATURE REVIEW

Capabilities are considered the implementation of "know-how" when carrying out activities in the various company departments, such as innovation and marketing (Eisenhardt & Martin, 2000; Krasnikov & Jayachandran, 2008; Morgan *et al.*, 2009). Currently, companies are forced to implement business models that are sustainable and profitable, given that they operate in highly volatile and competitive markets. Innovation capability emerges as a crucial factor for business survival in these complex environments (Andrés *et al.*, 2015). For Romijn & Albaladejo (2002, p. 1054), innovation capability is related to "the skills and knowledge necessary to effectively absorb, master, and improve existing technologies, and create new ones." This innovation capability, which refers to a company's ability to generate, accept, and implement new ideas, processes, products and also services, is an important instrument in improving and sustaining business development and income (Calantone *et al.*, 2002; Ngo & O'Cass, 2013). In terms of marketing capability, it refers to the ability of companies to use their resources with the purpose of offering specific value to their target audience to achieve the desired goal (Martin & Javalgi, 2016). A series of integrative processes designed to apply the company's collective knowledge, skills, and resources to market-related needs allows the company to add value to its products and services and meet competitive demands (O'Cass & Weerawardena, 2010).

As companies continue to develop their marketing and innovation capabilities, the relevance of value co-creation seems to be growing in response to the evolving environment we are currently experiencing. Explaining value co-creation is a challenge, given the polysemy of the concept; it is reflected in three research streams (Särkkä, 2011) that emphasize experiential aspects (e.g., Barile & Polese, 2010; Songailiene *et al.*, 2011), relational aspects (e.g., Nenonen & Storbacka, 2010; Vargo, 2011), or both (e.g., Merz *et al.*, 2009; Ojasalo, 2010; Plé & Chumpitaz Cáceres, 2010). In this research, we uphold the concept of value co-creation that emphasizes the collaborative process between organizations and customers and that generates unique value for both internal and external stakeholders of the company (Erhardt *et al.*, 2019) —value that does not reside in the products or services offered but in the experience itself (Berenguer *et al.*, 2020). Value co-creation can involve collaboration with the entire network or ecosystem of agents in the company's environment, both suppliers and customers (Kaartemo *et al.*, 2017). In this way, the value creation process is generated between all the actors involved within a service ecosystem (Hein *et al.*, 2019) in a reciprocal process where value is delivered when all the parties involved assume their roles and fulfill their responsibilities (Williams & Aitken, 2011).

Organizations that prioritize and encourage innovation naturally tend toward co-creating value with their partners and customers, given that innovation and collaboration are intrinsically related (Kim & Chai, 2017). A company's innovation capability not only contributes towards a more sustainable value proposition, but also positions it to generate value in collaboration with various actors in the business ecosystem, such as supply chain partners and customers (Zhang *et al.*, 2022). Leveraging innovation capabilities drives value creation by providing knowledge, competencies, and insights into new ideas (Yousaf *et al.*, 2022). In this way, innovativeness enhances value co-creation by enabling firms to adapt dynamically, involving customers as active participants in service improvement and resilience (Lopez *et al.*, 2024), thus consolidating stronger and longer-lasting relationships. From the service-dominant (S-D) logic perspective, innovation favors the exchange of information and knowledge between employees and customers, driving collaboration for value co-creation (Cabiddu *et al.*, 2013).

Thus, it is hypothesized that:

H1: Innovation capability (IC) is positively associated with value co-creation (VCC).

However, a company's success derives not only from the creation of value for its customers through the development of new and relevant goods and services, but also from its marketing methods (Lee & Hsieh, 2010). When a company provides salespeople with industry and market information, it helps the sales team quickly identify potential customers (Liu & Zhao, 2021), which facilitates value co-creation. A strong marketing capability strengthens relationships with customers and allows companies to anticipate changes in their preferences, suggesting an ability to adapt and respond quickly to market demands (O'Cass & Sok, 2014). From the perspective of service-dominant logic (Vargo & Lusch, 2004), marketing should be considered as a set of processes and resources with which the company seeks to co-create value. Considering that this approach works, it can be observed that marketing capability plays a fundamental role in the joint co-creation of value between salesperson-customer in the contemporary market, and based on these reflections and previous research, it is hypothesized that:

H2: Marketing capability (MC) is positively associated with value co-creation (VCC).

Furthermore, this value co-creation approach fosters an environment in which the customer actively participates in the development and customization of services, providing feedback that can increase the radicalness and innovative performance of these services (Melton & Hartline, 2015). In this process, the salesperson plays a key role in gathering customer insights (Alnakhli *et al.*, 2021) and integrating them into their own innovative service behavior. Innovative behavior differs from innovation because it focuses on the individual level as the unit of analysis (Alzghoul *et al.*, 2024). The direct interaction of salespeople with customers allows them to actively contribute to value co-creation, thereby developing a strong innovative behavior in service (Li & Hsu, 2018). Based on these reflections, hypothesis 3 is proposed:

H3: Value co-creation (VCC) is positively associated with salespeople's innovative service behavior (SISB).

In this context of collaboration, developing the skills of employees, specifically salespeople, to be able to analyze and understand the context of customer interactions is imperative for companies that seek to differentiate themselves from their competitors by improving and creating new services. From time to time, companies have assigned specific responsibilities to frontline employees, whether in services or sales roles. However, the boundaries between sales and services, while once distinct, have become increasingly blurred (Panagopoulos *et al.*, 2020). Service activities are understood as those focused on satisfying customer needs, such as addressing comments and resolving complaints, while sales activities focus on offering products and services, initiating new transactions or renewing existing ones (Ahmad *et al.*, 2022a).

Increasing competition in the business environment and rising customer expectations have meant that the ambidextrous sales approach, in which salespeople are simultaneously responsible for selling (cross-selling) and servicing the customer (providing customer service), has become the norm in today's sales organisations (Temerak et. al., 2024). This phenomenon has motivated further research on ambidexterity in sales and services, both in business practice and in academia (Panagopoulos *et al.*, 2020). This emerging research draws on the contextual ambidexterity literature to argue that a salesperson's two key activities (services and sales) can be maximized simultaneously by seeking and exploiting synergies between the two (Shiue *et al.*, 2021). In this study, the sales service ambidexterity scale proposed by Jasmand *et al.* (2012) is used. It is composed of two dimensions: customer service provision, which refers to "the activities carried out with the objective of helping customers satisfy their needs through the portfolios of products or services they already consume" (p. 22), and cross-/up-selling, which refers to "activities aimed at modifying (that is, expanding or replacing parts of) the current portfolios of products or services consumed by customers, based on their needs not met by said current portfolios" (p. 22).

Studies have recently been carried out on how the combination of sales and service activities has the potential to generate greater value for both buyers and sellers by reducing or even mitigating the disconnect between the objectives of the supplier and the buyer (Hughes & Ogilvie, 2020). Simplifying interactions between sellers and customers is essential to co-creating value and preventing a lack of coordination from harming customer service (Plouffe *et al.*, 2024). Sales and service ambidexterity allows salespeople to personalize their approaches, generating a sense of collaboration that strengthens the customer-salesperson relationship and promotes a positive experience, leading to a greater willingness of customers to engage in value co-creation (Ahmad *et al.*, 2024). These results lead to hypotheses H4 and H5:

H4: Customer service provision (CSP) on the part of the salesperson is positively associated with value co-creation (VCC).

H5: Cross-/Up-selling (CUS) is positively associated with value co-creation (VCC).

Previous research has also revealed other formulas through which salespeople can develop their innovative service behavior. Ahmad (2022b) demonstrated in B2B salespeople that, when they balance both sales generation and service requirements, they can offer innovative solutions to meet their customers' needs. Delving into this relationship, Nijssen *et al.* (2017) consider that this type of ambidexterity is essential to achieve a wide variety of innovations and therefore impact innovative behavior in salespeople's services. As a result of these investigations, hypotheses H6 and H7 can be formulated:

H6: Customer service provision (CSP) is positively associated with salespeople's innovative service behavior (SISB).

H7: Cross-/Up-selling (CUS) is positively associated with salespeople's innovative service behavior (SISB).

Figure 1 presents the theoretical model.

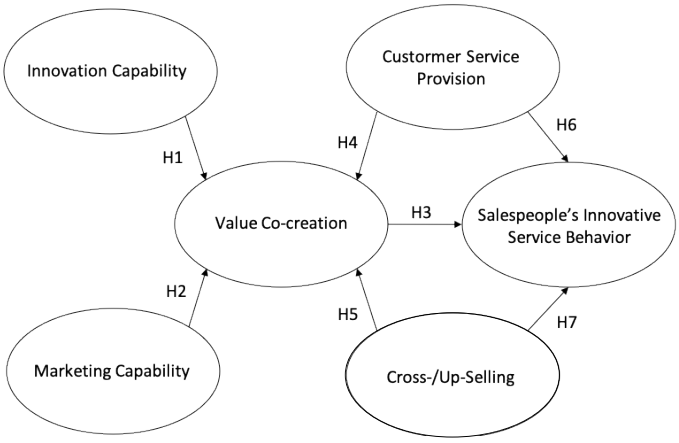

Figure 1
Theoretical Model
Source: Own elaboration.

3. METHODOLOGY

A leading multinational company in construction and decoration materials was selected as the focus of this study. The family-owned company is recognized for the high quality and innovative design of its products, offering interior and exterior solutions with ceramic coatings and bathroom and kitchen fittings and accessories. Its outstanding innovation capability is

evident in the constant development of cutting-edge solutions and products that become trends in both consumer (B2C) and organizational (B2B) markets. Committed to research and development, it has created advanced technologies and designs that have revolutionized the industry and have been widely acclaimed for their originality and quality, positioning the company as a benchmark in innovation in its sector. In this research we focus exclusively on analyzing the salespeople it employs in two of its international markets (United States and United Kingdom). The choice of these markets is due to their strategic importance and their receptivity to innovation in the construction and decoration materials sector, which allows the study of sellers' performance and their ability to generate innovation in their relationships with customers. The exclusive focus on the company's salespeople is because they are the key players in the direct interface with customers in both consumer and organizational markets. These salespeople play a critical role not only in selling products, but also in developing their innovative behavior to offer service-solutions for customers.

In this work, a quantitative approach is used by means of a self-administered ad hoc survey via the Internet; the questionnaire was sent to the entire population through a link in the company's digital newsletter that reached the salesperson's e-mail. The link led recipients to a LimeSurvey server through which the questionnaire was accessed, preceded by a letter written by the company. The structured questionnaire is made up of scales adapted from the literature (Table 1) to which are added a series of questions that allow the characterization of the sample made up of salespeople from both the United States and the United Kingdom. The items of each construct were evaluated using Likert scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Table 1
Scales

Construct	Dimensions	Number of Items	Original Scales by Authors
Innovation Capability (IC)	Unidimensional	4 items	Wang & Ahmed (2004)
Marketing Capability (MC)	Unidimensional	4 items	Morgan *et al.*, (2009); Ngo & O'Cass (2012)
Value Co-Creation (VCC)	Unidimensional	6 items	Claro & Claro (2010)
Sales-Service Ambidexterity	Customer Service Provision (CSP)	6 items	Jasmand *et al.* (2012)
	Cross-/Up-Selling (CUS)	6 items	
Salespeople's Innovative Service Behavior (SISB)	Unidimensional	6 items	Luoh *et al.* (2014); Ahmad *et al.*, (2022b)

Source: Own elaboration.

The population consisted of 348 company salespeople in both countries. The field work was carried out from 16 June to 16 July 2023. An effective sample of 91 salespeople was obtained, which implies an overall response rate of 26.15%.

As shown in Table 2, there is a balanced distribution between the percentage of men (46.15%) and women (46.15%) participants. The age of the respondents is very diverse, but the majority are over 31 years old (81.3%). Regarding the level of education, one in two participants (51.64%) have a bachelor's or postgraduate studies degree and their experience as a salesperson throughout their working life exceeds 11 years in the majority of cases (65.1%). Over half (54.94%) do not have more than five years of experience in the company. There is a balance between the number of employees dedicated to B2C sales (49.45%) and the number of sales representatives assigned to B2B sales (50.54%).

Table 2
Sample Characteristics

Variables	N	%
Gender		
Man	42	46.15%
Woman	42	46.15%
Prefer not to answer	7	7.69%
Age		
20-25 years	5	5.49%
26-30 years	10	10.98%
31-35 years	15	16.48%
36-40 years	16	17.58%
41-45 years	17	18.68%
46-50 years	12	13.18%
50+ years	14	15.38%
N/A	2	2.19%
Educational level completed		
Primary school	1	1.09%
Secondary school	13	14.28%
CertHE	11	12.08%
DipHE	14	15.38%
Foundation degree	5	5.49%
Bachelor's degree	41	45.05%
Postgraduate studies	6	6.59%
Experience as a salesperson		
1-5 years	13	14.28%
6-10 years	18	19.78%
11-15 years	19	20.87%
16-20 years	17	18.68%
21-25 years	13	14.28%
25+ years	11	12.08%

Variables	N	%
Experience as a salesperson in the company		
1-5 years	50	54.94%
6-10 years	12	13.18%
11-15 years	12	13.18%
16-20 years	12	13.18%
21-25 years	4	4.39%
25+ years	1	1.09%
Geographical location		
United Kingdom	40	43.95%
United States	51	56.04%
Group of salespeople		
B2B salesperson	46	50.54%
B2C salesperson	45	49.45%

Source: Own elaboration.

The theoretical model was tested using the partial least square method (PLS-SEM) and SmartPLS4 software (Ringle, *et al.*, 2022).

4. ANALYSIS OF THE RESULTS

The evaluation of the measurement model recommended the elimination of indicators that were much lower than the reference value (0.70), although two from the value co-creation and service innovation scale were retained (0.696 and 0.687 respectively) due to their proximity to the reference value and to preserve the content validity of the scales, taking into account the significance of both loadings. The rest of the reflective indicators showed adequate values of internal consistency and composite reliability. Convergent validity is adequate with values greater than 0.5 in all cases, which implies that each compound explains at least 50% of the variance of the assigned indicators. All this allows us to confirm the reliability and validity of the measurement instrument (Table 3).

Table 3
Measurement Instrument of the Structural Model: Reliability and Convergent Validity

Factor	Item	Loadings	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
Innovation Capability (IC)	IC_1 During the past five years, our firm has developed many new management approaches for our customers.	0.758**	0.800	0.870	0.627
	IC_2 Key executives of our firm are willing to take risks to seize and explore "chancy" growth opportunities in market.	0.839**			
	IC_3 Our firm's research & development department or product development resources are adequate to handle the development needs of new products and services.	0.719**			
	IC_4 Our firm is willing to try new ways of doing things and seek unusual, novel solutions for our customers.	0.844**			
Marketing Capability (MC)	MC_1 Our firm's incorporation of customer needs into marketing of products and services has been better than that of competitors.	0.889**	0.920	0.943	0.806
	MC_2 Our firm's implementation of marketing activities has been better than that of competitors.	0.918**			
	MC_3 Our firm's advertising management and creative skills are better in comparison with our competitors.	0.923**			
	MC_4 Our firm has stronger public relation skills than our competitors.	0.859**			
Value Co-creation (VCC)	VCC_1 Customers actively participate in the process of new product development of our company.	0.753**	0.874	0.905	0.615
	VCC_2 Our company shares long-term plans of our products with customers.	0.837**			
	VCC_3 Customers and our company deal with problems that arise in the course of the relationship together.	0.780**			
	VCC_4 In most aspects of the relationship with the buyers, the responsibility for getting things done is shared.	0.771**			
	VCC_5 Our company is flexible in response to changes in the relationship with our customers.	0.857**			
	VCC_6 When some unexpected situation arises, customers and our company can work out a new deal.	0.696**			

Factor	Item	Loadings	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
Customer Service Provision (CSP)	CSP_4 I usually listen attentively to customers in order to take appropriate action to handle their concerns regarding their products.	0.882**	0.838	0.903	0.756
	CSP_5 I usually pay attention to the customers' questions about their products to answer them correctly.	0.882**			
	CSP_6 Making sure that I fully understand the reason why the customers contact me allows me to better help them with their questions and concerns regarding their products.	0.844**			
Cross-/Up-Selling (CUS)	CUS_8 I usually gather as much customer information as possible to offer a suitable product to customers.	0.742**	0.824	0.884	0.656
	CUS_10 I usually ask questions to assess whether the customers would be willing to buy an additional product.	0.829**			
	CUS_11 I rarely neglect a good opportunity to advise customers of a product which they could benefit from.	0.828**			
	CUS_12 I usually offer an additional product which meets the customers' needs best.	0.837**			
Salespeople's Innovative Service Behavior (SISB)	SISB_2 While working in the sales department, I try to propose my own creative ideas and convince customers.	0.833**	0.788	0.863	0.614
	SISB_3 While working in the sales department, I seek new service techniques, methods or techniques.	0.816**			
	SISB_4 While working in the sales department, I provide a suitable innovative plan to the customers.	0.789*			
	SISB_6 Overall, I consider myself a creative member of my team in this sales department.	0.687**			

Note: *p < 0.05. **p < 0.01.

Source: Own elaboration.

Regarding discriminant validity, it was verified that the cross-loadings were never greater than the loadings of the construct itself (Hair *et al.*, 2017). In the application of the Fornell and Larcker (1981) criterion, the square root of the average variance extracted (AVE) is greater than the estimated correlation between the factors. Likewise, the Heterotrait-Monotrait ratio of correlations (HTMT) (Henseler *et al.*, 2015) shows that all values are less than 0.90 (critical value for related constructs). Therefore, with these results, it can be concluded that the instrument has discriminant validity (Table 4).

Table 4
Discriminant Validity

	IC	MC	VCC	CSP	CUS	SISB
IC	**0.791**	0.829	0.662	0.127	0.302	0.358
MC	0.716	**0.897**	0.664	0.112	0.292	0.310
VCC	0.576	0.621	**0.784**	0.086	0.326	0.358
CSP	0.075	0.099	0.053	**0.869**	0.759	0.615
CUS	0.251	0.263	0.282	0.624	**0.809**	0.704
SISB	0.287	0.263	0.293	0.502	0.571	**0.783**

Note: The values on the diagonal are the square roots of the average variance extracted (AVE). Below the diagonal: correlations between factors. Above the diagonal: HTMT ratio. The terms IC, MC, VCC, CSP, CUS and SISB refer to the variables innovation capability, marketing capability, value co-creation, customer service provision, cross-/up-selling and salespeople's innovative service behavior, respectively.

Source: Own elaboration.

Once the conditions of the measurement model were validated, the significance of the structural relationships was analyzed through the bootstrapping algorithm in order to contrast the hypotheses. Based on the results obtained (see Table 5), it can be stated that the model, initially supported at a theoretical level, finds statistical support in five of the seven proposed hypotheses.

Table 5
Structural Model Results

Hypothesis	Relationships	Results	Path coefficient	T-value	Structural VIF
H1	IC->VCC	Confirmed	0.247*	1.807	2.079
H2	MC->VCC	Confirmed	0.406**	3.122	2.083
H3	VCC->SISB	Confirmed	0.180*	1.878	1.116
H4	CSP->VCC	Not confirmed	–0.125	1.176	1.659
H5	CUS->VCC	Not confirmed	0.191	1.545	1.780
H6	CSP->SISB	Confirmed	0.275*	2.656	1.684
H7	CUS->SISB	Confirmed	0.348*	2.633	1.824

Note: VIF = Variance inflation factors.
VcC $R^2 = 0.442$; $Q^2 = 0.254$. SIC $R^2 = 0.390$; $Q^2 = 0.303$. *p < 0.05, **p < 0.01. SRMR = 0.077.
The terms IC, MC, VCC, CSP, CUS and SISB refer to the variables innovation capability, marketing capability, value co-creation, customer service provision, cross-/up-selling and salesperson service innovative behavior, respectively.

Source: Own elaboration.

The results show that both innovation capability (IC) and marketing capability (MC) can significantly predict value co-creation (VCC), which confirms hypothesis 1 and hypothesis 2. Specifically, while the relationship between innovation capability (IC) and value co-creation (VCC) is significant, with a path coefficient of 0.247, the relationship between marketing capability (MC) and value co-creation (VCC) is stronger and exerts a greater influence, reflected by a higher path coefficient of 0.406.

It can also be seen that the perception of value co-creation (VCC) significantly impacts salespeople's innovative service behavior (SISB) confirming hypothesis 3. Regarding the factors that come from sales-service ambidexterity, both customer service provision (CSP) and cross-/up-selling (CUS) significantly predict salespeople's innovative service behavior (SISB), but not value co-creation (VCC). In this way, hypotheses 6 and 7 are confirmed but hypotheses 4 and 5 are rejected.

5. CONCLUSIONS

The focus of this study was on how firm capabilities and ambidexterity of salespeople influence value co-creation, and, in turn, how this value co-creation and ambidexterity affect salespeople's innovative behavior in service delivery. An attempt has been made to draw conclusions to identify practices and strategies that contribute to innovative service behavior.

The relationship between innovation capability (IC) and value co-creation (VCC) is significant. As Kim and Chai (2017) point out, innovation and collaboration are intrinsically related, indicating that companies that prioritize innovation are more likely to co-create value with their customers. This not only helps maintain a more sustainable value proposition, but also places the company in a position to generate value in collaboration with various actors in the business ecosystem, such as supply chain partners and customers (Zhang *et al.*, 2022). Our results are thus in line with other research works (Lopez *et al.*, 2024).

In parallel, the relationship between marketing capability (MC) and value co-creation (VCC) is stronger and has more influence compared to innovation capability. Therefore, this capability emerges as an indispensable element in strengthening relationships with customers and anticipating market demands (Liu & Zhao, 2021). Integrative marketing processes thus not only add value to products and services, but also facilitate the identification of potential customers and the joint creation of value (O'Cass & Sok, 2014). Furthermore, marketing capability is also reaffirmed as a tool for adaptation and rapid response to changes in market preferences, emphasizing its crucial role in generating competitive value propositions (Vargo & Lusch, 2004).

The importance of both innovation and marketing capability in value co-creation is therefore validated, but marketing capability appears to have a stronger influence, based on our results. As a whole, the development of both capabilities by the company is the necessary impetus for co-creation with customers, which in turn affects salespeople's innovative service behavior. This axis of significant relationships reveals the importance of the business context so that salespeople can develop innovative initiatives in their respective professional fields.

A second axis, which complements the first, emerges from salesperson ambidexterity, and is an essential factor in the promotion of innovative behavior in service. On the one hand, customer service provision (CSP) and cross-/up-selling (CUS) were expected to be positively associated with value co-creation (VCC) (Ahmad *et al.*, 2024; Plouffe *et al.*, 2024). However, the results do not confirm these expectations. It could be that the relationship between CSP/CUS and VCC is more complex than originally assumed. The sample size used in the study may also play a role; the actual effects may not be large enough to be detected accurately. Furthermore, the relationships between variables may vary depending on the specific context of the study, such as industry, customer type, or company strategy (Mason & Perreault, 1991). In this particular context, customer service provision and cross-/up-selling may not have a direct impact on value co-creation.

On the other hand, a positive and significant association was found between customer service provision (CSP), cross-/up-selling (CUS), and salespeople's innovative service behavior (SISB) (Ahmad, 2022b; Nijssen *et al.*, 2017). Improving understanding of the context of customer interactions can foster the ways in which salespeople can offer innovative solutions to meet their needs (Ahmad *et al.*, 2022b). It is the ambidextrous roles that have a stronger relationship with the innovative behavior in service initiatives developed by salespeople. Thus, the latter not only depends on the strategy and the favorable context that stimulates the company, but also on the ambidextrous profile of its salespeople, meaning that these characteristics are as important as the co-creation itself. These findings emphasize the importance of developing ambidextrous skills in frontline employees to enhance their ability to innovate in services and differentiate in a competitive business environment (Ahmad *et al.*, 2024; Hughes & Ogilvie, 2020; Liu & Zhao, 2021; Temerak *et al.*, 2024).

In conclusion, this study reveals a first axis, in which the fundamental importance of innovation and marketing in the generation of business value is highlighted, especially in the context of value co-creation with customers. It can be observed that marketing capability has a significant influence on value co-creation. There is also a second axis, which complements the first; although a direct relationship between the provision of customer services and cross-/up-selling with value co-creation is not confirmed, it reveals that both are positively associated with innovation capability in salesforce services, thus underlining the importance of developing ambidextrous skills in frontline employees to improve their innovative behavior in service and differentiation in a competitive business environment.

Regarding the practical implications from a business perspective, this research encourages reflection on the crucial role that salespeople play in the development of innovative practices when providing the customer with a service, since ambidexterity in sales and services has the power to boost the salespeople's innovative service behavior. To customers, salespeople are the face of the company and their ability to understand customer needs and effectively communicate the value of products or services is essential. Furthermore, collaboration between salespeople and customers benefits the process of innovating in service provision, which highlights the importance of sellers' active partici-

pation in value co-creation. All of this occurs within a business context propelled by the organization's innovation and marketing capabilities, which generate the appropriate environment so that salespeople are not only responsible for driving sales but also play an integral role in generating value for the company through the co-creation of value with customers.

Although most of the objectives of this study were confirmed, there are limitations that suggest areas for future research. Firstly, instead of focusing on a single company, repeating the study with different companies in the same sector could help to corroborate or refute these findings. Even though studies with similar sample sizes have been conducted (Amyx *et al.*, 2016; Fallah *et al.*, 2018), additional studies are required to replicate these results using larger and more representative samples. Furthermore, the use of the same source of information to measure both antecedent and consequence variables increases the risk of common method variance (CMV), which could influence the results, and therefore, it will be necessary to consider it in the design of future studies to reach more reliable conclusions. Moreover, although a sample composed of two different countries was used, comparing the results with samples of other nationalities could reveal variations in behavior. Additionally, testing the model by comparing B2B and B2C environments could determine whether the variables have similar impacts in both relational contexts.

In addition, to complement the findings, a second study could be conducted, potentially employing a qualitative approach or, alternatively, experimental methods to provide stronger evidence for the findings. Future research could also explore the longitudinal effects of these variables to examine changes over time. Another avenue could involve studying industry-specific impacts to see if certain sectors display unique patterns in innovation and co-creation. Finally, analyzing the role of digital tools in facilitating ambidexterity and co-creation may reveal how technology enhances or moderates these relationships.

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7. REFERENCES

Ahmad, B., Yuan, J., Ashfaq, M., Shahzad, K., & Zhang, T. (2024). Does salesperson bricolage matter in fostering service-sales ambidexterity in B2B markets? A perspective through the sales management control system. *Industrial Marketing Management*, *121*, 115-130. https://doi.org/10.1016/j.indmarman.2024.07.011

Ahmad, B., Liu, D., Akhtar, N., & Akbar, M. I. U. D. (2022a). Identifying aggressive versus ethical sales supervision in B2B service recovery: a multilevel perspective. *Asia Pacific Journal of Marketing and Logistics, 34*(10), 2331-2349. https://doi.org/10.1108/APJML-03-2021-0222

Ahmad, B., Liu, D., Akhtar, N., & Siddiqi, U. I. (2022b). Does service-sales ambidexterity matter in business-to-business service recovery? A perspective through salesforce control system. *Industrial Marketing Management*, *102*, 351-363. https://doi.org/10.1016/j.indmarman.2022.02.007

Ahmad, B., Liu, D., Asif, M. H., Ashfaq, M., & Irfan, M. (2022c). Ambidextrous Leadership and Service Recovery Performance Under B2B Selling Context: An Examination Through Service Innovation Capability. *Sage Open, 12*(2). https://doi.org/10.1177/21582440221096454

Alnakhli, H., Inyang, A. E., & Itani, O. S. (2021). The Role of Salespeople in Value Co-Creation and Its Impact on Sales Performance. *Journal of Business-to-Business Marketing, 28*(4), 347-367. https://doi.org/10.1080/1051712X.2021.2012079

Alqhaiwi, Z.O., Koburtay, T. & Karatepe, O.M. (2023). Linking person–job fit and intrinsic motivation to salespeople's service innovative behavior. *Journal of Services Marketing, 37*(9), 1186-1200. https://doi.org/10.1108/JSM-04-2023-0154

Alzghoul, A., Khaddam, A. A., Alshaar, Q., & Irtaimeh, H. J. (2024). Impact of knowledge-oriented leadership on innovative behavior, and employee satisfaction: The mediating role of knowledge-centered culture for sustainable workplace. *Business Strategy & Development, 7*(1), e304. https://doi.org/10.1002/bsd2.304

Amyx, D., Bhuian, S.N., & Shows, G.D. (2016). Customer-salespeople relationship: Influence of salespeople entrepreneurial behaviours. *Marketing Intelligence & Planning*, *34*(5), 586-604. https://doi.org/10.1108/MIP-09-2015-0170

Andrés, M. R., Broncano, S. G., & Monsalve, J. N. M. (2015). Could innovative teams provide the necessary flexibility to compete in the current context? *Cuadernos de Gestión, 15*(1), 145-163. https://doi.org/10.5295/cdg.130446mr

Bahadir, S. C., Bharadwaj, S. G., & Srivastava, R. K. (2008). Financial Value of Brands in Mergers and Acquisitions: Is Value in the Eye of the Beholder? *Journal of Marketing, 72*(6), 49-64. https://doi.org/10.1509/jmkg.72.6.049

Bani-Melhem, S., Zeffane, R., & Albaity, M. (2018). Determinants of employees' innovative behavior. *International Journal of Contemporary Hospitality Management, 30*(3), 1601-1620. https://doi.org/10.1108/IJCHM-02-2017-0079

Barile, S., & Polese, F. (2010). Linking the viable system and many-to-many network approaches to service-dominant logic and service science. *International Journal of Quality and Service Sciences, 2*(1), 23-42. https://doi.org/10.1108/17566691011026586

Batt-Rawden, V. H., Lien, G., & Slåtten, T. (2019). Team learning capability–an instrument for innovation ambidexterity?. *International Journal of Quality and Service Sciences*, *11*(4), 473-486. https://doi.org/10.1108/IJQSS-02-2019-0026

Berenguer-Contrí, G., G. Gallarza, M., Ruiz-Molina, M. E., & Gil-Saura, I. (2020). Value co-creation in B-to-B environments. *Journal of Business & Industrial Marketing, 35*(7), 1251-1271. https://doi.org/10.1108/JBIM-01-2019-0061

Cabiddu, F., Lui, T. W., & Piccoli, G. (2013). Managing value co-creation in the tourism industry. *Annals of Tourism Research, 42*, 86-107. https://doi.org/10.1016/j.annals.2013.01.001

Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial marketing management, 31*(6), 515-524. https://doi.org/10.1016/S0019-8501(01)00203-6

Chowdhury, N., Balaraman, P., & Liu, J. (2023). The evolution of B2B strategies in the rise of value co-creation and service management. *Journal of Strategy and Management*, *16*(4), 708-732. https://doi.org/10.1108/JSMA-03-2023-0064

Claro, D. P., & Claro, P. B. O. (2010). Collaborative buyer–supplier relationships and downstream information in marketing channels. *Industrial*

Marketing Management, 39(2), 221-228. https://doi.org/10.1016/j.indmarman.2009.03.009

Cooper, R. G., & Sommer, A. F. (2018). Agile–Stage-Gate for Manufacturers: Changing the Way New Products Are Developed Integrating Agile project management methods into a Stage-Gate system offers both opportunities and challenges. *Research-Technology Management, 61*(2), 17–26. https://doi.org/10.1080/08956308.2018.1421380

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic management journal, 21*(10-11), 1105-1121. https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E

Erhardt, N., Martin-Rios, C., & Chan, E. (2019). Value co-creation in sport entertainment between internal and external stakeholders. *International Journal of contemporary hospitality management, 31*(11), 4192-4210. https://doi.org/10.1108/IJCHM-03-2018-0244

Fallah, H., Jafariyan, H., & Savabieh, S. (2018). Investigation of Market Orientation and Self-Efficacy Effects on Sale Force Performance: Mediator Role of Sales Force Creativity and Innovation Implementation. *Journal of Relationship Marketing*, *17*(3), 188-203. https://doi.org/10.1080/15332667.2018.1440147

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50. https://doi.org/10.1177/002224378101800104

Gegužytė, G., & Bagdonienė, L. (2021). Value Co-Creation in engineering service innovation: resources and capabilities perspectives. *Central European management journal*, *29*(4), 91-123. https://doi.org/10.7206/cemj.2658-0845.61

Grawe, S.J., Chen, H. & Daugherty, P.J. (2009), The relationship between strategic orientation, service innovation, and performance. *International Journal of Physical Distribution & Logistics Management, 39*(4), 282-300. https://doi.org/10.1108/09600030910962249

Hair Jr, J. F., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: updated guidelines on which method to use. *International Journal of Multivariate Data Analysis, 1*(2), 107-123. https://doi.org/10.1504/IJMDA.2017.087624

Hartmann, N. N., Wieland, H., & Vargo, S. L. (2018). Converging on a New Theoretical Foundation for Selling. *Journal of Marketing*, 82(2), 1-18. https://doi.org/10.1509/jm.16.0268

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science, 43*, 115-135. https://doi.org/10.1007/s11747-014-0403-8

Hein, A., Weking, J., Schreieck, M., Wiesche, M., Böhm, M., & Krcmar, H. (2019). Value co-creation practices in business-to-business platform ecosystems. *Electronic Markets, 29,* 503-518. https://doi.org/10.1007/s12525-019-00337-y

Hughes, D. E., & Ogilvie, J. L. (2020). When Sales Becomes Service: The Evolution of the Professional Selling Role and an Organic Model of Frontline Ambidexterity. *Journal of Service Research, 23*(1), 22-32. https://doi.org/10.1177/1094670519878882

Iddris, F. (2016). Innovation Capability: A Systematic Review and Research Agenda. *Interdisciplinary Journal of Information, Knowledge, and Management, 11*, 235–260. https://doi.org/10.28945/3571

Inyang, E., Itani, O. S., Alnakhli, H., & White, J. (2023). Sales team value co-creation in turbulent markets: the role of team learning and agility. *Journal of Marketing Theory and Practice, 32*(4), 599-613. https://doi.org/10.1080/10696679.2023.2258266

Janteng, J., Tan, C. L., & Fernando, Y. (2017). The impact of value co-creation on service supply chain performance: a proposed conceptual framework. *Global Business and Management Research, 9*(4s), 239-249.

Jasmand, C., Blazevic, V., & de Ruyter, K. (2012). Generating Sales While Providing Service: A Study of Customer Service Representatives' Ambidextrous Behaviour. *Journal of Marketing, 76*(1), 20-37. https://doi.org/10.1509/jm.10.0448

Jörling, M., Böhm, R., & Paluch, S. (2019). Service Robots: Drivers of Perceived Responsibility for Service Outcomes. *Journal of Service Research, 22*(4), 404-420. https://doi.org/10.1177/1094670519842334

Kaartemo, V., Akaka, M. A., & Vargo, S. L. (2017). A service-ecosystem perspective on value creation: Implications for international business. *Value Creation in International Business, 2*, 131-149. https://doi.org/10.1007/978-3-319-39369-8_6

Kim, M., & Chai, S. (2017). The impact of supplier innovativeness, information sharing and strategic sourcing on improving supply chain agility: Global supply chain perspective. *International Journal of Production Economics*, 187, 42-52. https://doi.org/10.1016/j.ijpe.2017.02.007

Krasnikov, A., & Jayachandran, S. (2008). The Relative Impact of Marketing, Research-and-Development, and Operations Capabilities on Firm Performance. *Journal of Marketing, 72*(4), 1-11. https://doi.org/10.1509/jmkg.72.4.001

Kuo, Y. K., Kuo, T. H., & Ho, L. A. (2014). Enabling innovative ability: knowledge sharing as a mediator. *Industrial Management & Data Systems*, *114*(5), 696-710. https://doi.org/10.1108/IMDS-10-2013-0434

Lee, J. S., & Hsieh, C. J. (2010). A research in relating entrepreneurship, marketing capability, innovative capability and sustained competitive advantage. *Journal of Business & Economics Research, 8*(9), 109-119. https://doi.org/10.19030/jber.v8i9.763

Lee, S. M., Olson, D. L., & Trimi, S. (2012). Co-innovation: convergenomics, collaboration, and co-creation for organizational values. *Management decision, 50*(5), 817-831. https://doi.org/10.1108/00251741211227528

Li, M., & Hsu, C. H. (2018). Customer participation in services and employee innovative behavior: The mediating role of interpersonal trust. *International Journal of Contemporary Hospitality Management, 30*(4), 2112-2131. https://doi.org/10.1108/IJCHM-08-2016-0465

Liu, Y., & Zhao, X. (2021). Successful implementation of value-based selling: a value co-creation and dynamic capabilities perspective. *Journal of Business & Industrial Marketing, 36*(3), 372-389. https://doi.org/10.1108/JBIM-05-2020-0240

Lopez, E., Flecha-Ortiz, J.A., Santos-Corrada, M. & Dones, V. (2024). The role of organizational resilience in SME service innovation and value cocreation. *Journal of Services Marketing*, *38*(4), 443-459. https://doi.org/10.1108/JSM-03-2023-0081

Luoh, H. F., Tsaur, S. H., & Tang, Y. Y. (2014). Empowering employees: job standardization and innovative behavior. *International Journal of Contemporary Hospitality Management*, *26*(7), 1100-1117. https://doi.org/10.1108/IJCHM-03-2013-0153

Martin, S. L., & Javalgi, R. G. (2016). Entrepreneurial orientation, marketing capabilities and performance: the moderating role of competitive intensity on Latin American International new ventures. *Journal of Business research, 69*(6), 2040-2051. https://doi.org/10.1016/j.jbusres.2015.10.149

Mason, C. H., & Perreault, W. D. (1991). Collinearity, Power, and Interpretation of Multiple Regression Analysis. *Journal of Marketing Research, 28*(3), 268-280. https://doi.org/10.1177/002224379102800302

Melton, H. & Hartline, M.D. (2015). Customer and employee co-creation of radical service innovations. *Journal of Services Marketing, 29*(2), 112-123. https://doi.org/10.1108/JSM-02-2014-0048

Merz, M. A., He, Y., & Vargo, S. L. (2009). The evolving brand logic: a service-dominant logic perspective. *Journal of the academy of marketing science, 37*, 328-344. https://doi.org/10.1007/s11747-009-0143-3

Mom, T. J. M., Van Den Bosch, F. A. J., & Volberda, H. W. (2009). Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms. *Organization Science, 20*(4), 812-828. https://doi.org/10.1287/orsc.1090.0427

Morgan, N. A., Vorhies, D. W., & Mason, C. H. (2009). Market orientation, marketing capabilities, and firm performance. *Strategic management journal, 30*(8), 909-920. https://doi.org/10.1002/smj.764

Morgan, N. A., Slotegraaf, R. J., & Feng, H. (2022). Marketing capabilities for b2b firms. *Handbook of business-to-business marketing*, 96-116. https://doi.org/10.4337/9781800376878

Nenonen, S., & Storbacka, K. (2010). Business model design: conceptualizing networked value co-creation. *International Journal of Quality and Service Sciences, 2*(1), 43-59. https://doi.org/10.1108/17566691011026595

Ngo, L. V., & O'Cass, A. (2012). In search of innovation and customer-related performance superiority: The role of market orientation, marketing capability, and innovation capability interactions. *Journal of Product Innovation Management, 29*(5), 861-877. https://doi.org/10.1111/j.1540-5885.2012.00939.x

Ngo, L. V., & O'cass, A. (2013). Innovation and business success: The mediating role of customer participation. *Journal of Business Research, 66*(8), 1134-1142. https://doi.org/10.1016/j.jbusres.2012.03.009

Nijssen, E. J., Guenzi, P., & Van der Borgh, M. (2017). Beyond the retention-acquisition trade-off: Capabilities of ambidextrous sales organizations. *Industrial Marketing Management, 64*, 1-13. https://doi.org/10.1016/j.indmarman.2017.03.008

O'Cass, A., & Sok, P. (2014). The role of intellectual resources, product innovation capability, reputational resources and marketing capability combinations in firm growth. *International Small Business Journal*, 32(8), 996-1018. https://doi.org/10.1177/0266242613480225

O'Cass, A., & Weerawardena, J. (2010). The effects of perceived industry competitive intensity and marketing-related capabilities: Drivers of superior brand performance. *Industrial Marketing Management, 39*(4), 571-581. https://doi.org/10.1016/j.indmarman.2009.04.002

Ojasalo, J. (2010). E-service quality: a conceptual model. *International journal of Arts and Sciences, 3*(7), 127-143.

Panagopoulos, N. G., Rapp, A., & Pimentel, M. A. (2020). Firm Actions to Develop an Ambidextrous Sales Force. *Journal of Service Research, 23*(1), 87-104. https://doi.org/10.1177/1094670519883348

Plé, L., & Chumpitaz Cáceres, R. (2010). Not always co-creation: introducing interactional co-destruction of value in service-dominant logic. *Journal of services Marketing, 24*(6), 430-437. https://doi.org/10.1108/08876041011072546

Plouffe, C.R., DeCarlo, T.E., Fergurson, J.R., Kumar, B., Moreno, G., Schmitt, L., Sleep, S., Volpers, S. & Wang, H. (2024). Salespeople and teams as stakeholder and knowledge managers: a service-ecosystem, co-creation, crossing-points perspective on key outcomes. *European Journal of Marketing*, *58*(3), 704-732. https://doi.org/10.1108/EJM-04-2023-0249

Ringle, C. M., Wende, S., & Becker, J.M. (2022). SmartPLS 4. *Boenningstedt: SmartPLS GmbH*. http://www.smartpls.com.

Romijn, H., & Albaladejo, M. (2002). Determinants of innovation capability in small electronics and software firms in southeast England. *Research policy, 31*(7), 1053-1067. https://doi.org/10.1016/S0048-7333(01)00176-7

Saha, V., Goyal, P., & Jebarajakirthy, C. (2022). Value co-creation: a review of literature and future research agenda. *Journal of Business & Industrial Marketing, 37*(3), 612-628. https://doi.org/10.1108/JBIM-01-2020-0017

Sahi, G. K., Devi, R., Gupta, M. C., & Cheng, T. C. E. (2022). Assessing co-creation based competitive advantage through consumers' need for differentiation. *Journal of Retailing and Consumer Services*, *66*, 102911. https://doi.org/10.1016/j.jretconser.2022.102911

Santos-Vijande, M. L., López-Sánchez, J. Á. & Rudd, J. (2016). Frontline employees' collaboration in industrial service innovation: routes of co-creation's effects on new service performance. *Journal of the Academy of Marketing Science, 44*(3), pp. 350-375. https://doi.org/10.1007/s11747-015-0447-4

Sarmento, M., Simões, C., & Lages, L. F. (2024). From organizational ambidexterity to organizational performance: The mediating role of value co-creation. *Industrial Marketing Management*, *118*, 175-188. https://doi.org/10.1016/j.indmarman.2024.02.010

Särkkä, M. (2011). Exploring co-creation of value within customer-supplier and buyer-supplier relationships. *The Naples Forum on Service, Italy, June 14-17, 2011*. Giannini Editore.

Shiue, W., Tuncdogan, A., Wang, F., & Bredican, J. (2021). Strategic enablers of service-sales ambidexterity: A preliminary framework and research agenda. *Industrial Marketing Management, 92*, 78-86. https://doi.org/10.1016/j.indmarman.2020.11.001

Songailiene, E., Winklhofer, H., & McKechnie, S. (2011). A conceptualisation of supplier-perceived value. *European journal of marketing, 45*(3), 383-418. https://doi.org/10.1108/03090561111107249

Temerak, M. S., Micevski, M., Kadić-Maglajlić, S., & Latinovic, Z. (2024). Nuances of Sales-Service Ambidexterity across Varied Sales Job Types. *British Journal of Management, 35*(4), 1994-2010. https://doi.org/10.1111/1467-8551.12807

Tom, J. M. Mom, Frans A. J. van den Bosch & Henk W. Volberda, (2009) Understanding Variation in Managers' Ambidexterity: Investigating Direct and Interaction Effects of Formal Structural and Personal Coordination Mechanisms. *Organization Science 20*(4), 812-828. https://doi.org/10.1287/orsc.1090.0427

Tremblay, M. (2023). Is authenticity needed in service-sales ambidexterity? Examination of employees and customers' responses. *Journal of Personal Selling & Sales Management*, 1-21. https://doi.org/10.1080/08853134.2023.2284638

Vargo, S. L. (2011). Market systems, stakeholders and value propositions: Toward a service-dominant logic-based theory of the market. *European Journal of Marketing, 45*(1/2), 217-222. https://doi.org/10.1108/03090561111095667

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing, 68*(1), 1-17. https://doi.org/10.1509/jmkg.68.1.1.24036

Wang, C. L., & Ahmed, P. K. (2004). The development and validation of the organisational innovativeness construct using confirmatory factor analysis. *European journal of innovation management, 7*(4), 303-313. https://doi.org/10.1108/14601060410565056

Williams, J., & Aitken, R. (2011). The service-dominant logic of marketing and marketing ethics. *Journal of business ethics, 102*, 439-454. https://doi.org/10.1007/s10551-011-0823-z

Witell, L., Löfgren, M. & Gustafsson, A. (2011), Identifying ideas of attractive quality in the innovation process. *The TQM Journal*, 23 (1), 87-99. https://doi.org/10.1108/17542731111097515

Yousaf, Z., Panait, M., Tanveer, U., Cretu, A., Hrebenciuc, A., & Zahid, S. M. (2022). Value Creation through Frugal Innovation, Innovation Capability and Knowledge Sharing in a Circular Economy. *Sustainability,* 14(14), 8504. https://doi.org/10.3390/su14148504

Zhang, Z., Zhu, H., Zhou, Z., & Zou, K. (2022). How does innovation matter for sustainable performance? Evidence from small and medium-sized enterprises. *Journal of Business Research*, 153, 251-265. https://doi.org/10.1016/j.jbusres.2022.08.034

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Research on cybersecurity and business: A bibliometric review (2004-2023)

Investigación en ciberseguridad y negocios: una revisión bibliométrica (2004-2023)

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ABSTRACT

Cybersecurity poses a significant risk for companies due to the rise in cyberattacks worldwide, leading to increased uncertainty in security management and putting the sustainability of businesses at risk. Despite some academic contributions, limited bibliometric studies on integrating cybersecurity and business information exist. The research aims to assist academics, policymakers, and decision-makers in cybersecurity management. The authors conducted a bibliometric review using scientific mapping and performance analysis. The study used the Web of Science database and Bibliometrix software to analyze 410 articles and 1,355 authors across nine bibliometric indicators between 2004 and 2023. This article is novel in proposing a bibliometric review of cybersecurity and business, as the other studies addressed specific sectors and do not allow for an integrated view of information on these two topics. The main findings showed an annual growth of 27.63% and an international co-authorship of 31.46%. The United States of America has the highest scientific production, followed by the United Kingdom and China. Business Horizons and IEEE Access are the most influential journals in this field of research. This study can improve the analysis of academics, policymakers, and decision-makers in companies regarding security management. Future studies could propose management models to improve cybersecurity in organizations.

Keywords: Cybersecurity, Business, Safety Management, Scientific Mapping, risk, Bibliometrix.

RESUMEN

La ciberseguridad representa un riesgo importante para las empresas debido al aumento de los ciberataques en todo el mundo, lo que genera una mayor incertidumbre en la gestión de la seguridad y pone en riesgo la sostenibilidad de las empresas. A pesar de algunas contribuciones académicas, existen estudios bibliométricos limitados sobre la integración de la ciberseguridad y la información empresarial. La investigación tiene como objetivo ayudar a los académicos, los responsables políticos y los tomadores de decisiones en la gestión de la ciberseguridad. Los autores realizaron una revisión bibliométrica utilizando el mapeo científico y el análisis de rendimiento. El estudio utilizó la base de datos Web of Science y el software Bibliometrix para analizar 410 artículos y 1,355 autores en nueve indicadores bibliométricos entre 2004 y 2023. Este artículo es novedoso al proponer una revisión bibliométrica de la ciberseguridad y los negocios, ya que los otros estudios abordaron sectores específicos y no permiten una visión integrada de la información sobre estos dos temas. Los principales hallazgos mostraron un crecimiento anual del 27.63% y una coautoría internacional del 31.46%. Los Estados Unidos de América cuentan con la mayor producción científica, seguido de Reino Unido y China. Business Horizons e IEEE Access son las revistas más influyentes en este campo de investigación. Este estudio puede mejorar el análisis de académicos, formuladores de políticas y tomadores de decisiones en las empresas en relación con la gestión de la seguridad. Estudios futuros podrían proponer modelos de gestión para mejorar la ciberseguridad en las organizaciones.

Palabras clave: Ciberseguridad, Negocios, Gestión de la seguridad, Mapeo científico, Riesgo, Bibliometrix

1. INTRODUCTION

Cybersecurity is a critical risk for companies due to the increase in cyberattacks in various parts of the world (Bresniker *et al.*, 2019), which increases uncertainty in the process of managing it and, in turn, jeopardizes the sustainability of their businesses (Kosmowski *et al.*, 2022). Despite academic contributions, there are few bibliometric studies on cybersecurity and business. For example, a study dedicated to the healthcare sector provided an overview of the literature on the intersection of cybersecurity and healthcare (Jalali *et al.*, 2019). Key findings revealed that cyber vulnerabilities are not all digital and that physical threats contribute to breaches and impact the physical safety of patients (Jalali *et al.*, 2019). In another study, researchers conducted a bibliometric review of research on autonomous vessels' risk, safety, and reliability, and it confirmed the relevance of further cybersecurity risk analyses (Chaal *et al.*, 2023). Other researchers conducted a systematic literature review, not a bibliometric review, to analyze cybersecurity awareness in the industrial Internet of Things (IoT) context (Corallo *et al.*, 2022). In this case, the study analyzed 23 articles in four areas of analysis. In short, the studies presented use bibliometric or systematic literature review as a methodology and address specific sectors, which fulfills particular research objectives but does not allow for an integrated view of cybersecurity and business.

Scientific databases have shown an uptick in publications on cybersecurity and business in recent years. However, this increase in published scientific articles is fragmented, and there is a need for more integration of this information (Aria & Cuccurullo, 2017). This lack of integration hampers the ability of researchers, managers, and policymakers to analyze the data effectively. For these reasons, scientific mapping is essential for scholars in all scientific disciplines as it allows for determining the intellectual structure and knowing the research front of scientific fields (Aria & Cuccurullo, 2017). Other researchers validate this methodology as the most appropriate for this type of study (Chaal *et al.*, 2023). Therefore, the primary motivation of the study lies in filling the knowledge gap and analyzing safety management, considering the interfaces between technology, people, and organizations through a bibliometric review of cybersecurity and business. Based on the arguments and problems identified, the authors will seek to answer the following research questions (RQ):

RQ_1. What is the cybersecurity and business knowledge base and its intellectual structure?

RQ_2. What is the cybersecurity and business research front?

As a methodology, the authors perform a bibliometric review through scientific mapping and performance analysis (Cobo *et al.*, 2011a). The research uses the Web of Science (WoS) database and Bibliometrix software (Aria & Cuccurullo, 2017) to analyze 410 articles and 1,355 authors on nine bibliometric indicators over 20 years. The research aims to assist academics, policymakers, and business decision-makers with cybersecurity management. This research is novel in proposing a bibliometric review of cybersecurity and business since the other studies addressed specific sectors and do not allow for an integrated vision of information on these two topics.

The main results reveal an upward publication trend with an annual growth of 27.63%. The United States of America (USA) has the highest scientific production, followed by the United Kingdom (UK) and China. As the main theoretical contribution, the study advances the frontier of knowledge by filling the identified knowledge gaps. On a practical level, the study can improve the analysis of academics, policymakers, and decision-makers in companies on safety management. The study presents future lines of research on cybersecurity and business, such as developing models and algorithms to reduce uncertainty. This manuscript is organized into seven parts. Section 2 presents the theoretical background. Section 3 explains the methodology. Section 4 presents the results. Section 5 details the discussion. Section 6 presents the limitations and future research. Section 7 indicates the study's conclusions, followed by the references used.

2. THEORETICAL BACKGROUND

A business is any organization involved in commercial, industrial, or professional activities, whether for profit or to fulfill a charitable or social mission (Hayes, 2020). This term also includes the efforts of individuals to produce and sell goods and services. Businesses can vary in size, and various fields of study are dedicated to understanding business administration (Hayes, 2020). Given the pressing and growing importance of cybersecurity and business concerns, it is imperative to conduct research in this field.

Cybersecurity is a crucial risk for any company due to the exponential increase in occurrences (Bresniker *et al.*, 2019) and sophistication of attacks (Abeshu & Chilamkurti, 2018). It refers to a set of methods, protocols, and tools to protect computer networks, software, data, and devices from unauthorized access, damage, or attacks (Boyson, 2014). Researchers warn of the emergence of organized, prepared, and persistent groups that attack companies for financial gain (Ahmad *et al.*, 2021). During the COVID-19 pandemic, cybercrime, such as fraud, increased above expected levels (Kemp *et al.*, 2021). These cyber-attacks lead to negative consequences for organizations, such as loss of productivity, lack of customer confidence, and legal penalties (Ahmad *et al.*, 2021). In addition, cyber risk can affect brand reputation, competitiveness, financial value, and business sustainability (Ngoc Thach *et al.*, 2021).

Other researchers advise that business and financial risk can impact the Sustainable Development Goals (SDGs) (Marti & Cervelló-Royo, 2023). In this direction, investment strategies for cybersecurity, disruptive technologies, and robotics can promote the SDGs without sacrificing business returns (Naffa & Fain, 2020). On the other hand, some authors point out that the increasing availability of the Internet has changed work and leisure activities by facilitating access to information and communication (Kemp *et al.*, 2021). However, criminals spend more time on online crimes, such as cyber fraud (Kemp *et al.*, 2021). Also, using the Internet in various sectors exposed companies more to cyber risks (Rashid *et al.*, 2021). For example, the number of cybercrime cases is steadily increasing in online e-banking (Ngoc Thach *et al.*, 2021). Healthcare organizations are also vulnerable to cyber threats, which can compromise data integrity and affect medical devices' functionality (Jalali *et al.*, 2019). Other researchers have identified that digital technology has transformed the healthcare sector by providing easy access to medical knowledge resources and improving clinical support and patient care. However, the use of technology in healthcare has raised concerns about privacy and security (Paul *et al.*, 2023). Table 1 presents an analytical summary of the leading publications.

Table 1
Analytical summary of the leading publications

Author(s)	Topic/Methods/Industry	Main contributions	Gaps/Suggestions for future research
Abeshu & Chilamkurti (2018)	Cyber-attacks/ Model development and comparison/ IoT and cloud computing	The study makes a notable contribution by introducing a deep learning method to enhance the detection of cyber-attacks within cloud-to-things computing. It tackles the shortcomings of conventional approaches and utilizes deep learning's strengths to bolster security in decentralized IoT settings.	Using deep learning in fog-to-things computing to detect distributed attacks demonstrates potential, yet notable gaps must be filled. Subsequent research should prioritize increasing model scalability, merging with edge computing, refining detection accuracy, and reducing false alarm rates to unlock deep learning's capabilities in this field fully.
Bresniker *et al.* (2019)	Threat detection/ Case study analysis/ Industry, academia, and government	The article urges a unified international initiative to utilize Artificial Intelligence (AI) and Machine Learning (ML) technologies in cybersecurity, highlighting their ability to revolutionize threat detection and response methods.	To maximize AI and MI's potential in cybersecurity, it is crucial to tackle collaboration, scalability, and data quality issues. Upcoming research should concentrate on building international partnerships, creating sophisticated threat detection models, and considering ethical aspects to establish strong and efficient cybersecurity solutions.
Jalali *et al.* (2019)	Healthcare cybersecurity/ Systematic Review/ Health Care	The document highlights a focus on technology-driven research in healthcare cybersecurity, noting significant gaps in nontechnological and physical security studies. It calls for more comprehensive investigations in these areas to enhance healthcare systems' overall security and safety.	The evaluation highlights the importance of expanding research efforts to incorporate non-technological elements and physical security within healthcare cybersecurity. Tackling these shortcomings can result in more robust and well-rounded cybersecurity approaches that improve the safety and dependability of healthcare delivery systems.
Naffa *et al.* (2020)	Cybersecurity/ Survey and data analysis/ Business context	The research indicates that investments focused on ESG megatrends can coincide with sustainability objectives without compromising financial returns, even though transaction expenses may affect net gains. This reinforces the potential of ESG investments to advance the SDGs while still achieving competitive performance.	Future studies should examine cost reduction's impact on long-term performance and incorporate recent data to identify trends. Addressing these gaps could enhance our understanding of the relationship between these investments, financial performance, and sustainability goals.
Bhamare *et al.* (2020)	Intrusion detection system/ Comprehensive Review/ Industrial	The article emphasizes improved cybersecurity for industrial control systems connecting with IT networks. It underscores the role of machine learning in developing strategies to safeguard industrial operations and critical infrastructures from emerging cyber threats.	The paper notes deficiencies in cybersecurity for Industrial Control Systems (ICS) in cloud environments and recommends future research on secure integration, advanced machine learning, and standardized security protocols.
Kemp *et al.* (2021)	Cybercrime/ Time-series analysis study/ Business context	The research emphasizes the necessity of flexible approaches to tackle cybercrime, particularly during major societal shifts such as the COVID-19 pandemic. It stresses the significance of recognizing the varied effects on different types of fraud and victim groups to address and reduce these crimes effectively.	Subsequent studies should focus on the diversity in victim experiences, investigate long-term effects, and conduct international comparisons to improve understanding and guide policy and practice.
Ahmad *et al.* (2021)	Situation awareness/ Case study analysis/ Business context	The research emphasizes how organizations can enhance situational awareness through management strategies. It highlights the need to understand the cyber-threat landscape and business context, which can significantly improve incident response.	Upcoming research should focus on filling these gaps by creating holistic models incorporating diverse viewpoints and improving communication and cooperation among different organizational areas.
NGOC Thach *et al.* (2021)	Cybersecurity risk management/ Case study analysis/ Banking	The study concludes that incorporating Industry 4.0 technologies in Vietnam's banking sector requires improved technology quality management and cybersecurity risks. The capacity to quickly respond to unexpected changes is vital for reducing cybersecurity threats and guaranteeing banking operations' secure and effective functioning.	The research highlights the significance of incorporating cutting-edge technologies in the banking sector while addressing cybersecurity threats. Nevertheless, more in-depth studies on risk evaluation, adaptation approaches, and the creation of customized cybersecurity frameworks are needed to assist the banking industry in Vietnam and comparable emerging economies more effectively.

Author(s)	Topic/Methods/Industry	Main contributions	Gaps/Suggestions for future research
Rashid *et al.* (2021)	Cybersecurity information sharing/ Model development and simulation analysis/ Business context	The document outlines an economic model that improves value creation and distribution in the cybersecurity information-sharing ecosystem. It highlights the critical role of end users in value generation and offers insights for business strategy and sustainability, particularly in cloud and edge computing.	The study highlights significant shortcomings in the sustainability of the cybersecurity information-sharing environment, especially within crowded markets, and emphasizes the importance of fair value allocation among all parties involved. Upcoming research should aim to create sustainable business models and investigate the incorporation of new technologies to improve the efficacy and robustness of the ecosystem.
Kappelman *et al.* (2022)	Cybersecurity/ Survey and data analysis/ Information technology	The research emphasizes a transition towards purposeful investments in IT and the increasing significance of cybersecurity and data analytics. It also points out the difficulties in recruiting qualified IT personnel and the changing responsibilities of CIOs in organizational leadership.	These studies indicate that upcoming research needs to tackle deficiencies in IT management areas, including Cybersecurity, Alignment, Analytics, Digital Transformation, and Compliance, as well as the difficulties in locating qualified experts in Cybersecurity, Analytics, AI, Functional Knowledge, and Cloud.
Manuel *et al.* (2022)	Cyber threats/ Model development and comparison/ Corporate and Public Sector	CyberTOMP plays a vital role in the industry by providing a practical, immediately applicable framework that improves the efficiency of cybersecurity management at both the tactical and operational tiers. It tackles the deficiencies found in existing high-level standards.	The CyberTOMP framework fills critical vulnerabilities in cybersecurity management by offering comprehensive procedural components for tactical and operational tiers. Subsequent studies aim to improve these methodologies, ensuring they are flexible and incorporated with overarching frameworks to efficiently handle cybersecurity in an ever-changing landscape.
Tagarev *et al.* (2022)	Cybersecurity networks/ Survey and data analysis/ Cybersecurity industry	The study emphasizes that strong governance and organizational frameworks are essential for effective collaborative cybersecurity networks. It identifies key business and governance models that can support these networks, particularly European Union initiatives.	The study points out gaps in skills and collaboration for effective cybersecurity networks. Future research should focus on governance structures and cross-industry collaboration to enhance cybersecurity efforts.
Kosmowski *et al.* (2022)	Cyber threats/ Integrated Evaluation Approach within a BCM/ Energy	The document presents a framework for integrating functional safety and cybersecurity assessments into business continuity management for energy companies using Industry 4.0 technologies. Focusing on prevention and recovery aims to mitigate cyber threat risks and enhance operational resilience.	Integrating functional safety and cybersecurity into a BCM framework is vital for protecting energy companies from cyber threats. Key gaps include better evaluation methods, standardization, and ongoing risk assessment. Future research should focus on developing integrated frameworks, secure communication protocols, real-time monitoring systems, and cross-industry collaboration.
Marti & Cervelló-Royo (2023)	Country risk/ Cluster analysis/ Countries	The paper presents a novel Sustainable Development Goal (SDG) achievement analysis based on the 2030 Agenda and its relationship with country risk, differentiating countries by income levels. The authors applied the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS).	The study identifies limitations for future research, including the unclear relationship between country risk indicators and specific SDGs and data gaps in SDG scores that may overlook transboundary impacts. It stresses the importance of analyzing the evolution of SDGs and country risk indicators over time and updating indices to account for changes in country performance due to political leadership.
Paul *et al.* (2023)	Security and privacy issues/ Case study analysis/ Health Care	This article contributes by examining how digital technologies affect the healthcare sector and exploring the security and privacy issues related to digitalization in healthcare.	Future studies should focus on privacy and security regulations in healthcare, the impact of digitalization on patient outcomes, and the risks associated with wearable devices. Additional research opportunities include the role of artificial intelligence, the effects of blockchain technology, and patient involvement in privacy and security issues.

Author(s)	Topic/Methods/Industry	Main contributions	Gaps/Suggestions for future research
Javaheri *et al.* (2023)	Cyber-attacks/ Systematic survey/ Private companies, enterprises, and government agencies	The document discusses the complexities of cybersecurity, focusing on vulnerabilities to DDoS attacks that lead to financial and reputational harm. It reviews DDoS attacks and proposes a framework for understanding them, highlighting effective defense strategies such as fuzzy-based detection techniques to improve intrusion detection systems.	The paper emphasizes challenges in fuzzy anomaly detection due to large datasets and high dimensionality, calling for more research in feature selection, online training, and incremental learning for DDoS detection. It also highlights the need for standardized, updated datasets with real network traces to evaluate emerging security attacks better.
Corallo *et al.* (2023)	Cybersecurity issues in Industry 4.0/ Single case study with multiple units of analysis/ Aeronautical	The document evaluates cybersecurity issues in Industry 4.0, providing insights for researchers and businesses. By using impact assessment methodology, companies can improve the security of critical manufacturing data and mitigate cyber-attack risks in innovative manufacturing environments.	The document highlights cybersecurity challenges in manufacturing systems 4.0, especially in the aeronautical sector, and suggests that broader research across various sectors and strategies could improve threat management in advanced manufacturing.

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Risks arise when companies adopt Industry 4.0 technologies in the industrial sector (Kosmowski *et al.*, 2022), as computer systems remain highly vulnerable to various types of distributed denial of service (DDoS) attacks (Javaheri *et al.*, 2023). The lack of adequate security in new multi-cloud platforms can cause high costs associated with security breaches in real-time industrial platforms (Bhamare *et al.*, 2020) and introduce new challenges in cybersecurity, such as identifying critical assets to protect against cyberattacks and evaluating commercial impacts (Corallo *et al.*, 2023). Cloud computing for Industrial Control Systems (ICS), present in industrial sectors and critical infrastructures, shows advantages such as scalability, cost-effectiveness, and flexibility (Bhamare *et al.*, 2020). However, by moving to the cloud, ICSs may become exposed to new threats and vulnerabilities (Bhamare *et al.*, 2020). Other researchers associated potential security issues with using open systems and networks for communication and control (Kosmowski *et al.*, 2022). To address these drawbacks and achieve an adequate level of cybersecurity, technological solutions, such as antivirus software, firewalls, intrusion detection systems, virtual private networks, access control systems, and content filters, need more advanced and collaborative approaches (Rashid *et al.*, 2021).

Moreover, critical infrastructures such as nuclear and thermal power plants, water treatment facilities, heavy industries, and distribution systems may expose new threats and vulnerabilities (Bhamare *et al.*, 2020). Cyber-attack problems may also disrupt the energy sector, such as industrial energy companies, power plants, and distributed renewable energy plants (Kosmowski *et al.*, 2022). For these reasons, cybersecurity is a growing concern for most organizations (Kappelman *et al.*, 2022).

A lack of investment in cybersecurity impacts increased risks, economic costs of incidents, societal losses, and reduced levels of individual and national security (Rashid *et al.*, 2021). Therefore, organizations need to invest in cybersecurity to adapt quickly and effectively and improve the quality of technology management (Ngoc Thach *et al.*, 2021). In this direction, information technology (IT) spending levels return from Covid-induced peaks in 2020 (Kappelman *et al.*, 2022). Managers also need to understand how organizations can protect against sophisticated and persistent cyberattacks; this is a significant challenge for research and practice (Ahmad *et al.*, 2021). In addition, the industrial sector needs to understand the risks posed by potential cyberattacks when adopting Industry 4.0 technologies (Kosmowski *et al.*, 2022). However, the different cybersecurity reference models are not directly applicable to lower levels due to the lack of specific procedural details. Therefore, organizations need a methodological basis to manage cybersecurity at these levels (Manuel *et al.*, 2022). For other researchers, an effective response to advanced cyber threats requires investment in greater awareness, trained personnel, and cutting-edge technology (Tagarev *et al.*, 2022). However, only a few companies have the resources to offer comprehensive solutions and maintain high technological expertise. The same study highlights a possible solution for creating a network of cybersecurity competence centers (Tagarev *et al.*, 2022).

In summary, the articles analyzed reveal the importance of understanding and protecting against cyberattacks, the challenges in applying reference models in cybersecurity, and the need for a methodological basis for organizations.

3. METHODOLOGY

Bibliometrics involves using quantitative methods to study bibliographic material in library and information sciences (Pritchard, 1969; Broadus, 1987). Eugene Garfield created this research discipline in 1955 (Garfield, 1955), and it is a widely used approach to summarizing key findings from a collection of bibliographic documents (Martínez-López *et al.*, 2018). The bibliometric review follows a combined approach (Noyons *et al.*, 1999) with scientific mapping and performance analysis in this research. Scientific mapping seeks to construct bibliometric visualizations showcasing the conceptual, intellectual, and social structure of specific disciplines, scientific domains, or research fields (Cobo *et al.*, 2011b). On the other hand, performance analysis shows the evaluation of groups of scientists and the impact of their activity on the bibliographic database (Cobo *et al.*, 2011a). The authors use a five-stage structured workflow to perform the bibliometric review (Zupic & Čater, 2015). Figure 1 presents the workflow applied in this paper.

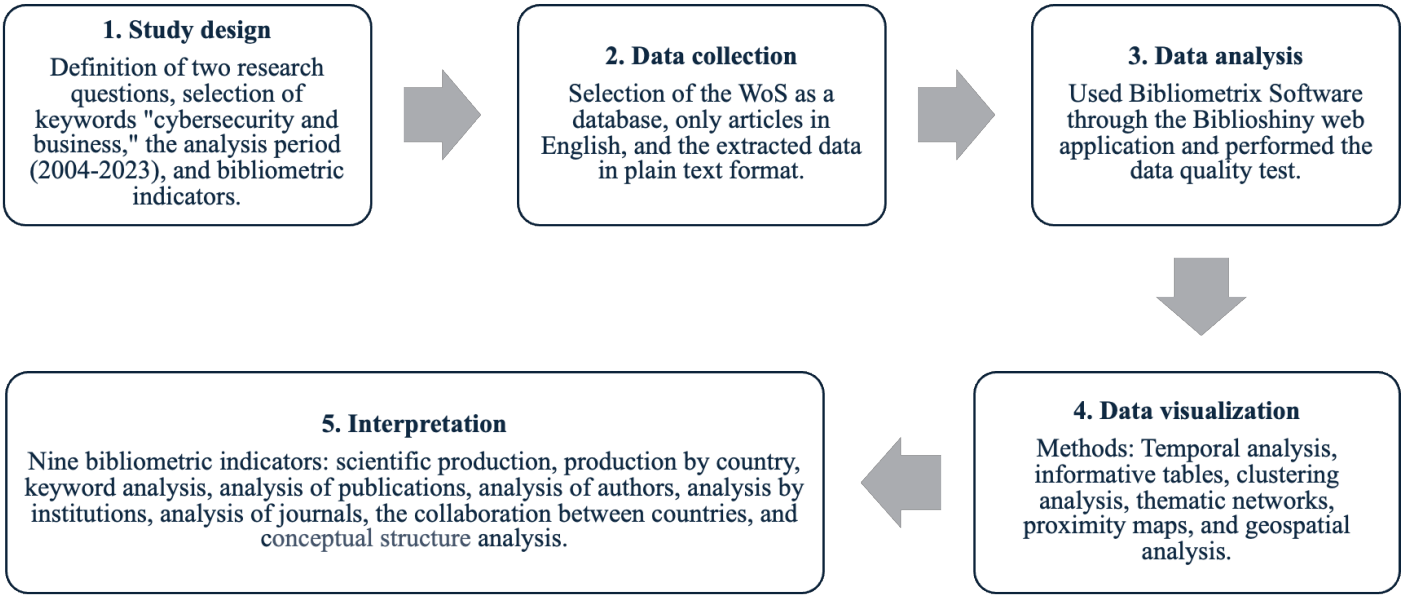

Figure 1
Methodology workflow applied in this paper
Source: Own elaboration based on Zupic and Čater (2015).

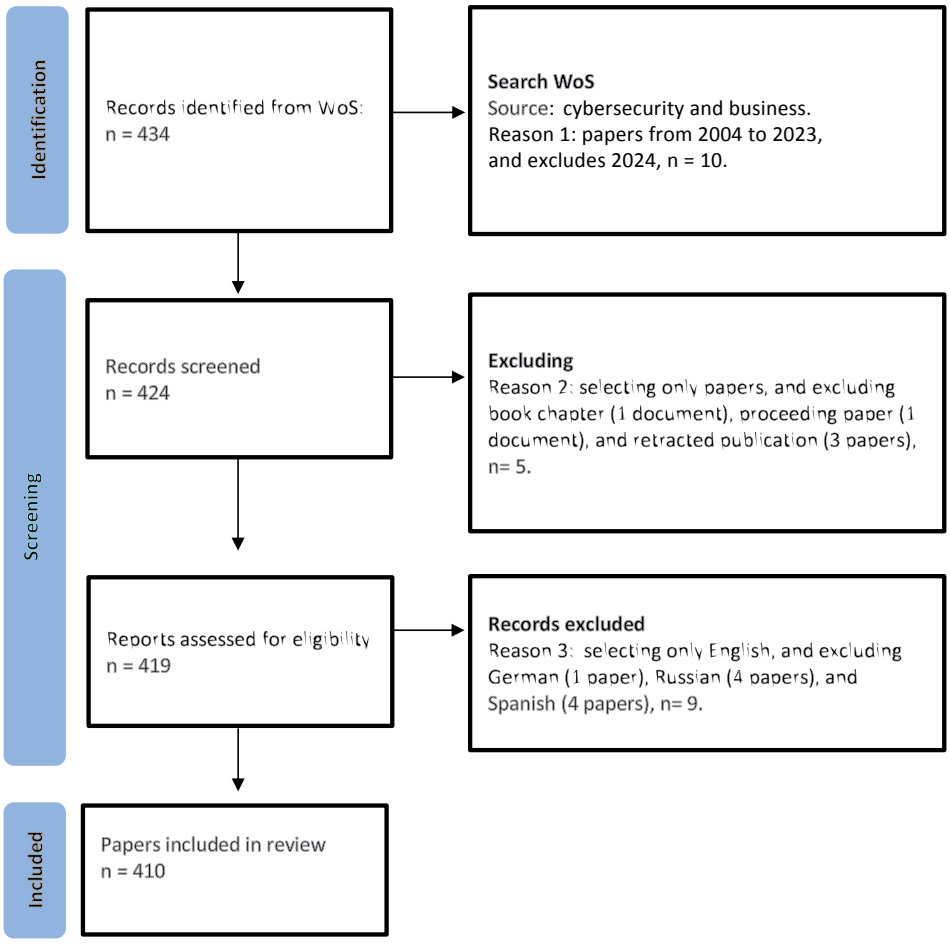

Figure 2
The PRISMA flowchart via WoS
Source: Own elaboration based on Page *et al.* (2021).

The first stage consists of the study's design, which includes the research questions presented in the introduction, the selection of keywords, the definition of the period of analysis and the bibliometric indicators (Pedraja-Rejas *et al.*, 2022). The selection of keywords helps to determine the study sample (Blanco-Mesa *et al.*, 2019), and the authors searched with 14 words organized into two sets of topics. The first set includes cybersecurity, cyber security, cyber-attacks, cyber risks, cyber fraud, cybercrime, and cyber threats. The second set covers business, enterprise, entrepreneurship, organizations, firms, industry, and business sustainability. As a result, the authors verified that the keywords in the topic section are "cybersecurity" AND "business" and represent the central themes of the research. The authors conducted a longitudinal study between 2004 and 2023, covering 20 years. Before this period, no articles were published with the keywords "cybersecurity" AND "business". The authors then choose nine indicators: scientific production, production by country, keyword analysis, publication analysis, author analysis, institution analysis, journal analysis, cross-country collaboration, and conceptual structure analysis. Bibliometric indicators can assist in understanding the caliber of academic work being assessed and in making an assessment, thus serving as a tool for evaluating research (Moed, 2005).

The second stage is for data collection, and the authors select the Web of Science (WoS) database. For some researchers WoS is preferable to other databases regarding data quality. For example, the reference elements in Scopus must be standardized and combined. On the other hand, in Dimensions, the algorithm that classifies the search areas could be more efficient (Aria & Cuccurullo, 2017). The authors use the keywords "cybersecurity" and "business" from 2004 to 2023 and excludes 2024. This gives a total of 424 papers. A filter is applied to focus specifically on research contributions by selecting only papers and excluding book chapters, proceeding papers, and retracted publications. This refines the results to 419 papers. An additional filter is applied for languages by selecting only English and excluding German, Russian, and Spanish. This refines the results to 410 papers, which will be used to create tables and figures with WoS. It is worth noting that the Prisma flowchart in Figure 2 can also be generated with WoS.

Data were extracted from WoS from May 1st, 2024, in plain text format. This format is preferable to others, as the BibTeX format of Scopus and the CSV format of Dimensions do not allow exporting some metadata (Aria & Cuccurullo, 2017). Table 2 provides a comprehensive overview of our meticulous data collection process. The key findings reveal 410 articles, demonstrating a robust 27.63% annual growth rate. We also identified 1,540 author keywords, 1,355 authors, and a 31.46% international co-authorship. These findings underscore the academic interest in this topic and highlight this research's global reach and collaborative nature.

The third stage is devoted to data analysis, and the authors employ the Bibliometrix software through the Biblioshiny web application to analyze the articles. The authors preferred this software tool, as other specialized tools usually perform only some steps of the scientific mapping analysis (Aria & Cuccurullo, 2017). Researchers used Bibliometrix and Biblioshiny to identify the most impactful studies on customer churn and map their field's conceptual and intellectual structure (Ribeiro *et al.*, 2022). Other researchers used this software to understand the impact of the informal economy and digital platforms (Silva & Moreira, 2022). This open-source tool allows a complete analysis of scientific literature mapping. In addition, it is a friendly tool for non-programmers, facilitating the application of this type of study by other scholars in their field of research.

After finishing the database loading, the authors performed a data quality test in Bibliometrix. The results showed that the metadata does not present critical problems, and most indicators are at excellent and good levels. Thus, the authors proceed with the data analysis.

Table 2
Data collection results

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2004:2023
Sources (Journals, Books, etc.)	251
Documents	410
Annual Growth Rate %	27.63
Document Average Age	3.1
Average citations per doc	12.64
References	21231
DOCUMENT CONTENTS	
Keywords Plus (ID)	564
Author's Keywords (DE)	1540
AUTHORS	
Authors	1355
Authors of single-authored docs	62
AUTHORS COLLABORATION	
Single-authored docs	66
Co-Authors per Doc	3.54
International co-authorships %	31.46
DOCUMENT TYPES	
article	410

Note: DE (the frequency distribution of authors' keywords); ID (the frequency distribution of keywords associated to the manuscript by Thomson Reuters' ISI Web of Knowledge database).

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

The fourth stage of our study is dedicated to data visualization, a crucial step in presenting our findings clearly and meaningfully. Bibliometric networks can be visualized or modelled graphically (Aria & Cuccurullo, 2017). The networkPlot function, which can display a network generated by biblioNetwork using R routines or VOS viewer software (van Eck & Waltman, 2010), is particularly useful in this context. The authors employed diverse methods, including temporal analysis, informative tables, clustering analysis, thematic networks, proximity maps, and geospatial analysis (Aria & Cuccurullo, 2017). Each technique was carefully chosen to represent the data best and enhance understanding. The final stage involves data interpretation, where we delve deeper into the results of our bibliometric review, offering valuable insights and implications.

4. RESULTS OF THE BIBLIOMETRIC REVIEW

4.1. Scientific production

Scientific production is a crucial indicator of research output, reflecting academics' efforts to push the boundaries of knowledge and address societal needs (Barcellos-Paula *et al.*, 2022). Table 2 reveals that scientific production is concentrated in the last five years (2019-2013), representing 90.45% of the 859 publications. This result indicates the novelty of the topic and its emerging significance, as it is being investigated more strongly in the countries, reinforcing this study's importance. Also, the results show that this topic is relevant to academia, and studies in this field are expanding due to the advancement of technology in business sectors (Paul *et al.*, 2023).

4.2. Production by countries

This indicator reveals that the USA leads this ranking with 270 publications, followed by the UK with 98 publications and China with 52. Table 3 reflects the current state of research in the intersection of cybersecurity and business, with the USA maintaining a significant lead, the UK showing steady growth, and China emerging as a strong contender.

Other relevant data shows that the USA was the pioneer country, with the first publication on cybersecurity and business in 2004. Between 2009 and 2013, there were seven publications, increasing to 39 publications from 2014 to 2018. Finally, in 2019-2023, 223 publications were registered from USA, further underlining the growing importance of this research area.

Table 3
Top 20 - Production by countries

Countries	D1	D2	D3	D4	TP
USA	1	7	39	223	270
UK	0	0	11	87	98
China	0	0	1	51	52
Australia	0	0	8	40	48
Saudi Arabia	0	0	0	41	41
Italy	0	0	8	32	40
Spain	0	0	2	37	39
Ukraine	0	0	0	33	33
India	0	0	0	28	28
Malaysia	0	0	1	27	28
South Korea	0	0	1	24	25
Germany	0	0	0	22	22
Poland	0	0	0	22	22
Canada	0	0	2	18	20
Pakistan	0	0	0	19	19
Russia	0	0	0	19	19
Greece	0	0	0	18	18
Netherlands	0	0	0	13	13
Sweden	0	0	0	13	13
France	0	0	1	10	11
Total	1	7	74	777	859
%	0.12%	0.81%	8.61%	90.45%	100%

Abbreviations: D1=2004-2008; D2=2009-2013; D3=2014-2018; D4=2019-2023; TP = total publications; % = percentage of publications.

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

4.3. Keywords analysis

This indicator has a simple word count based on the keywords plus (Aria & Cuccurullo, 2017). The research uses the word cloud method to analyze keywords, with the word size representing the number of occurrences. Figure 3 shows that the most frequent words are security, internet, and impact.

Figure 3
Word cloud "cybersecurity" and "business"

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Table 4
Top 20 - Most frequent words

Words	D1	D2	D3	D4	TO
security	0	0	3	32	35
internet	0	0	1	28	29
impact	0	0	0	25	25
systems	0	0	0	24	24
cybersecurity	0	1	1	21	23
model	0	0	2	21	23
framework	0	0	4	16	20
business	0	0	0	16	16
challenges	0	0	0	16	16
information	0	0	0	16	16
management	0	0	1	14	15
things	0	0	1	14	15
information security	0	0	2	11	13
technology	0	0	0	12	12
risk	0	0	0	11	11
information-technology	0	0	0	10	10
innovation	0	0	0	10	10
privacy	0	0	0	10	10
attacks	0	0	2	7	9
behavior	0	0	0	9	9
Total	0	1	17	323	341
%	0%	0.29%	4.99%	94.72%	100%

Abbreviations: D1=2004-2008; D2=2009-2013; D3=2014-2018; D4=2019-2023; TO = total occurrences. % = percentage of occurrences.

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Table 4 presents a list of the 20 most frequent words. The results reveals that 94.72% of the words have occurred in the last five years (2019-2023) and shows that the first position is security, with 35 occurrences; internet, with 29; and impact, with 25. This outcome reinforces that the word "security" is more consolidated and present in most publications. On the other hand, business is in eighth position among the most used words, indicating a research

opportunity in this study area. In 2023, the trending topics were information, innovation, and trust, reflecting the evolving research landscape at the intersection of cybersecurity and business.

4.4. Analysis of publications

This subsection analyzes the most cited papers by considering the number of times each manuscript has been cited (TC), the average annual number of times each manuscript has been cited (TC per year), and the overall normalized citation count (normalized TC). The normalized TC is calculated by dividing the actual count of cited items by the expected citation index for papers with the same year of publication (Aria & Cuccurullo, 2017). Table 5 presents a list of the 20 most cited papers. The results indicate that the first place goes to Babiceanu and Seker (2016) with 285 citations, followed by Nishant *et al.* (2020) with 207 citations, and in third place Abeshu and Chilamkurti (2018), with 185 citations. The main articles are listed below.

Table 5
Most globally cited documents

Author-year	Journal	TC	TCY	NTC
(Babiceanu & Seker, 2016)	Comput Ind	285	31.67	5.09
(Nishant *et al.*, 2020)	Int J Inform Manage	207	41.40	10.90
(Abeshu & Chilamkurti, 2018)	IEEE Commun Mag	185	26.43	4.75
(Al-rimy *et al.*, 2018)	Comput Secur	169	24.14	4.34
(Knowles *et al.*, 2015)	Int J Crit Infr Prot	160	16.00	2.86
(Ghobakhloo, 2020)	Int J Prod Res	123	24.60	6.48
(Shah, 2020)	Pain Physician	119	23.80	6.27
(Leng *et al.*, 2021)	IEEE T Syst Man Cy-S	114	28.50	8.83
(Li *et al.*, 2019)	Int J Inform Manage	111	18.50	6.31
(Corallo *et al.*, 2020)	Comput Ind	107	21.40	5.64
(Bhamare *et al.*, 2020)	Comput Secur	101	20.20	5.32
(Hasanova *et al.*, 2019)	Int J Netw Manag	73	12.17	4.15
(Gupta *et al.*, 2020)	Int J Inform Manage	66	13.20	3.48
(Boyson, 2014)	Technovation	60	5.45	1.88
(Kure *et al.*, 2018)	Appl Sci-Basel	59	8.43	1.51
(Asghar *et al.*, 2019)	Comput Netw	51	8.50	2.90
(Protogerou *et al.*, 2021)	Evol Syst-Ger	46	11.50	3.56
(Kappelman, Johnson, *et al.*, 2018)	Mis Q Exec	44	6.29	1.13
(Kemp *et al.*, 2021)	J Contemp Crim Just	42	10.50	3.25
(Mendhurwar & Mishra, 2021)	Enterp Inf Syst-Uk	41	10.25	3.18

Abbreviations: TC = total citations; TCY = total citations per year; NTC = normalized total citations.

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Babiceanu and Seker (2016) analyze the landscape and prospects of big data and virtualization manufacturing cyber-physical systems (CPS). They highlight the ability of these technologies to transform manufacturing operations by providing better connectivity, forecasting capabilities, and more effective decision-making while highlighting the urgent need for robust cybersecurity protocols. Nishant *et al.* (2020) examine how AI can aid sustainability, emphasizing its ability to bring about significant change and the obstacles that must be overcome. It establishes a research framework that promotes a comprehensive method, incorporating multiple fields to guarantee AI's responsible and sustainable use.

4.5. Analysis of authors

This indicator calculates and plots the production of the most relevant authors (number of publications and total citations per year) over time. Figure 4 shows the results. Kappelman, Maurer, and Torres lead with six publications.

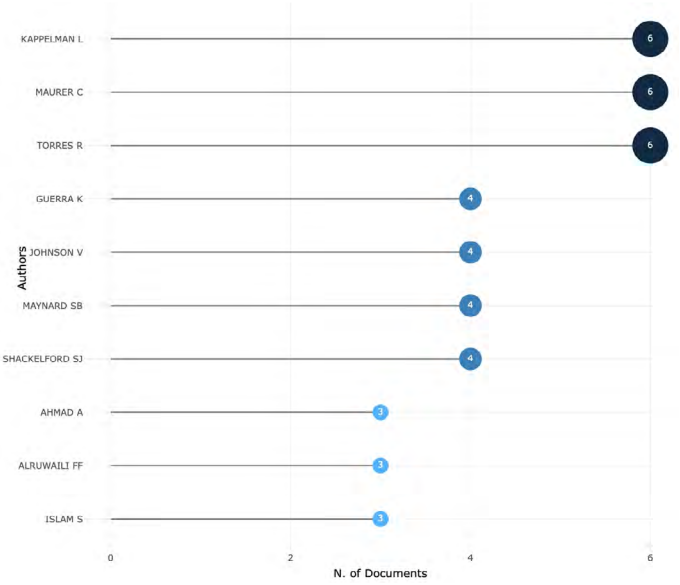

Figure 4
Most relevant authors

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Table 6 shows the production of the most relevant authors, including the year of publication, number of citations, and total citations per year. The most cited documents are Kappelman, Johnson, *et al.* (2018), Kappelman *et al.* (2019) and Kappelman, Torres, *et al.* (2018).

Table 6
Most relevant authors

Author-year	Document	TC	TCY
Kappelman *et al.* (2018)	The 2017 SIM IT issues and trends study	44	6.286
Kappelman *et al.* (2019)	A study of information systems issues, practices, and leadership in Europe	33	5.500
Kappelman *et al.* (2018)	The 2018 SIM IT issues and trends study	32	5.333
Kappelman *et al.* (2021)	The 2020 SIM IT issues and trends study	13	3.250
V. Johnson *et al.* (2023)	The 2022 SIM IT issues and trends study	3	1.500
Kappelman *et al.* (2022)	The 2021 SIM IT issues and trends study	3	1.000
Klaus *et al.* (2022)	Prioritizing IT management issues and business performance	1	0.333

Abbreviations: TC = total citations; TCY = total citations per year.

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Kappelman, Johnson, *et al.* (2018) state that in 2017, the primary recent IT expenditure was in Business Analytics, with Security, Cloud, Software Development, and ERP following closely behind. The most concerning IT management challenges for CIOs (Chief information officer) include Cybersecurity, IT Talent Shortage, alignment between business and IT, and Compliance and Regulation. IT executives' top concerns 2017 were alignment, digital transformation, cybersecurity, costs, and business agility (Kappelman, Johnson, *et al.*, 2018). The primary IT investments in 2018 were analytics, cybersecurity, cloud, software development and maintenance, and ERP (Kappelman, Torres, *et al.*, 2018). IT spending as a percentage of revenue has slightly increased, but it has remained similar to the 10-year average of 5.7%. The top concerns for IT management in 2022 are Cybersecurity, Alignment, Analytics, Compliance, and Digital Transformation. Significant IT investments include analytics, cybersecurity, cloud, application development, and enterprise resource planning (ERP) (Johnson *et al.*, 2023). Researchers found that companies prioritizing cybersecurity/privacy and IT-business alignment exhibit greater profitability than those not (Klaus *et al.*, 2022).

4.6. *Analysis by institutions*

The institutions are ranked based on scientific production and collaborative networks. Figure 5 shows Indiana University System is in first place with 19 publications, Indiana University Bloomington in second place with 18, and the State University System of Florida in third place with 15.

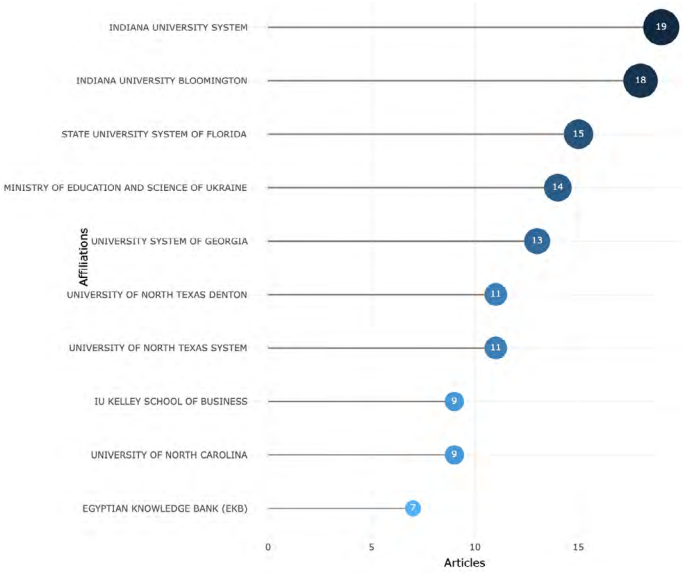

Figure 5
Most relevant affiliations
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Figure 6 presents a temporal analysis of the scientific production of the affiliations. In 2023, Indiana University System solidified its position as the leading institution in the intersection of cybersecurity and business. All affiliations grew in publication numbers, reflecting a competitive landscape and diverse research contributors.

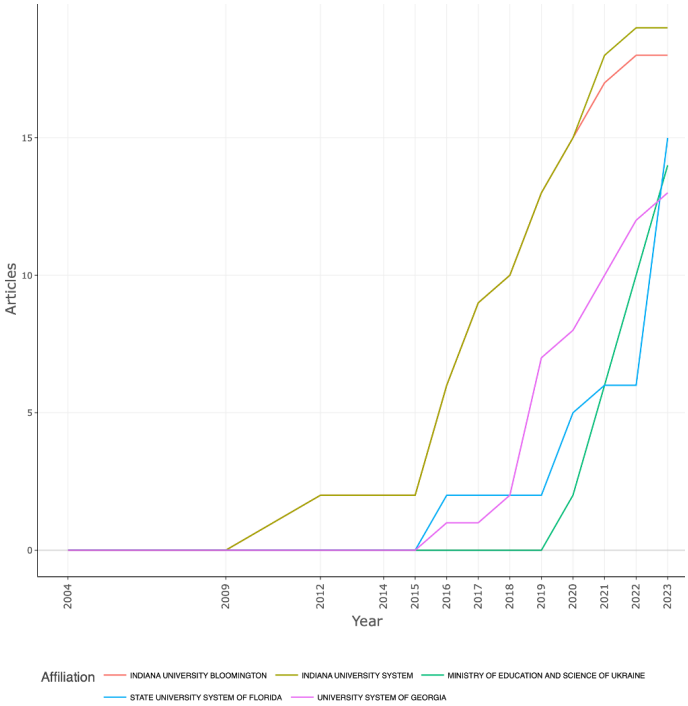

Figure 6
Scientific production of affiliations over time
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

4.7. *Analysis of journals*

This indicator is relevant as scientific journals are essential in disseminating knowledge (Barcellos-Paula *et al.*, 2022). Figure 7 shows an analysis of the most influential journals. Business Horizons and IEEE Access are tied for first place with 17 publications each, followed by Computers & Security with 15.

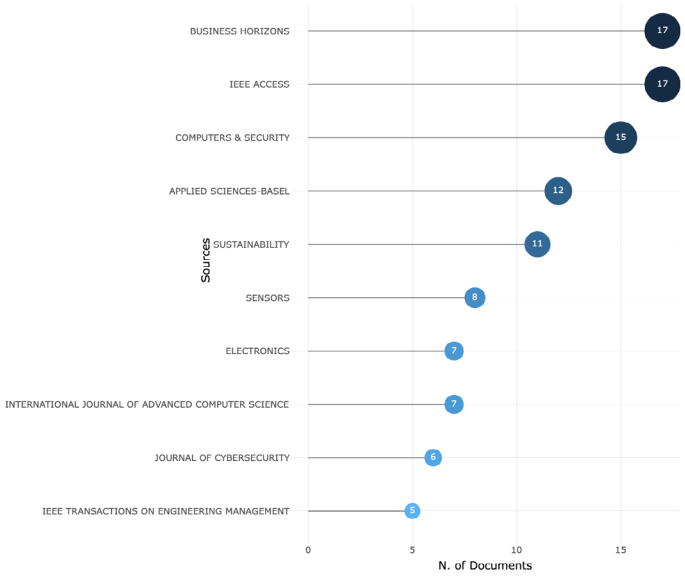

Figure 7
Most influential journals
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

4.8. Collaboration between countries

This indicator shows links between international scientific cooperation and knowledge dissemination globally. Figure 8 indicates that the USA leads worldwide collaborations with Australia, Canada, China, Saudi Arabia, and India. Notable collaborations include the UK, Spain, China, and Korea.

Figure 8
Collaboration between countries
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

4.9. Conceptual Structure Analysis

This subsection discusses two types of analysis based on conceptual structure. The first type uses a network approach with stages including thematic evolution, thematic map, and co-occurrence networks. The second type uses a factorial approach involving a map of words and a dendrogram of words.

4.9.1. Network Approach

Thematic evolution analysis

The first stage addresses the thematic evolution analysis based on co-word network analysis and clustering (Cobo *et al.*, 2011a). The thematic evolution is divided into more relevant periods between the research topics: 2004-2014, 2015-2018, and 2019-2023. Figure 9 display the thematic evolution.

Research from 2004-2014 focused on cybersecurity, including viewing information risk as a challenge and integrating risk analysis into business decisions (Johnson *et al.*, 2009). There was also research on "Supply Chain Cyber Risk Management", which merges cybersecurity, supply chain management, and enterprise risk management (Boyson, 2014).

During the second period (2015-2018), research focused on cybersecurity, risk management, cyberattacks, and cloud computing. For instance, Knowles *et al.* (2015) provide valuable insights by reviewing existing approaches to cybersecurity management in industrial control systems, pinpointing crucial deficiencies in security metrics, and suggesting avenues for future research. Additionally, it presents the idea of functional assurance to strengthen the resilience and security of industrial control systems. Babiceanu and Seker (2016) proposed a framework for designing predictive cyber-physical systems integrated with IoT and big data analytics to improve manufacturing operations and control. Another research presented a decision model for companies to evaluate investing in on-premises IT infrastructure instead of outsourcing IT services in a multi-cloud environment, aiming to reduce costs and security risks (Hosseini-Shirvani *et al.*, 2018).

Figure 9
Thematic evolution
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

The third period (2019-2023) focused on cybersecurity, machine learning, security, and blockchain. Hasanova *et al.* (2019) researched blockchain cybersecurity vulnerabilities and suggests countermeasures. Blockchain technology has broad applications beyond cryptocurrencies, using peer-to-peer networks and distributed systems to store transactions in linked blocks. Despite being considered secure, it has faced successful cyber-attacks (Hasanova *et al.*, 2019). Nishant *et al.* (2020) suggested that AI can revolutionize companies and address sustainability issues. Organizations can reduce natural resources and energy intensity, but challenges include over-reliance on historical data and uncertain human behavior. Future research must consider multiple factors to demonstrate immediate AI solutions without compromising environmental sustainability (Nishant *et al.*, 2020). In 2022, a study highlighted security vulnerabilities in IoT environments. The researchers proposed a multi-level DDoS mitigation approach using a device-based blockchain verification mechanism developed using Hyperledger Caliper (Hayat *et al.*, 2022). Finally, the research conducted by Corallo *et al.* (2023) demonstrates that the impact assessment methodology can assist companies in recognizing essential assets and evaluating the business implications of cybersecurity incidents in manufacturing systems 4.0.

Thematic map analysis

In the second stage, the thematic map analysis includes co-word analysis to extract clusters of keywords. The strategic diagram identifies four different types of topics based on their position in a quadrant: Motor themes (A), Basic topics (B), Peripheral topics (C), and Niche topics (D) (Aria & Cuccurullo, 2017). Figure 10 shows the results with nine clusters.

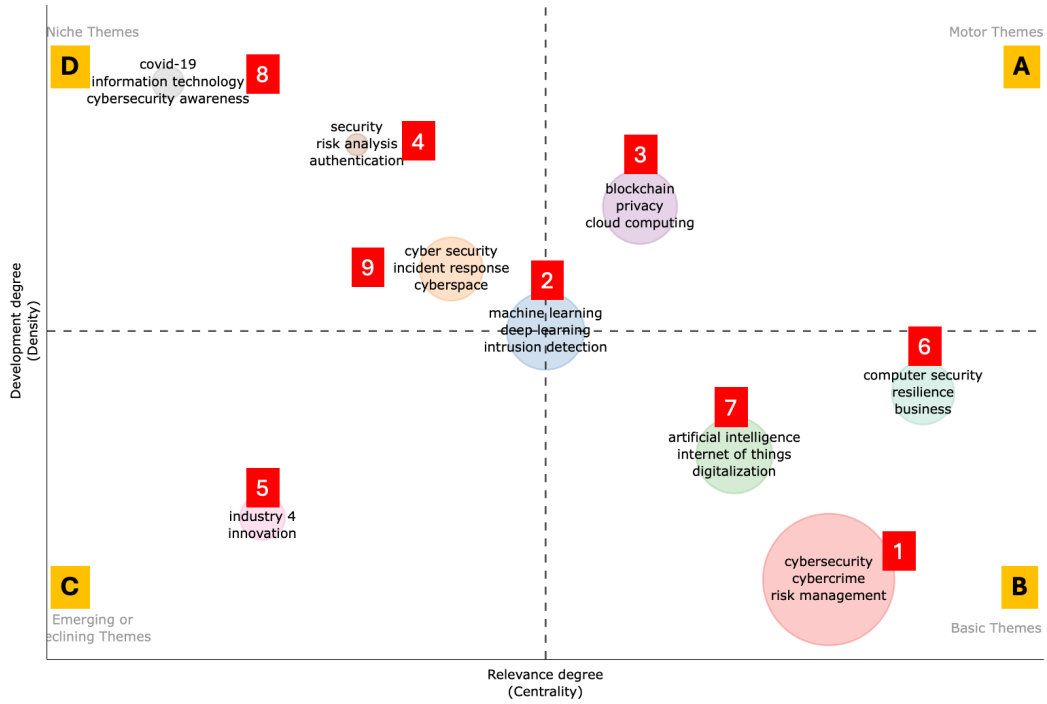

Figure 10
Thematic map

Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

In quadrant A, cluster 3 stands out, consisting of the driving topics of blockchain, privacy, and cloud computing. This result indicates that cluster 3 represents well-developed and meaningful concepts that form the domain's core framework. It is worth highlighting cluster 2, which consists of machine learning, deep learning, and intrusion detection, in the center of the diagram.

In quadrant B, cluster 1 stands out, consisting of cybersecurity, cybercrime, and risk management. We have highlighted some influential investigations in cybersecurity. The first research uses Cyber Threat Intelligence (CTI) and Machine Learning (ML) to predict cyber threats and improve supply chain security (Yeboah-Ofori *et al.*, 2021). The second paper examines the impact of cyber-attacks on companies and the role of cyber risk insurance (Shackelford, 2012). The third study introduces a decision-support framework for optimal cybersecurity investment (Tsiodra *et al.*, 2023). The fourth investigation provides a detailed analysis of a prominent financial institution with a well-established incident response capability developed from prior attack incidents (Ahmad *et al.*, 2021). The last paper discusses using blockchain technology for secure and transparent digital forensic investigations (Khan *et al.*, 2021). Cluster 7 stands out: artificial intelligence, the Internet of Things, and digitalization. Cluster 6 is also observed, consisting of computer security, resilience, and business. These results indicate that these topics are significant across different areas of the domain. On the other hand, in quadrant D, cluster 9 (cyber security, incident response, and

cyberspace), cluster 4 (security, risk analysis, and authentication), and cluster 8 (COVID-19, information technology, and cybersecurity awareness) stand out as niche topics, suggesting that they are strongly developed yet marginal within the studied domain. Finally, in quadrant C, cluster 5 stands out as an emerging or declining topic, consisting of industry 4.0 and innovation, indicating that they are not fully developed or only marginally relevant.

Co-occurrence network analysis

In the third stage, network analysis shows the connections between the author's keywords. This helps visualize links between words and identify different groupings. Each color represents a grouping, the node size represents occurrence, and the line thickness shows co-occurrence. Figure 11 displays co-occurrences.

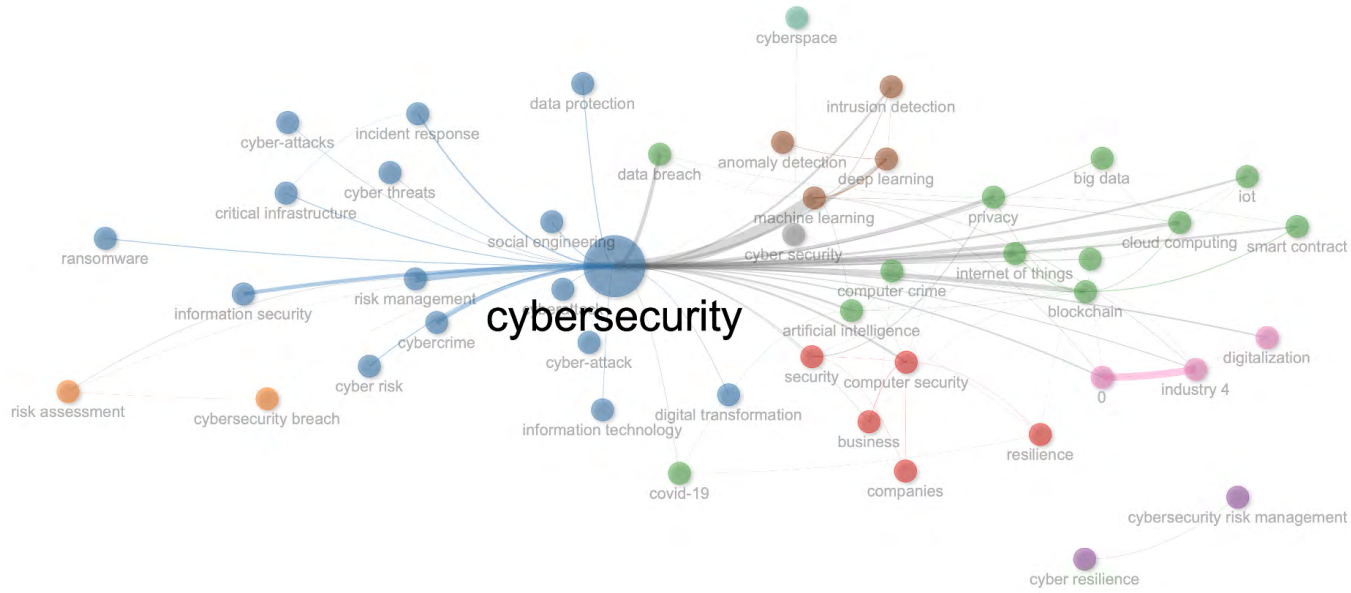

Figure 11
The co-occurrences between cybersecurity and business
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

The results show nine clusters. The cybersecurity cluster (blue) has 16 interconnected words, such as risk management and cybercrime. For instance, research seeks solutions to combat the increase in cyber-attacks in various parts of the world (Bresniker *et al.*, 2019), propose effective defensive strategies (Javaheri *et al.*, 2023), reduce uncertainty in the management process (Kosmowski *et al.*, 2022), and help improve business sustainability (Javaheri *et al.*, 2023).

The artificial intelligence cluster (green) has 12 interconnected words, including blockchain and the Internet of Things. The security cluster (red) has five interconnected words, such as computer security and business. This helps visualize the terms associated with cybersecurity and business, confirming the research's relevance.

4.9.2. Factorial analysis

Factorial analysis is a technique that helps understand the underlying structure of a framework by analyzing word associations within a network. It uses the R package Bibliometrix, which employs Multiple Correspondence Analysis (MCA) through the author's keywords to identify shared concepts and K-means clustering to group-related documents. MCA produces a concise representation of the original data by performing a homogeneity analysis of a matrix of indicators (Aria & Cuccurullo, 2017). The first outcomes of the factorial analysis are depicted in Figure 12.

The results are interpreted based on the relative positions of the points and their distribution along the four dimensions. Dimension 1 covers cybersecurity, cybercrime, risk management, and information security. For instance, as for Abeshu and Chilamkurti (2018), they reveal that traditional cryptographic solutions and machine learning-based attack detection mechanisms have limitations for IoT. For these reasons, they propose a distributed deep learning scheme to detect cyber-attacks in fog computing with higher accuracy, lower false alarm rates, and higher scalability than shallow models.

Dimension 2 encompasses machine learning, the Internet of Things, cloud computing, artificial intelligence, and blockchain. For example, Babiceanu and Seker (2016) review virtualization and cloud-based services for manufacturing systems and propose a framework for predictive manufacturing cyber-physical systems with Internet of Things and Big Data analytics capabilities. Nishant *et al.* (2020) highlight the potential of Artificial Intelligence (AI) to promote environmental governance. While AI can help reduce the use of natural resources, research on AI for sustainability faces challenges such as reliance on historical data, uncertain human behavior, cybersecurity risks, negative impacts, and measurement challenges.

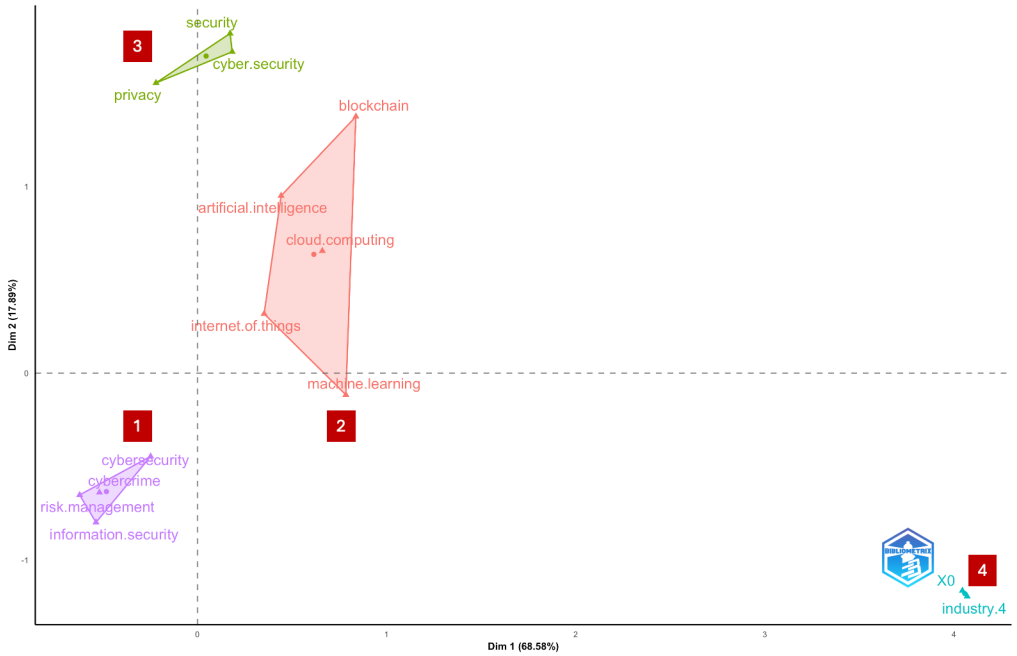

Figure 12
Conceptual structure map-method: MCA
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

Dimension 3 contains security, cyber security, and privacy. In addition, dimension 4 includes Industry 4.0. For instance, Leng *et al.* (2021) contribute to understanding blockchain's role in enhancing smart manufacturing by identifying key cybersecurity challenges and proposing metrics for effective implementation. It also sets a foundation for future research to address these challenges, promoting the secure and intelligent evolution of Industry 4.0. It should be noted that the map's origin represents the average position of all column profiles, and therefore, dimension 1 represents the center of the research field, confirming that cybersecurity and risk management are the most common and significant shared themes.

Additionally, Bibliometrix allows a correspondence and grouping analysis to be carried out through a dendrogram of words. This helps to understand the relationship between the topics and corroborates the findings of the conceptual structure map-method. Figure 13 shows the results.

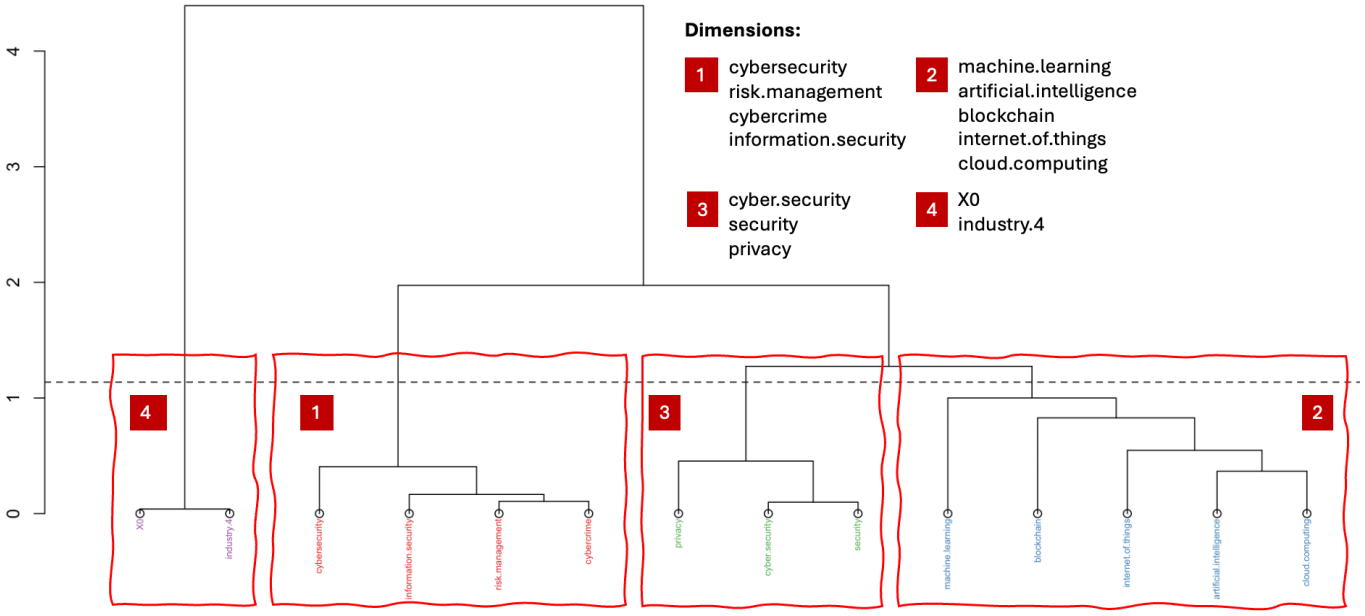

Figure 13
Dendrogram of words
Source: Own elaboration based on Aria and Cuccurullo (2017) and Clarivate (2023).

First, height measures the distance between words or groups of words. For this reason, the height of dimension 4 is more significant than 4.07, which confirms the distance from the other dimensions. For instance, a study found that robots and cybersecurity are the most used Industry 4.0 technologies worldwide, with different companies using them to increase efficiency or balance productivity with environmental sustainability. However, there is potential for more effective global adoption to drive sustainability-focused business models (Calabrese *et al.*, 2023).

Second, the height helps to choose where to cut the dendrogram that defines the partition. In this case, the dendrogram's height of 1.12 defines the four dimensions. Third, the distant words define a different concept or topic, and the dendrogram shows that the words of dimension 4 are more distant from dimension 2. Lastly, similar words explain a similar concept or topic, verified, for example, in dimension 3 (privacy, cyber security, and security), confirming the strong relationship between the three topics.

In summary, factor analysis helped understand the underlying structure of a framework by analyzing word associations within a network and reduced the complexity of the data by defining four dimensions. In this way, the results can help academics, policymakers, and business decision-makers in cybersecurity management.

5. DISCUSSION

This section discusses the main results of the bibliometric review on cybersecurity and business.

The study revealed an expressive growth in scientific production from 2018, and it shows the academic interest in these topics and the need to respond to a growing concern in most organizations (Kappelman *et al.*, 2022). The results also revealed "security" among the top ten most occurring words, which agrees with other researchers in recommending that companies in the energy sector should prepare for existing and emerging dangers and threats, including cyber-attacks (Kosmowski *et al.*, 2022). This outcome also responds to another study that showed that essential security vulnerabilities in IoT environments were worth highlighting (Hayat *et al.*, 2022).

The indicator of global trends over time revealed "information", "innovation", and "trust" as the main ones in 2023. This result converges with other authors who indicated that Industry 4.0 could be used more effectively globally despite its potential to drive business models focused on sustainability (Calabrese *et al.*, 2023). Furthermore, this finding responds to researchers who warned about the scarcity of applicable and detailed models at lower levels to manage cybersecurity (Manuel *et al.*, 2022). In this regard, the research proposes a model with a methodology to manage lower-level cybersecurity (Manuel *et al.*, 2022).

The bibliometric study has not only allowed us to identify the most cited articles, but also to uncover novel solutions for cybersecurity. For instance, research has proposed a unique framework for predictive manufacturing cyber-physical systems with IoT and Big Data analytics capabilities (Babiceanu & Seker, 2016). This finding is a direct response to concerns raised by other researchers about real-time security breaches in industrial platforms the need to identify critical assets for protection against cyberattacks (Bhamare *et al.*, 2020), and the evaluation of commercial impacts (Corallo *et al.*, 2023). Another study has underscored the potential of AI in promoting environmental governance (Nishant *et al.*, 2020), aligning with other research on reducing impacts on the Sustainable Development Goals (SDGs) (Marti & Cervelló-Royo, 2023). Lastly, researchers have suggested a distributed deep learning scheme for detecting cyberattacks in cloud computing, which offers higher accuracy and scalability than traditional methods (Abeshu & Chilamkurti, 2018). These findings directly address concerns raised by other authors about privacy and security in healthcare (Paul *et al.*, 2023).

The thematic evolution analysis showed that the relevance of the study theme coincides with the research in which the authors indicate that adopting artificial intelligence and machine learning applied to cybersecurity requires the global partnership of industry, academia, and public administration (Bresniker *et al.*, 2019). The analysis of the thematic map revealed that the driving topics are blockchain, privacy, and cloud computing, as well as machine learning, deep learning, and intrusion detection, which are at the center of the diagram. These results respond to researchers who indicated that to address the threat, and organizations must develop situational awareness in their incident response practices (Ahmad *et al.*, 2021). Also, the thematic map coincides with findings from another research that reveal that advances in cybersecurity depend on the involvement of industry, academia, and public administration (Bresniker *et al.*, 2019). Finally, the result confirms that one of the industrial sector's biggest challenges is understanding the risks posed by potential cyber-attacks (Kosmowski *et al.*, 2022). In summary, these results reduce the first knowledge gap on the need to generate awareness as an organizational response to incidents (Ahmad *et al.*, 2021) and understand the cyber risks they are exposed to (Kosmowski *et al.*, 2022).

The theoretical background indicated several causes and effects connected to cybersecurity and business. For example, one research mentioned that cyberattacks could generate a loss of productivity, a lack of customer trust, and legal sanctions (Ahmad *et al.*, 2021). Another research indicated that cybercrime cases constantly increase in online e-banking (Ngoc Thach *et al.*, 2021). The same research showed that cyber risk could affect brand, reputation, competitiveness, and financial value (Ngoc Thach *et al.*, 2021), and another study on business sustainability (Kosmowski *et al.*, 2022). These findings help raise awareness among decision-makers about the risks that companies may be exposed to and the consequences of not adequately managing this issue. Other research has shown solutions to reduce the mentioned problems and improve business management. For example, organizations need to invest in cybersecurity and improve technology management (Ngoc Thach *et al.*, 2021). Technological solutions require more advanced and collaborative approaches (Rashid *et al.*, 2021). Additionally, the industrial sector needs to understand cyber-attack risks when adopting technologies (Kosmowski *et al.*, 2022).

This paper is novel in conducting a bibliometric review on cybersecurity and business, which reduces the second identified knowledge gap. The results of the indicators (scientific production, keyword analysis, publication analysis, author analysis, and conceptual structure analysis) respond to RQ_1 by presenting the knowledge base on cybersecurity and business and its intellectual structure. On the other hand, the results of the indicators

(production by countries, analysis by institutions, journal analysis, and cross-country collaboration) respond to RQ_2 by showing the cybersecurity and business research front.

6. LIMITATIONS AND FUTURE RESEARCH

This research provides an overview of the current bibliometric landscape in cybersecurity and business. However, some limitations should be acknowledged.

First, the findings are subject to change over time. As a result, these conclusions may evolve with the increasing popularity of new variables in the future.

Second, this study adheres to the methodologies used by WoS. Consequently, the limitations associated with these databases also apply to this work. For example, WoS implements a complete count, meaning that articles written by multiple people have a more significant impact than those with a single author. This research employs fractional counting in visual mapping using Biblioshiny to address this issue. However, more comprehensive methods will be necessary in the future.

Third, it is essential to acknowledge that the findings of this paper are strongly influenced by popularity and related factors. While this approach effectively identifies salient trends, it is critical to understand that other valuable research may not yield equally favorable results due to topic-specific characteristics such as a smaller research community or concepts that have not yet gained significant traction among scholars publishing in academic journals.

Fourth, the research only considered articles in English. Future studies may include research in other languages and publications such as books, book chapters, and conference proceedings.

Fifth, using WoS as a database alone may be a limitation. Despite justifying this choice for this research, future studies may consider other databases such as Scopus and Dimensions.

Finally, there are opportunities to deepen business research, with particular emphasis on information, innovation, and trust. Future lines of research can explore multi-criteria decision-making models and fuzzy logic to reduce uncertainty and cyber-attacks. Along these lines, future studies can propose management models that increase cybersecurity in companies and, at the same time, reduce uncertainty and risks in decision-making. Therefore, a promising field of research opens that may include Multi Criteria Decision-Making (MCDM) (Blanco-Mesa *et al.*, 2017) and Fuzzy Logic models (Barcellos-Paula *et al.*, 2022), such as, for example, the "Forgotten Effects Theory" (Kaufmann & Gil-Aluja, 1988) as a relationship algorithm, the "Affinities Theory" (Gil-Aluja, 1999) as a grouping algorithm; and the "OWA Operator" (Yager, 1988) as a sorting algorithm.

7. CONCLUSIONS

The research identified the knowledge base on cybersecurity and business and its intellectual structure and provided insight into the scientific progress in this discipline. The authors used the WoS database and Bibliometrix software to analyze 410 articles and 1,355 authors across nine bibliometric indicators between 2004 and 2023. The theoretical background also identified knowledge gaps and broadened the discussion on cybersecurity and business.

The main results revealed an upward trend in publications with an annual growth of 27.63% and 31.46% international co-authorship, reinforcing the academic interest in cybersecurity and business to reduce a growing concern of organizations. The research indicated that the USA has the highest scientific output, followed by the UK and China. The study showed that "security" is the most used keyword in research. Other findings revealed Business Horizons and IEEE Access as the top journals and authors Kappelman, Maurer, and Torres as the most relevant. Top affiliations were Indiana University System, Indiana University Bloomington, and State University System of Florida. The thematic mapping revealed that the driving topics are blockchain, privacy, and cloud computing. Therefore, researchers can deepen studies in this field. Finally, the factorial analysis confirmed that cybersecurity, cybercrime, risk management, and information security are the most common and significant topics shared.

As theoretical contributions, the study advanced the frontier of knowledge by narrowing the gaps identified to minimize cyber risks and analyzing security management. Likewise, the bibliometric review made it possible to determine the intellectual structure and to learn about the research front on cybersecurity and business. The study also showed promising lines of research. Finally, the study presented a bibliometric review methodology that other researchers can apply.

As practical contributions, the research broadened the debate on cybersecurity and business, seeking to raise decision-makers awareness of the risks to which companies may be exposed and find solutions for better business management. In addition, the study showed the terms most associated with cybersecurity and business, which can improve the analysis of managers and policymakers in decision-making and cybersecurity management.

Finally, the study's main scientific merit is its innovation. It conducted a bibliometric review on cybersecurity and business using a combined approach, including scientific mapping and performance analysis, with 410 articles and nine bibliometric indicators. Additionally, the authors sought to raise awareness among decision-makers about the links between cybersecurity and business.

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9. REFERENCES

Abeshu, A., & Chilamkurti, N. (2018). Deep Learning: The Frontier for Distributed Attack Detection in Fog-to-Things Computing. *IEEE Communications Magazine*, *56*(2), 169–175. https://doi.org/10.1109/MCOM.2018.1700332

Ahmad, A., Maynard, S. B., Desouza, K. C., Kotsias, J., Whitty, M. T., & Baskerville, R. L. (2021). How can organizations develop situation awareness for incident response: A case study of management practice. *Computers & Security*, *101*, 102122. https://doi.org/10.1016/j.cose.2020.102122

Al-rimy, B. A. S., Maarof, M. A., & Shaid, S. Z. M. (2018). Ransomware threat success factors, taxonomy, and countermeasures: A survey and research directions. *Computers & Security*, *74*, 144–166. https://doi.org/10.1016/j.cose.2018.01.001

Aria, M., & Cuccurullo, C. (2017). bibliometrix : An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Asghar, M. R., Hu, Q., & Zeadally, S. (2019). Cybersecurity in industrial control systems: Issues, technologies, and challenges. *Computer Networks*, *165*. https://doi.org/10.1016/j.comnet.2019.106946

Babiceanu, R. F., & Seker, R. (2016). Big Data and virtualization for manufacturing cyber-physical systems: A survey of the current status and future outlook. *Computers in Industry*, *81*, 128–137. https://doi.org/10.1016/j.compind.2016.02.004

Barcellos-Paula, L., de La Vega, I., & Gil-Lafuente, A. M. (2022). Bibliometric review of research on decision models in uncertainty, 1990–2020. *International Journal of Intelligent Systems*, *37*(10), 7300–7333. https://doi.org/10.1002/int.22882

Bhamare, D., Zolanvari, M., Erbad, A., Jain, R., Khan, K., & Meskin, N. (2020). Cybersecurity for industrial control systems: A survey. *Computers & Security*, *89*, 101677. https://doi.org/10.1016/j.cose.2019.101677

Blanco-Mesa, F., León-Castro, E., & Merigó, J. M. (2019). A bibliometric analysis of aggregation operators. *Applied Soft Computing*, *81*, 105488. https://doi.org/10.1016/j.asoc.2019.105488

Blanco-Mesa, F., Merigó, J. M., & Gil-Lafuente, A. M. (2017). Fuzzy decision making: A bibliometric-based review. *Journal of Intelligent & Fuzzy Systems*, *32*(3), 2033–2050. https://doi.org/10.3233/JIFS-161640

Boyson, S. (2014). Cyber supply chain risk management: Revolutionizing the strategic control of critical IT systems. *Technovation*, *34*(7). https://doi.org/10.1016/j.technovation.2014.02.001

Bresniker, K., Gavrilovska, A., Holt, J., Milojicic, D., & Tran, T. (2019). Grand Challenge: Applying Artificial Intelligence and Machine Learning to Cybersecurity. *Computer*, *52*(12), 45–52. https://doi.org/10.1109/MC.2019.2942584

Broadus, R. N. (1987). Early approaches to bibliometrics. *Journal of the American Society for Information Science*, *38*(2). https://doi.org/10.1002/(SICI)1097-4571(198703)38:2<127::AID-ASI6>3.0.CO;2-K

Calabrese, A., Costa, R., Tiburzi, L., & Brem, A. (2023). Merging two revolutions: A human-artificial intelligence method to study how sustainability and Industry 4.0 are intertwined. *Technological Forecasting and Social Change*, *188*. https://doi.org/10.1016/j.techfore.2022.122265

Chaal, M., Ren, X., BahooToroody, A., Basnet, S., Bolbot, V., Banda, O. A. V., & Gelder, P. Van. (2023). Research on risk, safety, and reliability of autonomous ships: A bibliometric review. *Safety Science*, *167*, 106256. https://doi.org/10.1016/j.ssci.2023.106256

Clarivate (2023). Journal Citation Reports: Reference Guide. Journal Citation Reports.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011a). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. *Journal of Informetrics*, *5*(1), 146–166. https://doi.org/10.1016/j.joi.2010.10.002

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011b). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the American Society for Information Science and Technology*, *62*(7), 1382–1402. https://doi.org/10.1002/asi.21525

Corallo, A., Lazoi, M., & Lezzi, M. (2020). Cybersecurity in the context of industry 4.0: A structured classification of critical assets and business impacts. *Computers in Industry*, *114*, 103165. https://doi.org/10.1016/j.compind.2019.103165

Corallo, A., Lazoi, M., Lezzi, M., & Luperto, A. (2022). Cybersecurity awareness in the context of the Industrial Internet of Things: A systematic literature review. *Computers in Industry*, *137*, 103614. https://doi.org/10.1016/j.compind.2022.103614

Corallo, A., Lazoi, M., Lezzi, M., & Pontrandolfo, P. (2023). Cybersecurity Challenges for Manufacturing Systems 4.0: Assessment of the Business Impact Level. *IEEE Transactions on Engineering Management*, *70*(11). https://doi.org/10.1109/TEM.2021.3084687

Garfield, E. (1955). Citation indexes for science. *Science*, *122*(3159). https://doi.org/10.1126/science.122.3159.108

Ghobakhloo, M. (2020). Determinants of information and digital technology implementation for smart manufacturing. *International Journal of Production Research*, *58*(8), 2384–2405. https://doi.org/10.1080/00207543.2019.1630775

Gil-Aluja, J. (1999). *Elements for a Theory of Decision in Uncertainty* (Vol. 32). Springer US. https://doi.org/10.1007/978-1-4757-3011-1

Gupta, S., Meissonier, R., Drave, V. A., & Roubaud, D. (2020). Examining the impact of Cloud ERP on sustainable performance: A dynamic capability view. *International Journal of Information Management*, *51*. https://doi.org/10.1016/j.ijinfomgt.2019.10.013

Hasanova, H., Baek, U. jun, Shin, M. gon, Cho, K., & Kim, M. S. (2019). A survey on blockchain cybersecurity vulnerabilities and possible countermeasures. *International Journal of Network Management*, *29*(2). https://doi.org/10.1002/nem.2060

Hayat, R. F., Aurangzeb, S., Aleem, M., Srivastava, G., & Lin, J. C. W. (2022). ML-DDoS: A Blockchain-Based Multilevel DDoS Mitigation Mechanism for IoT Environments. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2022.3170519

Hayes, A. (2020). Business Definition. *Investopedia*.

Hosseini Shirvani, M., Rahmani, A. M., & Sahafi, A. (2018). An iterative mathematical decision model for cloud migration: A cost and security risk approach. *Software - Practice and Experience*, *48*(3). https://doi.org/10.1002/spe.2528

Jalali, M. S., Razak, S., Gordon, W., Perakslis, E., & Madnick, S. (2019). Health Care and Cybersecurity: Bibliometric Analysis of the Literature. *Journal of Medical Internet Research*, *21*(2), e12644. https://doi.org/10.2196/12644

Javaheri, D., Gorgin, S., Lee, J. A., & Masdari, M. (2023). Fuzzy logic-based DDoS attacks and network traffic anomaly detection methods: Classification, overview, and future perspectives. *Information Sciences*, *626*. https://doi.org/10.1016/j.ins.2023.01.067

Johnson, M. E., Goetz, E., & Pfleeger, S. L. (2009). Security through information risk management. *IEEE Security and Privacy*, *7*(3). https://doi.org/10.1109/MSP.2009.77

Johnson, V., Torres, R., Maurer, C., Guerra, K., Srivastava, S., & Mohit, H. (2023). The 2022 SIM IT Issues and Trends Study. *MIS Quarterly Executive*, *22*(1). https://doi.org/10.17705/2msqe.00075

Kappelman, L., Johnson, V., Maurer, C., McLean, E., Torres, R., David, A., & Nguyen, Q. (2018). The 2017 SIM IT issues and trends study. *MIS Quarterly Executive*, *17*(1).

Kappelman, L., Johnson, V., Torres, R., Maurer, C., & McLean, E. (2019). A study of information systems issues, practices, and leadership in Europe. *European Journal of Information Systems*, *28*(1). https://doi.org/10.1080/0960085X.2018.1497929

Kappelman, L., Maurer, C., Mclean, E. R., Kim, K., Johnson, V. L., Guerra, K., Torres, R., & Snyder, M. (2021). The 2020 SIM IT Issues and Trends Study. *MIS Quarterly Executive, 20*(1).

Kappelman, L., Torres, R., McLean, E., Maurer, C., Johnson, V., & Kim, K. (2018). The 2018 SIM IT issues and trends study. *MIS Quarterly Executive*, *18*(1). https://doi.org/10.17705/2msqe.00008

Kappelman, L., Torres, R., McLean, E. R., Maurer, C., Johnson, V. L., Snyder, M., & Guerra, K. (2022). The 2021 SIM IT Issues and

Trends Study. *MIS Quarterly Executive*, *21*(1), 75–114. https://doi.org/10.17705/2msqe.00060

Kaufmann, A. & Gil-Aluja, J. (1988). *Modelos para la investigación de efectos olvidados*. Editorial Milladoiro.

Kemp, S., Buil-Gil, D., Moneva, A., Miró-Llinares, F., & Díaz-Castaño, N. (2021). Empty Streets, Busy Internet: A Time-Series Analysis of Cybercrime and Fraud Trends During COVID-19. *Journal of Contemporary Criminal Justice*, *37*(4), 480–501. https://doi.org/10.1177/10439862211027986

Khan, A. A., Uddin, M., Shaikh, A. A., Laghari, A. A., & Rajput, A. E. (2021). MF-Ledger: Blockchain Hyperledger Sawtooth-Enabled Novel and Secure Multimedia Chain of Custody Forensic Investigation Architecture. *IEEE Access*, *9*. https://doi.org/10.1109/ACCESS.2021.3099037

Klaus, J. P., Kim, K., Masli, A., Guerra, K., & Kappelman, L. (2022). Prioritizing IT Management Issues and Business Performance. *Journal of Information Systems*, *36*(2). https://doi.org/10.2308/ISYS-2020-016

Knowles, W., Prince, D., Hutchison, D., Disso, J. F. P., & Jones, K. (2015). A survey of cyber security management in industrial control systems. *International Journal of Critical Infrastructure Protection*, *9*, 52–80. https://doi.org/10.1016/j.ijcip.2015.02.002

Kosmowski, K. T., Piesik, E., Piesik, J., & Śliwiński, M. (2022). Integrated Functional Safety and Cybersecurity Evaluation in a Framework for Business Continuity Management. *Energies*, *15*(10), 3610. https://doi.org/10.3390/en15103610

Kure, H. I., Islam, S., & Razzaque, M. A. (2018). An integrated cyber security risk management approach for a cyber-physical system. *Applied Sciences (Switzerland)*, *8*(6). https://doi.org/10.3390/app8060898

Leng, J., Ye, S., Zhou, M., Zhao, J. L., Liu, Q., Guo, W., Cao, W., & Fu, L. (2021). Blockchain-Secured Smart Manufacturing in Industry 4.0: A Survey. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, *51*(1), 237–252. https://doi.org/10.1109/TSMC.2020.3040789

Li, L., He, W., Xu, L., Ash, I., Anwar, M., & Yuan, X. (2019). Investigating the impact of cybersecurity policy awareness on employees' cybersecurity behavior. *International Journal of Information Management*, *45*, 13–24. https://doi.org/10.1016/j.ijinfomgt.2018.10.017

Manuel, D.-D., Carmona-Murillo, J., Cortes-Polo, D., & Rodriguez-Perez, F. J. (2022). CyberTOMP: A Novel Systematic Framework to Manage Asset-Focused Cybersecurity From Tactical and Operational Levels. *IEEE Access*, *10*, 122454–122485. https://doi.org/10.1109/ACCESS.2022.3223440

Marti, L., & Cervelló-Royo, R. (2023). Disparities in sustainable development goals compliance and their association with country risk. *Sustainable Development*. https://doi.org/10.1002/sd.2568

Martínez-López, F. J., Merigó, J. M., Valenzuela-Fernández, L., & Nicolás, C. (2018). Fifty years of the European Journal of Marketing: a bibliometric analysis. In *European Journal of Marketing* (Vol. 52, Issues 1–2). https://doi.org/10.1108/EJM-11-2017-0853

Mendhurwar, S., & Mishra, R. (2021). Integration of social and IoT technologies: architectural framework for digital transformation and cyber security challenges. *Enterprise Information Systems*, *15*(4). https://doi.org/10.1080/17517575.2019.1600041

Moed, H. F. (2005). Citation Analysis in Research Evaluation (Information Science and Knowledge Management). In *Analysis*.

Naffa, H., & Fain, M. (2020). Performance measurement of ESG-themed megatrend investments in global equity markets using pure factor portfolios methodology. *PLOS ONE*, *15*(12), e0244225. https://doi.org/10.1371/journal.pone.0244225

Ngoc Thach, N., Thanh Hanh, H., Ngoc Huy, D. T., Gwozdziewicz, S., Viet Nga, L. T., & Thanh Huong, L. T. (2021). Technology Quality Management of the Industry 4.0 and Cybersecurity Risk Management on Current Banking Activities in Emerging Markets - The Case in Vietnam. *International Journal for Quality Research*, *15*(3), 845–856. https://doi.org/10.24874/IJQR15.03-10

Nishant, R., Kennedy, M., & Corbett, J. (2020). Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda. *International Journal of Information Management*, *53*, 102104. https://doi.org/10.1016/j.ijinfomgt.2020.102104

Noyons, E. C. M., Moed, H. F., & Luwel, M. (1999). Combining mapping and citation analysis for evaluative bibliometric purposes: A bibliometric study. *Journal of the American Society for Information Science*, *50*(2), 115–131. https://doi.org/10.1002/(SICI)1097-4571(1999)50:2<115::AID-ASI3>3.0.CO;2-J

Page MJ, McKenzie JE, Bossuyt PM, et al (2021) The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. The BMJ 372:71.

Paul, M., Maglaras, L., Ferrag, M. A., & Almomani, I. (2023). Digitization of healthcare sector: A study on privacy and security concerns. In *ICT Express* (Vol. 9, Issue 4). https://doi.org/10.1016/j.icte.2023.02.007

Pedraja-Rejas, L., Rodríguez-Ponce, E., & Muñoz-Fritis, C. (2022). Human resource management and performance in Ibero-America: Bibliometric analysis of scientific production. *Cuadernos de Gestion*, *22*(2). https://doi.org/10.5295/cdg.211569lp

Pritchard, A. (1969). Statistical Bibliography or Bibliometrics? In *Journal of Documentation* 25 (4): 348-349.

Protogerou, A., Papadopoulos, S., Drosou, A., Tzovaras, D., & Refanidis, I. (2021). A graph neural network method for distributed anomaly detection in IoT. *Evolving Systems*, *12*(1). https://doi.org/10.1007/s12530-020-09347-0

Rashid, Z., Noor, U., & Altmann, J. (2021). Economic model for evaluating the value creation through information sharing within the cybersecurity information sharing ecosystem. *Future Generation Computer Systems*, *124*, 436–466. https://doi.org/10.1016/j.future.2021.05.033

Ribeiro, H., Barbosa, B., Moreira, A. C., & Rodrigues, R. (2022). Churn in services – A bibliometric review. *Cuadernos de Gestion*, *22*(2). https://doi.org/10.5295/cdg.211509hr

Shackelford, S. J. (2012). Should your firm invest in cyber risk insurance? *Business Horizons*, *55*(4). https://doi.org/10.1016/j.bushor.2012.02.004

Shah, S. (2020). The Technological Impact of COVID-19 on the Future of Education and Health Care Delivery. *Pain Physician*, *4S;23*(8;4S), S367–S380. https://doi.org/10.36076/ppj.2020/23/S367

Silva, B. C., & Moreira, A. C. (2022). Entrepreneurship and the gig economy: A bibliometric analysis. *Cuadernos de Gestion*, *22*(2). https://doi.org/10.5295/cdg.211580am

Tagarev, T., Davis, B., & Cooke, M. (2022). Business, Organisational and governance modalities of collaborative cybersecurity networks. *Multimedia Tools and Applications*, *81*(7). https://doi.org/10.1007/s11042-021-11109-2

Tsiodra, M., Panda, S., Chronopoulos, M., & Panaousis, E. (2023). Cyber Risk Assessment and Optimization: A Small Business Case Study. *IEEE Access*, *11*. https://doi.org/10.1109/ACCESS.2023.3272670

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *SCIENTOMETRICS*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Yager, R. R. (1988). On ordered weighted averaging aggregation operators in multicriteria decisionmaking. *IEEE Transactions on Systems, Man, and Cybernetics*, *18*(1), 183–190. https://doi.org/10.1109/21.87068

Yeboah-Ofori, A., Islam, S., Lee, S. W., Shamszaman, Z. U., Muhammad, K., Altaf, M., & Al-Rakhami, M. S. (2021). Cyber Threat Predictive Analytics for Improving Cyber Supply Chain Security. *IEEE Access*, *9*. https://doi.org/10.1109/ACCESS.2021.3087109

Zupic, I., & Čater, T. (2015). Bibliometric Methods in Management and Organization. *Organizational Research Methods*, *18*(3), 429–472. https://doi.org/10.1177/1094428114562629

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Football clubs' social awareness as a leading strategy for performance: A fan token-based panel data analysis

La conciencia social de los clubes de fútbol como una estrategia para el desempeño: Un análisis de datos de panel basado en fan tokens

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ABSTRACT

This paper analyses the extent to which football clubs' emotional value —fan token-based— is related to economic value—share-based. Specifically, this research investigates the relationship between fan tokens and stock prices in European football clubs, aiming to discern fan engagement's impact on financial market dynamics. We posit that fan token values are significantly linked to the valuation of clubs' stocks. To assess this, a panel data analysis employing econometric models is conducted on six prominent football clubs that regularly participate in European competitions. The study period covers comprehensive data on fan token values and stock prices from 2022-2023. The findings reveal a positive and statistically significant correlation between fan token evolution and stock price movement. Individual ordinary least squares (OLS) regressions further confirm this trend. Moreover, a long/short strategy backtest emphasizes the substantial relationship between fan token evolution and stock performance. Hence, we demonstrate that clubs' emotional perceptions —for which sustainability plays a key role— help predict clubs' economic results. In other words, we demonstrate that being socially responsible is a strategy that could lead clubs to obtain a competitive advantage by improving fans' perceptions, which in turn would have a positive impact on clubs' performance. This study sheds light on the potential influence of fan engagement on football clubs' financial market standing, offering insights crucial for stakeholders navigating the intersection of sports and finance.

Keywords: Fan Tokens, Football Clubs, Stock Prices, Socially Responsible Investing, Corporate Social Responsibility, Panel Data Analysis.

RESUMEN

Este artículo tiene como objetivo analizar la relación entre el valor emocional de los clubes de fútbol, medido a través de los fan tokens y su valor económico, medido a través de las acciones. La investigación se centra en cómo los fan tokens influyen en los precios de las acciones de los clubes de fútbol, con el fin de discernir el impacto del compromiso de los aficionados en el mercado financiero. Se propone que los valores de los fan tokens están significativamente vinculados a la valoración de las acciones de los clubes. Para evaluar esto, se realiza un análisis de datos de panel en seis destacados clubes de fútbol que participan en competiciones europeas. El período de estudio abarca los años 2022 y 2023, incluyendo datos sobre el valor de los fan tokens y los precios de las acciones. Los resultados muestran una correlación positiva y estadísticamente significativa entre la evolución de los fan tokens y el movimiento de los precios de las acciones. Esta tendencia se confirma mediante análisis de regresión lineal de mínimos cuadrados ordinarios (OLS). Además, una prueba retrospectiva de estrategia *long-short* subraya una relación sustancial entre la evolución de los fan tokens y el rendimiento de las acciones. Se demuestra que las percepciones emocionales de los clubes, donde la sostenibilidad juega un papel clave, ayudan a predecir los resultados económicos. La responsabilidad social es una estrategia que podría proporcionar a los clubes una ventaja competitiva al mejorar las percepciones de los aficionados, impactando positivamente en su rendimiento económico.

Palabras clave: Fan Tokens, Clubes de Futbol, Acciones, Inversión socialmente responsable, Responsabilidad social corporativa, Panel de datos.

1. INTRODUCTION

Millions of people worldwide are fascinated with football as a sport (Cifuentes-Faura, 2022). Football clubs have been acknowledged as cultural entities with the potential to spur favourable change (Giulianotti, 2021). The passion and loyalty that fans have for their teams (Shtudiner *et al.*, 2022) is proof of how well sports can unite people and improve their lives. However, football is a powerful force for social transformation and not merely for entertainment. The capacity of football clubs to better society is becoming more widely understood (Romero-Jara *et al.*, 2023).

In recent years, there has been a growing interest in the role that football clubs can play in promoting social awareness and change (Morrow, 2023). Social awareness refers to a club's ability to understand and respond to social issues, as well as its ability to engage with its fans and foster a sense of community. It is not only a moral obligation for clubs to address social issues but also a key factor in their success (Anagnostopoulos *et al.*, 2022).

Research has shown that clubs that are more socially aware and actively engaged with their fans are likely to see higher levels of fan loyalty, which can translate into better performance on the field (Tachis & Tzetzis, 2015). Fan loyalty is important for clubs, as it leads to increased ticket sales, merchandise purchases, and sponsorship deals (Hyatt *et al.*, 2013). Therefore, it is in a club's best interest to foster a strong sense of community among its fans.

One way that football clubs are achieving brand loyalty in the digital era (Pandita & Vapiwala, 2023) is through the use of fan tokens. Fan tokens are digital assets that allow fans to participate in club decision-making, access exclusive content, and earn rewards for their loyalty (Tachis & Tzetzis, 2015). They are a new and innovative way for clubs to engage with their fans and strengthen their community. Thus, fan tokens have the potential to improve fan engagement and loyalty, which can lead to better club performance (Hyatt *et al.*, 2013).

The use of fan tokens as a tool for measuring social awareness is a relatively new concept, but it has already shown great promise. In recent years, the sports industry has witnessed a fascinating convergence between traditional fandom and modern finance, epitomized by the emergence of fan tokens in the realm of football clubs. This evolution marks a paradigm shift, entwining supporters' passion for and loyalty to financial market dynamics (Ersan *et al.*, 2022). Fan tokens allow clubs to track fan engagement and provide feedback on various social initiatives, which can help them identify areas for improvement (Inoue *et al.*, 2013). Fan tokens can also provide clubs with a new revenue stream and help them to monetize their brand, as happens in other impactful industries such as the music industry (Centorrino *et al.*, 2022).

In turn, stock price prediction is still a popular —yet complex— topic for researchers (Deng *et al.*, 2024). The variety of variables influencing stock prices today, along with the occurrence of unexpected events, plays a significant role in the volatility of financial markets (Dhingra *et al.*, 2024). Not surprisingly, researchers aim to pinpoint variables that can help predict the future trajectory of stock prices. Against this background, our study aims to contribute to the research that links emotional performance, which is based on more intangible aspects such as emotional perceptions and added emotional value, to future stock prices. Specifically, this study adds value to the existing stock price forecasting-related literature by highlighting fan token usefulness for stock price prediction.

A football club's fan tokens and stock prices are closely linked (Demir *et al.*, 2022). Stock prices are mostly based on financial factors —in this case, they are driven mostly by performance-related cash flows— while fan tokens are more prone to the mood effect (Demir *et al.*, 2022) and capture more emotional performance, i.e., not only on the basis of sporting results; in fact, misalignment between clubs' culture, values, and CSR strategy and clubs' actions have a negative impact on fans' emotional perceptions, which in turn helps explain the decrease in stock prices.

Nevertheless, studies investigating the fan token–stock price relationship are lacking. We aim to bridge this gap by examining the extent to which the evolution of fan tokens helps forecast stock price movements in the football industry, where socioemotional benefits are key (Rodriguez-Pomeda *et al.*, 2017) and ESG is gaining more attention (Tettamanzi *et al.*, 2024). Therefore, this study explores the following research questions: Are fan tokens intricately linked to fluctuations in football clubs' stock prices? Does the evolution of a football club's fan tokens have predictive power over the evolution of its stock price? In short, this study examines the relationship between football clubs' fan tokens and their stock prices in the financial market and provides further insights to help mitigate the difficulty of predicting the evolution of stock prices in an industry in which firms operate with various stakeholders (Daddi *et al.*, 2024) and are victory maximizers rather than profit maximizers (Tettamanzi *et al.*, 2024). This study falls within the field of behavioural finance, which assumes that investor rationality is limited. Furthermore, understanding the emotional ties of investors to the club (measured through fan tokens) will provide better insights into the evolution of stock prices. In short, this study aims to develop a leading indicator that enables investors to better understand and predict the evolution of the stock prices of publicly traded football clubs, even for implementing profitable investment strategies.

The primary hypothesis driving this study suggests that the value and trajectory of a football club's fan token are intricately linked to fluctuations in the club's stock prices. This hypothesis arises from the underlying belief that heightened fan participation, as manifested through fan tokens, might exert a discernible influence on the club's financial market standing.

To examine this relationship, a thorough investigation is warranted. By employing panel data techniques and econometric modelling, this study analyses the correlation between fan token metrics and stock price movements across a select group of European football clubs. The choice of these clubs, guided by their consistent participation in prestigious European competitions and the availability of comprehensive fan token data, offers a valid setting generalizability within the football landscape.

By assessing the explanatory and predictive power of fan tokens on stock price evolution, this research aims to uncover potential indicators and trends within the financial market. Understanding the implications of greater fan involvement for club valuation holds relevance not only for financial analysts but also for club management, investors, and the broader spectrum of stakeholders involved in the intersection of sports and finance.

The findings and insights from this study are anticipated to contribute a valuable perspective to the ongoing discourse surrounding the influence of fan engagement on the financial dynamics of football clubs, paving the way for further exploration and strategic decision-making in both sporting and financial domains.

In short, this study explores the relationships among fan engagement, social awareness, and economic performance in football clubs, emphasizing the role of fan tokens. The study highlights that clubs actively engaging with fans and adopting sustainable practices can enhance their brand reputation and financial performance. Fan tokens serve as a tool to foster fan engagement, offering both explanatory and predictive power over stock prices. The study contributes to the literature on sports management, CSR, and SRI, offering insights for both academia and industry.

The paper is organized as follows. Section 2 provides an overview of the existing literature and develops the research hypotheses. Section 3 describes the method used; specifically, the sample and how the data are collected are described. Section 4 outlines the main results obtained. In Section 5, the main conclusions are discussed. Section 6 explains the theoretical contributions and practical implications of the study. Finally, the main conclusions, limitations, and future lines of research are addressed in Section 7.

2. LITERATURE REVIEW AND HYPOTHESES

Stakeholder theory posits that companies are responsible for all stakeholders, including shareholders, employees, customers, and the community (Freeman & Phillips, 2002). This theory argues that companies should consider the interests of all stakeholders rather than just focus on shareholder value. In other words, according to stakeholder theory, different stakeholders exert pressure on the organization itself so that the needed actions are taken.

The stakeholder landscape in today's professional football is quite heterogeneous (Jaeger, 2021). Thus, stakeholder theory has both conceptual and empirical value and can be used to clarify key issues in sport management (Walters & Tacon, 2010).

The European sports ecosystem has often been approached through stakeholder theory (Jaeger, 2021) since football clubs must meet the expectations of a wide range of stakeholders (Babiak & Kihl, 2018) (see Jaeger, 2021, for a literature review on stakeholder classification criteria). Stakeholder dialogue is a form of CSR action that firms can adopt (Babiak & Kihl, 2018). As stated by Jaeger (2021), professional football teams in Europe are utility maximizers rather than profit maximizers while focusing on success.

The literature on CSR and SRI has extensively discussed the impact of sustainability practices on company performance (Alikaj *et al.*, 2017; Beloskar *et al.*, 2023). CSR refers to a company's commitment to act responsibly towards its stakeholders, including its employees, customers, and environment. SRI, on the other hand, refers to investment strategies that consider companies' social and environmental impact alongside financial performance.

In the context of football clubs, CSR and SRI practices have become increasingly important due to the growing social awareness of fans and stakeholders. Football clubs are not only economic entities but also cultural and social entities, with a significant impact on the communities in which they operate. Since football clubs can be seen as brands themselves, brand image is an important concern (Blumrodt *et al.*, 2013). Therefore, clubs that adopt sustainable practices and engage with their fans and stakeholders have a competitive advantage in terms of building brand reputation and loyalty (Marrucci *et al.*, 2023).

Overall, the literature suggests that football clubs' social awareness and sustainability practices are essential for building brand reputation, loyalty, and economic performance. The adoption of sustainable practices and engagement with fans and stakeholders can have a positive effect on clubs' fan perceptions, which can translate into better economic results. The use of fan tokens can also be a valuable tool for clubs to measure fan perceptions and engagement while monetizing their brand. Studies suggest that fan tokens represent a new competitive landscape for the football industry, which can enhance brand loyalty and create new revenue streams for clubs (Солнцев *et al.*, 2022; Hasan Gözkonan *et al.*, 2022).

2.1. Corporate social responsibility and football clubs

The development of responsible management practices has gained increasing interest (Preget, 2023). Specifically, CSR is becoming increasingly important in the corporate and sporting worlds since it is motivated by profit or philanthropic reasons (Kulczycki & Koenigstorfer, 2016). CSR, in its broadest meaning, has arisen as an umbrella word for a concept in which corporations voluntarily integrate social and environmental issues into their business operations and interactions with their stakeholders (Zeimers *et al.*, 2019). The growing importance of the relatively new CSR phenomenon in the sports industry around the world (Hallmann *et al.*, 2024) has led to insights into the motivations (Babiak & Kihl, 2018; Manoli & Hodgkinson, 2021), practices (Walker & Parent, 2010), communications (Kolyperas & Sparks, 2011), club ownership and governance systems related to financial outcomes and performance (Hamil & Walters, 2010; Inoue *et al.*, 2013), program evaluations (Kihl *et al.*, 2014), and stakeholders' attitudes and behaviours (Tapp, 2004; Walker & Kent, 2009). We focus on the football sector, which has significant societal relevance through its CSR-related initiatives (Houben *et al.*, 2021).

In Europe, sports account for more than 2% of the gross domestic product (Houben *et al.*, 2021). Sports organizations need to operate in an increasingly competitive environment (Anagnostopoulos *et al.*, 2017). Football has long been viewed as the most popular entertainment activity in Europe (Blumrodt *et al.*, 2013). Furthermore, it is considered to be the world's leading, most commercialized and mediated sport (Houben *et al.*, 2021). Football clubs exhibit advanced management practices (Manoli & Hodgkinson, 2021) and are characterized by an over-investment environment (Rohde & Breuer, 2017). Several of the world's most successful football clubs are now controlled by global corporations, and diversified international investors are pouring in (Plumley *et al.*, 2017; Rohde & Breuer, 2017; Wilson *et al.*, 2013).

The football industry has evolved significantly over recent years and has long prioritized profitability (Beek *et al.*, 2018) on the basis of professionalization, commercialization, and internationalization (Rohde & Breuer, 2017), which is not incompatible with focusing on sustainability-related aspects; in fact, sports teams aim to be perceived as socially responsible to meet stakeholders' expectations (Babiak & Kihl, 2018).

Analysing CSR in professional football clubs is a relatively new topic (Jenkins & James, 2012; Ribeiro *et al.*, 2019). Football clubs traditionally engage with different stakeholders (Walters & Chadwick, 2009). To be successful, football clubs must fulfil the expectations of a wide range of stakeholders, including fans. Football fans, according to Senaux (2008), are definite stakeholders and they meet all three stakeholder categorization criteria (legitimacy, power, and urgency) provided by Mitchell *et al.* (1997). Recently, it has been emphasized that football fans' powerful role as stakeholders warrants further scientific investigation (Jaeger, 2021), and experimental models should be used to assess clubs' overall success (Plumley *et al.*, 2017). In truth, most football clubs may be guided by a set of financial and sports goals. Nonetheless, there has been a significant increase in awareness and initiatives by football clubs to include sustainability in their work and actions (Breitbarth *et al.*, 2015; Hugaerts *et al.*, 2021).

The importance of CSR and its reporting is growing but is still low in the football industry (Raimo *et al.*, 2021), for which football clubs' websites are efficient (Ribeiro *et al.*, 2019), even when not much sustainability-related information is disclosed on clubs' websites (Raimo *et al.*, 2021).

2.2. Socially responsible investment and football clubs

SRI is a type of investment that focuses on companies that demonstrate strong social and environmental practices, as well as good corporate governance, commonly known as ESG factors (Palma-Ruiz *et al.*, 2020). Currently, football clubs are increasingly under pressure to satisfy their fans' participation and demands (Manoli, 2015). Fan participation in clubs has a considerable effect on fan engagement and satisfaction, audience levels, and all types of merchandise consumption, which favour or detriment the club's long-term financial performance (Cleland, 2010; Hyatt *et al.*, 2013). Even when extensive research has been conducted on the market response to various favourable announcements, such as sponsorships, conflicts and tensions develop when fans are dissatisfied with the way teams are managed (Numerato & Giulianotti, 2018). As a result, fans play an important role in football club decision-making processes since they are important stakeholders to consider (García & Welford, 2015; Uhrich, 2021).

Vale and Fernandes (2018) explored sports fan engagement with their favourite teams, particularly focusing on social media interactions. Drawing on the Uses and Gratifications approach and the Consumers' Online Brand-Related Activities framework, they identified seven motivations (information, entertainment, personal identity, integration and social interaction, empowerment, remuneration, and brand love) and three dimensions of online engagement behaviours (consumption, contribution, and creation). A web-based survey of football club fans in a major UEFA league on Facebook, with 562 responses, revealed that the need for information, empowerment, and brand love drive consumption, contribution, and creation, respectively. Integration and social interaction emerged as the second most important motivation overall. This study contributes to understanding social media use in the sports marketing literature, providing insights for managers to effectively engage their fan base online. In a recent study, Fathy, Elsharnouby and AbouAish (2022) investigated fan engagement behaviours in sports marketing, employing mixed methods. Qualitative and quantitative findings identify team jealousy, competitiveness, and morality as new predictors of fan engagement. Fan role readiness and team identification significantly influence management cooperation and prosocial behaviour. Notably, team morality positively impacts performance tolerance. Despite existing research, further exploration is needed to understand fan engagement. This study contributes by shedding light on fans' unique behavioural responses, offering insights that are valuable for enhancing organizational performance in the sports industry. The main conclusions drawn from these studies highlight key factors influencing fan engagement in sports marketing.

Open innovation is felt in many other aspects of fan engagement. For example, influencer marketing has emerged as a potent strategy for open innovation. Ingrassia *et al.* (2022) assessed the impact of evocative elements as a novel model for leveraging influencer marketing in advertising and revitalizing the tourism and catering sectors. Cooke *et al.* (2022) contributed to open innovation and fan engagement by exploring digital reality replication for cultural consumption and green-digital open-system innovation in the context of post-COVID-19 sustainability. This study addresses issues such as unsustainable tourism practices, urban rebranding, fast fashion, and overtourism; analyses the role of digital media in conserving natural and cultural environments; and proposes strategies for sustainable intervention in over-touristed city centres.

2.3. Fan tokens and football clubs

A token is a digital representation of asset ownership that can be traded. Tokens can be fungible (such as Bitcoin, where any bitcoin can be exchanged for another; see Rao *et al.*, 2022) or nonfungible (such as Ethereum) with property rights over such assets (Kugler, 2021). The act of transforming a real or virtual asset into a digital representation (a token such as an image, video, artwork, ticket, sports card, etc.) that can be purchased and sold is a popular pursuit among individuals (Behl *et al.*, 2023) and is known as tokenization (Aki, 2021; Kugler, 2021).

Fan tokens have emerged as a new way for football clubs to engage with fans —they provide ways of participating in decision-making, minor remuneration can be accessed and financial benefits can be achieved through trading (Chen, 2024)— and measure their social awareness. Fan tokens are digital assets that provide fans with voting rights and exclusive access to club merchandise, events, and experiences. Fans are not only mere spectators but also active decision-makers (Ante *et al.*, 2024). The value of fan tokens is based on fans' emotional perceptions of the club, which are influenced by the club's sustainability practices and social responsibility (Baker *et al.*, 2022).

Fan tokens are fungible tokens that allow supporters to participate in club decision-making and offer feedback (e.g., uniform design or selection, player honours), which in turn increases engagement (Ante *et al.*, 2024). Chiliz, a blockchain startup, has teamed with high-profile teams such as FC Barcelona, A.C. Milan, Paris Saint-Germain FC, and Juventus FC to introduce fan tokens, which have generated millions of dollars in income (Evans, 2021). The value of fan tokens is a result of fans' perceptions of clubs' behaviour and performance (Anagnostopoulos *et al.*, 2022).

The importance of investors gathering, evaluating, and weighting information on ESG aspects is explicitly represented by fan tokens. This statement is supported by previous studies on the importance of ESG factors in investment decisions. For example, Capelle-Blancard and Petit (2019) examined the performance of ESG funds and reported that they can provide competitive returns, indicating the importance of considering ESG aspects in investment decisions. Similarly, Gödker and Mertins (2018) reported that ESG ratings can have a positive influence on the financial performance of firms. In the case of football clubs and fan tokens, the inclusion of ESG factors in the valuation of fan tokens highlights the importance of social responsibility and sustainability for both investors and fans. ESG factors, fan tokens, and football club stocks are interconnected, as fan engagement through tokens can influence club performance, impacting investor perceptions and stock value on the basis of sustainability.

As previously discussed, on the one hand, shares reflect the economic performance of a football club as a company. Therefore, the share price will appreciate when higher turnover and better profits are expected. However, fan tokens are based on fans' emotional perceptions of the club. Within this emotional assessment, the results of the club's main team are surely decisive, but it is also observed that when large signings or relevant news for the club occur, the price of the fan token is affected. We could say that in the emotional assessment of the club, measured by the price of fan tokens, fans consider, in addition to the sporting results, whether the club acts in a way aligned with its values or not, which implies that it would be acting in a socially responsible way or not.

According to the previous theoretical framework, the main hypothesis of this research is that the value of fan tokens, as a measure of community engagement and commitment among football club supporters, is significantly related to the evolution of clubs' stock prices in the financial market. It is proposed that greater fan participation and involvement, represented by fan tokens, positively influences the valuation of clubs' stocks in the market.

Hence, on the basis of the above discussion, we hypothesize the following:

H1: The evolution of a football club's fan tokens has explanatory power over the evolution of its stock prices.

Stakeholder theory emphasizes that companies must consider the interests of all stakeholders, including shareholders, employees, and customers (Freeman & Phillips, 2002). In the case of football clubs, fans play a pivotal role as stakeholders whose emotional engagement can directly impact the club's financial performance (Jaeger, 2021). Fan tokens, which allow fans to participate in decision-making and express their loyalty, represent a tangible connection between fan engagement and the club's value (Ante *et al.*, 2024). As fan engagement increases through fan tokens, it positively influences stock prices, demonstrating the relevance of stakeholder involvement in driving financial outcomes.

This hypothesis directly addresses the research question by asserting that the evolution of fan tokens influences the valuation of football club stocks in the financial market. By testing this hypothesis, the study aims to determine whether fan engagement, as measured by fan tokens, impacts the economic performance of football clubs.

By incorporating a lagged variable as an explanatory variable, we assess the ability of fan tokens to predict the evolution of stock prices. Therefore, we propose the following hypothesis:

H2: The evolution of a football club's fan tokens has predictive power over the evolution of its stock prices.

H2 posits that the evolution of a football club's fan tokens has predictive power over its stock prices. Stakeholder theory emphasizes that a company must cater to all its stakeholders, including fans, who significantly influence the club's brand and financial performance (Freeman & Phillips, 2002). In football, fan engagement is crucial, and fan tokens provide an innovative way to measure it. As these tokens reflect fans' emotional and social perceptions, they serve as indicators of clubs' sustainability practices and social responsibility (Ante *et al.*, 2024). Therefore, the value of fan tokens, driven by fan sentiment, can predict stock price movements by reflecting broader investor perceptions of the club's performance and reputation.

3. METHOD

3.1. Methodology

Panel data analysis is a statistical method widely employed in the social sciences. Working with panel data and variables in growth rates rather than raw data can provide several advantages, such as stationarity (change rates can often render data more stationary than raw data), normalization (which makes comparisons more meaningful by removing the scale effect), better trend and pulse detection, easier interpretation of data, and reduced autocorrelation, among others.

Hence, panel data analysis offers a valid framework for examining the relationship between fan tokens and stock prices over time and among different clubs. This methodological approach provides new insights into the evolving dynamics of fan engagement and its impact on football club economics. The panel data analysis involves statistical techniques examining the potential influence of fan tokens on the evolution of clubs' stock prices. Econometric models, such as fixed or random effects regressions, are used to control for unobserved individual and time-specific factors that may affect both fan tokens and stock prices.

The model used is as follows:

$$Y_{it} = a + b\,X_{it} + u_{it} \qquad \textit{(Model 1)}$$

where:

— Y_{it} is the weekly return of the shares of the "i" team in period "t".
— X_{it} is the weekly return of the fan token of the "i" team in period "t".

We will validate H1 if the b parameter is significantly different from 0.

The second hypothesis of this study extends the investigation by examining whether changes in fan token values precede changes in stock prices, thus serving as a predictive indicator. By testing this hypothesis, the study seeks to assess the predictive power of fan tokens in forecasting future movements in football club stock prices.

The model used is as follows:

$$Y_{it} = a + b\, X_{it-1} + u_{it} \qquad \textit{(Model 2)}$$

where:

— Y_{it} is the weekly return of the shares of the "i" team in period "t".
— X_{it-1} is the weekly return of the fan token of the "i" team in the period "t-1".

We will validate H2 if the b parameter is significantly different from 0.

The objective is to rigorously and systematically examine whether the value of fan tokens can serve as a leading or explanatory indicator of the evolution of football club stock prices in the financial market. However, if the previous hypotheses are validated, a deeper analysis will be conducted. An individual ordinary least squares (OLS) study of both models will be carried out to identify in which clubs the relationship is stronger. Additionally, a long/short strategy simulation will be performed where the positions in the football club's stocks will be taken on the basis of the previous week's fan token evolution.

3.2. Sample and data collection

To assess the hypotheses, a panel data approach is employed, incorporating historical data on fan token values and the stock prices of various European football clubs. Data are collected over a specific period, enabling the analysis of relationships over time and among different clubs.

Data selection focuses on six football clubs for the following reasons. First, they are clubs that hold significance by regularly participating in European competitions. Second, these clubs have had their fan tokens listed and traded for at least the past two years, providing a substantial historical dataset for analysis. Third, these clubs' fan tokens are listed on prominent exchanges such as Binance, ensuring accessibility and reliability in market data. Consequently, the football clubs that meet these criteria are FC Porto (Portugal), S.S. Lazio (Italy), Juventus FC (Italy), Galatasaray S.K. (Turkey), Trabzonspor (Turkey), and Fenerbahçe S.K. (Turkey).

Juventus FC is a very geographically diversified club that has expanded to new markets outside the home country in Italy (Fühner *et al.*, 2021). Additionally, Juventus is one of the first football clubs in the world to integrate sustainability into its business, embracing sustainability practices and social responsibility (Juventus, 2023).

FC Porto (Portugal) currently announced its adherence to and participation as a pilot partner in the ACCESS project to acquire skills to become the beacon of environmental sustainability in Portugal.

As stated by Binance, S.S. Lazio is raising funds for Binance Charity's Fight Hunger Worldwide project, which seeks to assist the UN's Sustainable Development Goal (SDG) of eradicating hunger by 2030.

If we focus on Turkish teams, for example, we could state that Galatasaray S.K. has recently made it into the Guinness World Records by having the "most powerful solar-powered stadium". Trabzonspor and Fenerbahçe S.K. are also very important teams in Turkey, where they have an impact on society.

There is a two-year historical record of weekly quotations covering the entirety of 2022 and 2023. The selection of a two-year sample period is attributed to the nascent nature of the fan tokens under examination and their recent introduction into the market. As a relatively new phenomenon in the realm of football club economics, fan tokens have only gained traction and garnered attention from investors, clubs, and fans alike over the past few years. Consequently, the availability of comprehensive historical data on fan token values and associated financial metrics is confined to a relatively short timeframe.

Given the limited duration since their inception, the dataset for this study encompasses the entirety of available data, spanning from 2022 to 2023. This period represents the only window during which the selected football clubs' fan tokens have been fully listed and actively traded on prominent exchanges. As such, this timeframe offers a unique opportunity to analyse the relationship between fan token dynamics and football club stock prices within the context of their emerging presence in the market.

While the truncated sample period may impose constraints on the depth of analysis and generalizability of findings, it is nevertheless reflective of the current landscape of fan token adoption and integration within the football industry. Despite its limitations, this study endeavours to provide valuable insights into the evolving dynamics of fan engagement and its implications for football club economics during this pivotal juncture of technological innovation and market evolution.

The research is based on a dataset with weekly observations over two years and six entities (in this case, football clubs). The number of observations can be calculated by multiplying the number of weeks in two years (approximately 104) by the number of entities. This gives us a total of approximately 624 observations in the dataset. The data are transformed into weekly return observations.

4. RESULTS

We opted to use Gretl for the regressions because it is an open-source software, making it both accessible and cost-effective. Additionally, Gretl is widely regarded as reliable and robust for statistical analysis, providing a wide range of features for econometric modelling; its transparency, being open source, allows for easy verification of results and methodologies, which is crucial for maintaining the integrity and replicability of our analyses. Furthermore, its user-friendly interface and comprehensive documentation make it a suitable choice for conducting the required regressions in a clear and efficient manner.

The estimation of the panel data model described above uses the following fixed effects algorithm (Model 1) (Table 1):

Table 1
Model 1 results

Model 1: Fixed effects			Value	
Number of observations			624,000	
Cross-sectional units included			6,000	
Time series length			104,000	
Variable	**Coefficient**	**Standard deviation**	**t statistic**	**p value**
Const	0,5730910	0,2820670	2,032	0,0426 **
Fantoken	0,0695554	0,0225184	3,089	0,0021 ***
Dependent variable mean			0,550	
Dependent variable standard deviation			7,100	
Sum of squared residuals			30617,640	
Regression standard deviation			7,040	
MCVF R-squared			0,030	
Intra R-squared			0,020	
F(6, 617) MCVF			2,770	
F value p			0,010	
Log-likelihood			–2100,090	
Akaike criterion			4214,180	
Schwarz criterion			4245,230	
Hannan-Quinn criterion			4226,250	
Rho			–0,090	
Durbin-Watson			2,150	
Test			**Test statistic**	**p value**
Joint test of regressors (excluding constant)			F(1, 617) = 9,54084	0,00209982
Test of different intercepts by groups			F(5, 617) = 1,43369	0,21012

Source: Authors' own research.

Using the aleatory effects algorithm, the model is as follows (Model 2) (Table 2):

Table 2
Model 2 results

Model 2: Random effects (GLS)			Value	
Number of observations			624	
Cross-sectional units included			6	
Time series length			104	
Variable	**Coefficient**	**Standard deviation**	**z statistic**	**p value**
Const	0,5730230	0,3719250	1,541	0,1234
Fantoken	0,0693063	0,0224906	3,082	0,0021 ***
Dependent variable			**Value**	
Mean			0,5543430	
Standard deviation			7,1041080	
Sum of squared residuals			30973,3600000	
Regression standard deviation			7,0509910	
Log-likelihood			–2103,6940000	
Akaike criterion			4211,3880000	
Schwarz criterion			4220,2610000	
Hannan-Quinn criterion			4214,8360000	
Rho			–0,0889050	
Durbin-Watson			2,1499870	

Variance	Value	
Between variance	0,3537830	
Within variance	49,6234000	
Theta for quasidemeaning	0,2422180	
Corr(y, yhat)^2	0,0148981	
Test	**Test statistic**	**p value**
Joint test of regressors	Chi-square(1) = 9,49608	0,00205911
Breusch–Pagan test	Chi-square(1) = 0,114422	0,73516500
Hausman test	Chi-square(1) = 0,117004	0,73230700

Source: Authors' own research.

Although the Hausman test indicates that we should choose the random effects model, both show a similar b parameter, which is significantly different from 0 within a 99% confidence interval.

The parameter is positive, which indicates that the evolution of fan tokens has explanatory power over the evolution of football clubs' stocks, which supports H1.

If we estimate Model 2 by adding a lag to the explanatory variable, we obtain Models 3 (Table 3) and 4 (Table 4).

Table 3
Model 3 results

Model 3: Fixed effects	Value			
Number of observations	618			
Cross-sectional units	6			
Time series length	103			
Variable	**Coefficient**	**Standard deviation**	**t statistic**	**p value**
Const	0,5184900	0,283119	1,831	0,0675 *
Fantoken_1	0,0648752	0,022502	2,883	0,0041 ***
Dependent variable mean	0,502702			
Dependent variable standard deviation	7,000000			
Sum of squared residuals	30255,62			
Regression standard deviation	7,000000			
R-squared MCVF (LSDV)	0,025091			
R-squared 'intra'	0,013422			
F-statistic (6, 611)	3,000000			
P value (F statistic)	0,016215			
Log-likelihood	–2.079,000			
Akaike criterion	4.172,000			
Schwarz criterion	4.203,000			
Hannan-Quinn criterion	4.184,000			
Rho	–0,071984			
Durbin-Watson	2,000000			
Joint test of regressors (excluding constant)				
Test statistic	F(1, 611) = 8,31218			
P value	0,00407654			
Test of different Intercepts per groups				
Null hypothesis	[Groups have a common intercept]			
Test statistic	F(5, 611) = 1,49125			
P value	0			

Source: Authors' own research.

Table 4
Model 4 results

Model 4: Random effects (GLS)		Value		
Number of observations		618		
Cross-sectional units		6		
Time series length		103		
Variable	**Coefficient**	**Standard deviation**	**z statistic**	**p value**
Const	0,5184600	0,3847120	1,348	0,1778
Fantoken_1	0,0647528	0,0224736	2,881	0,0040 ***
Dependent variable mean		0,502702		
Dependent variable standard deviation		7,092158		
Sum of squared residuals		30624,84		
Regression standard deviation		7,045217		
Log-likelihood		–2082,955		
Akaike criterion		4169,91		
Schwarz criterion		4178,763		
Hannan-Quinn criterion		4173,352		
Rho		–0,071984		
Durbin-Watson		2,105619		
Between variance		0,408482		
Within variance		49,51820		
Theta used for quasidemeaning		0,264718		
Corr(y, yhat)^2		0,0131937		
Tests				
Joint test of regressors (excluding constant)		Chi-square(1) = 8,30177		0,00396065
Breusch–Pagan test		Chi-square(1) = 0,17709		0,67388600
Hausman test		Chi-square(1) = 0,0313362		0,85949200

Source: Authors' own research.

Again, we observe that the estimated parameter is positive and significant at 99%, thus confirming H2.

In the Appendix, we present the OLS regressions conducted to individually validate H1. We observe that H1 is rejected for FC Porto and Juventus FC, accepted at 90% for Galatasaray S.K., and accepted at 95% or higher for the other three analysed teams, namely, S.S. Lazio, Trabzonspor, and Fenerbahçe S.K.

If we add a lag to the regressor, we obtain the models outlined in the annex to validate H2. We observe that this hypothesis is accepted only for the Turkish teams, more precisely, for Galatasaray S.K. at 90% and for Trabzonspor and Fenerbahçe S.K. at least at 95%.

Considering that H2 has been supported, we conduct a back test to assess the potential return of a long/short strategy. This strategy would have opened a long position weekly if the fan token had appreciated in the previous week or a short position if it had depreciated. The normalized graphs comparing the evolution of the stock (orange) and the strategy (blue) are as follows (Figures 1 to 6).

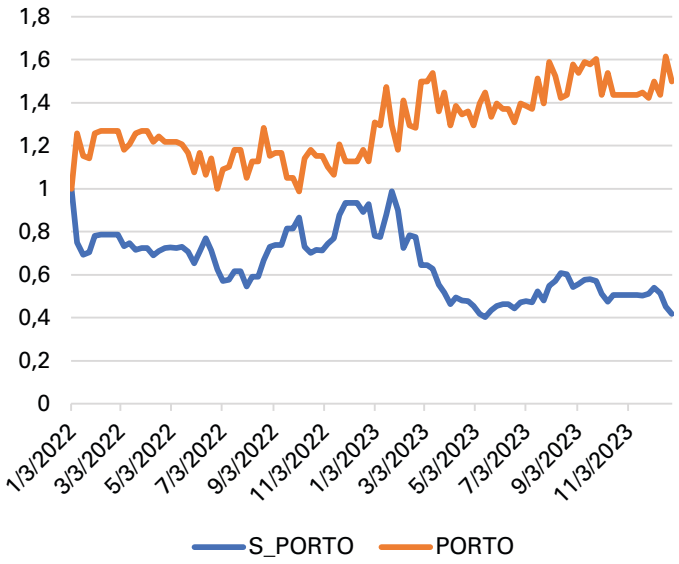

Figure 1
The evolution of the stock and the strategy for FC Porto
Note: In blue (lower line): the strategy. In orange (upper line): the stock.
Source: Authors' own research.

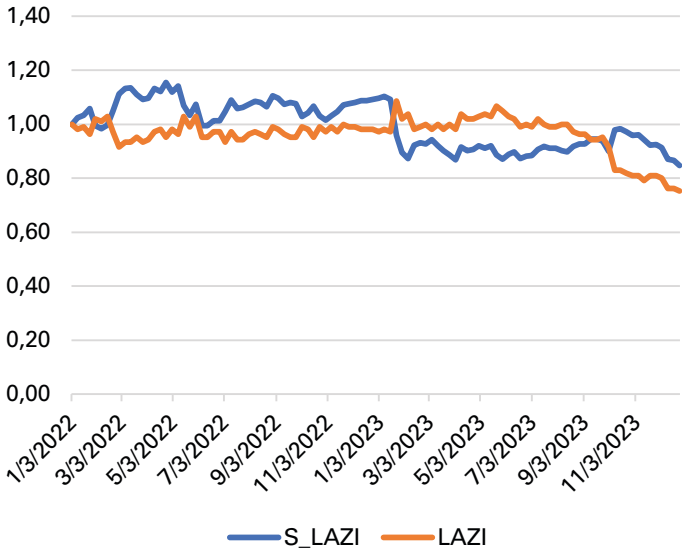

Figure 2

The evolution of the stock and the strategy for S.S. Lazio

Note: In blue (upper line at the beginning): the strategy. In orange (lower line at the beginning): the stock.

Source: Authors' own research.

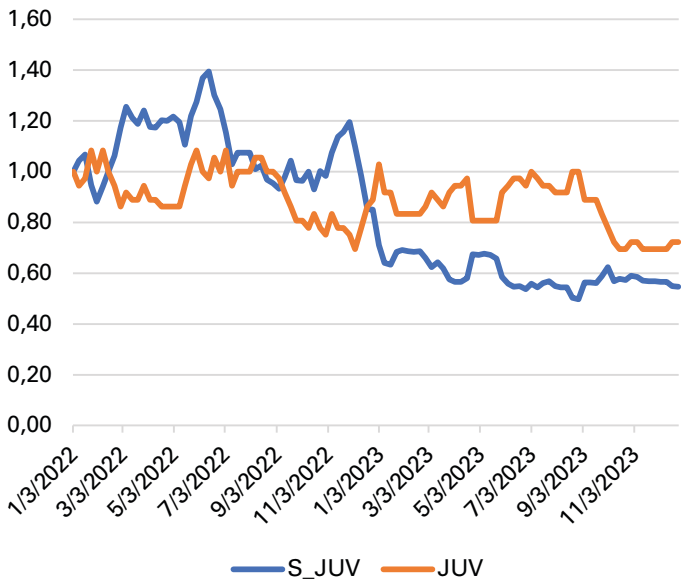

Figure 3

The evolution of the stock and the strategy for Juventus FC

Note: In blue (upper line at the beginning): the strategy. In orange (lower line at the beginning): the stock.

Source: Authors' own research.

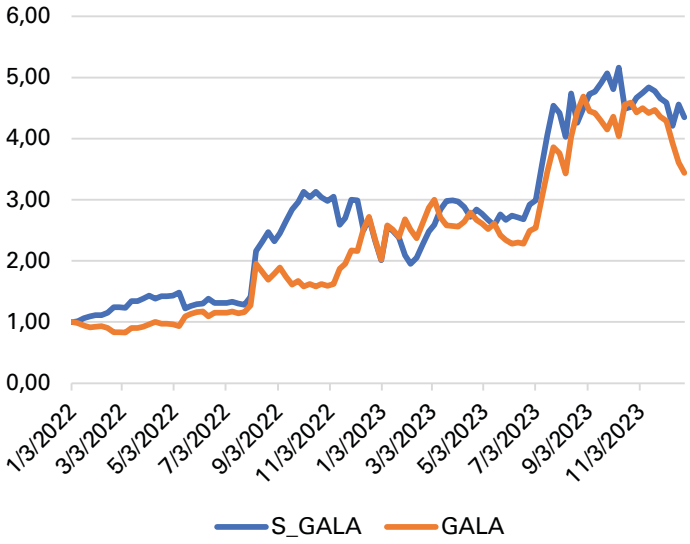

Figure 4

The evolution of the stock and the strategy for Galatasary S.K.

Note: In blue (upper line at the beginning): the strategy. In orange (lower line at the beginning): the stock.

Source: Authors' own research.

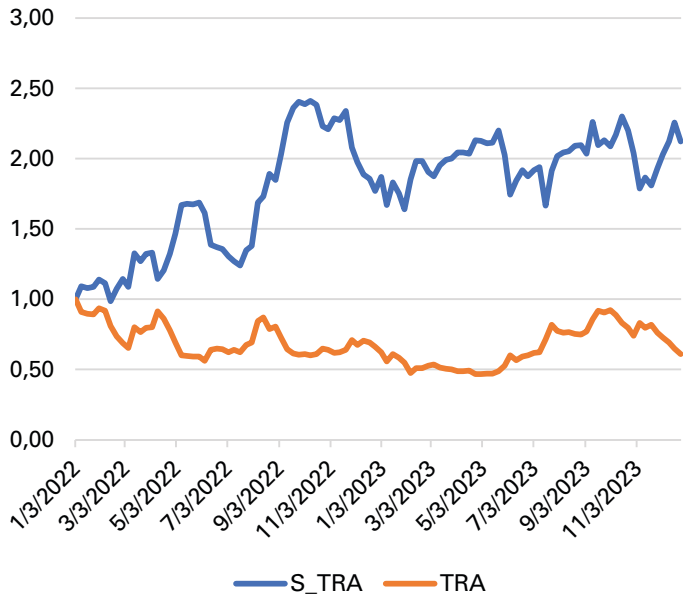

Figure 5

The evolution of the stock and the strategy for Trabzonspor

Note: In blue (upper line): the strategy. In orange (lower line): the stock.

Source: Authors' own research.

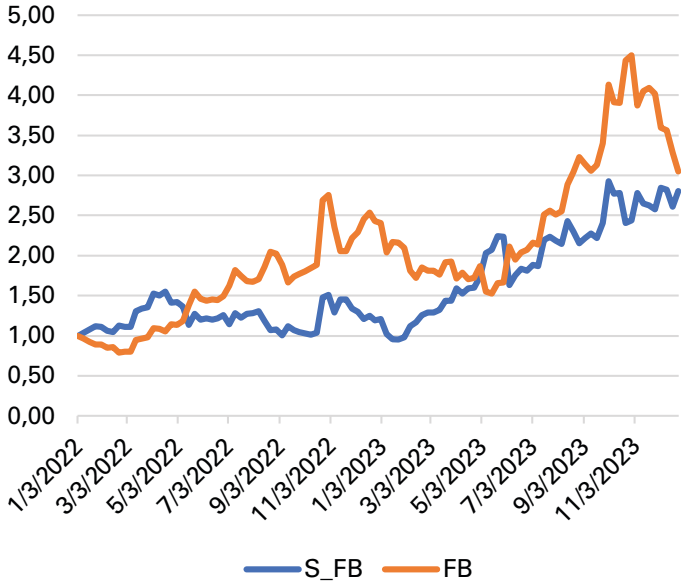

Figure 6
The evolution of the stock and the strategy for Fenerbahçe S.K.
Note: In blue (upper line at the beginning): the strategy. In orange (lower line at the beginning): the stock.
Source: Authors' own research.

The panel data analysis provides robust evidence that fan token evolution has a significant effect on the stock prices of football clubs. The results from the fixed effects (Model 1) and random effects (Model 2) models both confirm the positive relationship between fan token prices and football club stocks, as indicated by the statistically significant positive coefficients for the variable "Fantoken". The Hausman test suggests a preference for the random effects model, yet both models yield similar coefficients, reinforcing the reliability of the findings.

The inclusion of lags in the explanatory variable (Models 3 and 4) strengthens the evidence for this relationship, particularly for Turkish clubs such as Galatasaray S.K. and Trabzonspor, where the link is stronger. The models further validate the hypotheses, with significant coefficients indicating that fan token performance can predict stock price movements.

Additionally, the backtesting of a long/short strategy demonstrates the potential for profitable investment decisions on the basis of fan token price trends. In particular, Galatasaray S.K. showed the strongest correlation between fan token evolution and stock prices, highlighting the importance of fan perception in shaping financial outcomes for clubs.

In short, the results from the panel data models support the hypotheses. The estimated parameters, although indicated for choosing the random effects model per the Hausman test, displayed similarity and significance, confirming that fan token evolution has explanatory and predictive power over football clubs' stock prices. The positive parameter values suggest a meaningful relationship between fan token evolution and stock price. Individual OLS regressions validate H1 and H2 for different clubs, highlighting the varying strengths of this relationship across teams. The study's backtesting of a long/short strategy, which is based on previous fan token performance, underscores the profitability of strategies implemented on Galatasaray S.K.'s stock, emphasizing a strong and significant link between fan token evolution and stock price.

The analyses provide evidence for the potential implementation of a long–short trading strategy for football clubs' stocks on the basis of fan token prices. The significant relationship between fan token prices and share prices indicates that changes in fans' perceptions of football clubs' social awareness influence clubs' financial performance. Therefore, if the price of football clubs' fan token increases, it may be an indication of positive fan perception, and an investor could hold a long position on the club's stock. Conversely, if the price of the fan token drops, it may signal negative fan perception, and an investor could open a short position.

5. DISCUSSION

Sustainability is an effective driver of fan engagement in sports (Daddi *et al.*, 2024). Clubs that embrace ESG management foster a positive brand image among fans, which can lead to increased fan loyalty (Myung, 2024). Specifically, in the football sphere, audiences' growing interest in sustainability and social responsibility issues (Romero-Jara *et al.*, 2024) opens new avenues of research. As a way of engaging stakeholders, environmental issues have become crucial to most football organizations (Daddi *et al.*, 2024). According to stakeholder theory, companies must cater to all their stakeholders, which, in this context, include fans, who significantly impact clubs' performance (Freeman & Phillips, 2002). In other words, in addition to other stakeholders, such as institutional actors (Daddi *et al.*, 2021), the role of football fans in driving responsible practices among football clubs needs to be put forwards.

Football supporters' sustainable participation can take many forms (Bauers *et al.*, 2024). One of the newest tools is fan tokens, through which fans can assess sustainable aspects of their clubs. The use of fan tokens as a tool for measuring social awareness is a relatively new concept but offers a promising avenue for research. While numerous scholars have utilized stakeholder theory in their research on sport management (Daddi *et al.*, 2024), a cohesive framework that integrates digitalization and sustainability in sports management is still lacking (Glebova & Madsen, 2024). By acknowledging the importance of fans in the sport value chain (Pal Singh *et al.*, 2023) and using fan tokens, this study is able to shorten that gap; in short, we argue that fan tokens help predict future economic outcomes.

The findings of this study resonate with the broader literature on CSR, SRI, and stakeholder theory in the context of sports management. Shareholder primacy theory, which advocates for maximizing shareholder value, has long dominated business ideology. However, stakeholder theory offers a more holistic perspective, emphasizing the importance of considering the interests of all stakeholders, including fans. This resonates with the heterogeneous stakeholder landscape prevalent in professional football today.

Moreover, the study highlights the significance of CSR and SRI practices in football clubs, underscoring their role beyond mere economic entities. Football clubs, which are cultural and social institutions with profound community impacts, are in-

creasingly expected to demonstrate social responsibility and sustainability practices. This aligns with previous studies discussing the impact of sustainability practices on company performance, emphasizing the importance of CSR in enhancing brand reputation, loyalty, and economic performance.

The adoption of fan tokens as a mechanism for measuring fan engagement and monetizing brand value is another area where this study contributes to the literature. Fan tokens represent a novel approach to fan engagement, offering clubs a means to interact with fans while potentially enhancing brand loyalty and creating new revenue streams. This aligns with prior studies highlighting the emergence of fan tokens as a new competitive landscape in the football industry.

6. THEORETICAL CONTRIBUTIONS AND PRACTICAL IMPLICATIONS

This study contributes to the growing body of literature on sports management, CSR, and SRI by elucidating the complex relationships among fan engagement, social awareness, and economic performance in football clubs. In general, the findings of this study have significant implications for the football industry. Football clubs that actively engage fans and adopt sustainable practices are likely to enjoy enhanced brand reputation and economic returns. In this context, fan tokens are key players. Fan tokens are becoming effective mechanisms for football clubs to engage with fans, subsequently enhancing firm performance. Therefore, fan tokens should attract the attention of both managers and researchers. By establishing a positive relationship between fan tokens and stock prices, this study underscores the importance of fan engagement and social awareness in driving economic performance.

Thus, the study offers valuable insights with implications not only for academia but also for industry stakeholders; actually, football clubs' practitioners can gain valuable insights to improve good governance, and in the same vein, investors can make better-informed decisions.

From a theoretical perspective, the study offers interesting insights. On the basis of stakeholder theory, we build bridges between sports, finance and fan tokens —a new form of fan engagement (Ante *et al.*, 2024)— by exploring the explanatory and predictive power of fan tokens on football clubs' stock price evolution. Fans' tokens promote a paradigm shift in which fans are no longer passive stakeholders (Ante *et al.*, 2024) and have tools to punish or reward their teams on the basis of their behaviour, leveraging fan engagement to the next level. In this context, this study helps address the lack of environmental governance mechanisms in football clubs (Daddi *et al.*, 2024) by stressing fan tokens' role in football clubs' responsible behaviour, which in turn favours economic performance.

From a practical perspective, our results are also useful for managers, especially in industries such as the football industry, in which managers struggle to balance different interests when managing the coexistence of different institutional logics (Carlsson-Wall *et al.*, 2016). Football fans are already considered to play an important role since they can push football organizations towards sustainability (Daddi *et al.*, 2024). Hence, we suggest not underestimating the power of football fans and considering their priorities, which are increasingly aligned with responsible issues, resulting in higher levels of economic performance. Similarly, our results underscore the importance of fan tokens as a potential market signal for football clubs' stock prices. Hence, investors could also leverage this information to inform trading strategies, particularly in markets where fan engagement plays a crucial role in a club's financial performance.

7. CONCLUSIONS, LIMITATIONS AND FUTURE LINES OF RESEARCH

The findings of this study suggest that fan tokens, as a measure of fan engagement, significantly influence football clubs' stock prices. The positive relationship observed underscores the potential impact of fan participation on club financials, indicating a valuable avenue for financial analysis and investment strategies. The comprehensive approach of this study, which uses panel data and econometric modelling, offers insights into the dynamics between fan tokens and stock prices across different football clubs. In short, the evolution of a football club's fan tokens has both explanatory and predictive power over the evolution of its stock price. Our findings suggest that being socially responsible is not only the right thing to do but can also lead to improved economic performance and a competitive advantage for football clubs, not only in the short term but also in the long term. Hence, our work underscores the importance of fan involvement in driving club success and advocates for responsible management practices in the football industry.

Nevertheless, several limitations need to be considered. First, the study's focus on European clubs and the specific timeframe of available fan token data limits generalizability yet paves the way for future studies, which could investigate whether the relationship between fan token prices and share prices is consistent across different sports and industries beyond football clubs. Second, the analysis does not encompass other potential factors affecting stock prices, such as club performance, player transfers, or broader market trends. Third, the study's methodology relies on the assumption that the price of the fan token reflects the emotional perception of the club's social responsibility by its fans, which may not always be the case. Non-sustainability-related aspects might also have had an effect on fan tokens' price. Finally, while the relationship between fan tokens and stock prices is evident, the causal mechanisms underlying this connection require further exploration.

The advent of fan tokens, enabling supporters to partake in club-related decisions and activities, presents an intriguing proposition for financial market analysis. Overall, this study provides insights into the relationship between social responsibility and football clubs' fan perceptions by contributing to the relationship between fan tokens and football clubs' stock prices. However, when the impact of potential fan tokens on the valuation and performance of football clubs in the financial sphere is explored, future research should expand the analysis to incorporate additional factors and explore the causal mechanisms driving this relationship. Further investigation into the mechanisms through which fan tokens influence stock prices could offer deeper in-

sights into the causal relationships at play. Additionally, exploring the role of fan tokens in other sports industries or regions could help generalize the findings beyond European football clubs. Moreover, longitudinal studies tracking the evolution of fan engagement and economic performance over an extended period could provide a more comprehensive understanding of the long-term implications of fan tokens. Finally, qualitative research exploring fan perceptions and attitudes towards fan tokens could complement the quantitative analysis, offering a richer understanding of fan behaviour and preferences.

8. ACKNOWLEDGEMENTS

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9. REFERENCES

Aki, J. (2021, March 9). *Guide to tokens and NFTs: what is "tokenization" and how does it work?* Forkast. https://forkast.news/tokens-nfts-tokenization/

Alikaj, A., Nguyen, C. N., & Medina, E. (2017). Differentiating the impact of CSR strengths and concerns on firm performance: An investigation of MNEs and US domestic firms. *Journal of Management Development*, *36*(3), 401-409. https://doi.org/10.1108/JMD-04-2016-0058

Anagnostopoulos, C., Byers, T., & Kolyperas, D. (2017). Understanding strategic decision-making through a multi-paradigm perspective: The case of charitable foundations in english football. *Sport, Business and Management: An International Journal*, *7*(1), 2-20. https://doi.org/10.1108/SBM-02-2016-0005

Anagnostopoulos, C., Winand, M., Papadimitriou, D., & Zeimers, G. (2022). Implementing corporate social responsibility through charitable foundations in professional football: the role of trustworthiness. *Managing Sport and Leisure, 29*(5), 771-791. https://doi.org/10.1080/23750472.2022.2096672

Ante, L., Saggu, A., Schellinger, B., & Wazinski, F.-P. (2024). Voting participation and engagement in blockchain-based fan tokens. *Electronic Markets,* 34(26). https://doi.org/10.1007/s12525-024-00709-z

Babiak, K., & Kihl, L. A. (2018). A Case Study of Stakeholder Dialogue in Professional Sport: An Example of CSR Engagement. *Business and Society Review*, *123*(1), 119–149. https://doi.org/10.1111/basr.12137

Baker, B., Pizzo, A., & Su, Y. (2022). Non-Fungible Tokens. A Research Primer and Implications for Sports Management. *Sports Innovation Journal*, *3*, 1-15. https://doi.org/10.18060/25636

Bauers, S. B., Adam, S., Fuchs, M., Piotrowski, L., & Hovemann, G. (2024). Conceptualizing sustainable participation in the context of German football supporters. *German Journal of Exercise and Sport Research,* 54, 86–96. https://doi.org/10.1007/s12662-023-00919-1

Beek, R. N., Ernest, M., & Verschurren, J. (2018). Global Football: Defining the Rules of the Changing Game. In S. Chadwick, D. Parnell, P. Widdop, & C. Anagnostopoulos (Eds.), *Routledge Handbook of Football Business and Management* (pp. 20-32). Routledge. https://doi.org/10.4324/9781351262804

Behl, A., Pereira, V., Nigam, A., Wamba, S., & Sindhwani, R. (2023). Knowledge development in non-fungible tokens (NFT): a scoping review. *Journal of Knowledge Management*, *28*(1), 232-267. https://doi.org/10.1108/JKM-12-2022-0937

Beloskar, V. D., Haldar, A., & Nageswara Rao, S. V. D. (2023). Socially responsible investments: A retrospective review and future research agenda. *Business Strategy and the Environment, 32*(7), 4841-4860. https://doi.org/10.1002/bse.3396

Blumrodt, J., Desbordes, M., & Bodin, D. (2013). Professional football clubs and corporate social responsibility. *Sport, Business and Management*, *3*(3), 205-225. https://doi.org/10.1108/SBM-04-2011-0050

Breitbarth, T., Walzel, S., Anagnostopoulos, C., & van Eekeren, F. (2015). Corporate social responsibility and governance in sport: "Oh, the things you can find, if you don't stay behind!". *Corporate Governance*, *15*(2), 254-273. https://doi.org/10.1108/CG-02-2015-0025

Capelle-Blancard, G., & Petit, A. (2019). Every Little Helps? ESG News and Stock Market Reaction. *Journal of Business Ethics*, *157*(2), 543-565. https://doi.org/10.1007/s10551-017-3667-3

Carlsson-Wall, M., Kraus, K., & Messner, M. (2016). Performance measurement systems and the enactment of different institutional logics: Insights from a football organization. *Management Accounting Research,* 32, 45-61. https://doi.org/10.1016/j.mar.2016.01.006

Centorrino, G., Naciti, V., & Rupo, D. (2022). A new era of the music industry? Blockchain and value co-creation: the Bitsong case study. *European Journal of Innovation Management, 26*(7), 65-85. https://doi.org/10.1108/EJIM-07-2022-0362

Chen, C. (2024). Contesting fan tokens under crypto-capitalism: how sport NFT furthers the hypercommodification of fandom. *International Journal of Sports Marketing and Sponsorship*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/IJSMS-03-2023-0057

Cifuentes-Faura, J. (2022). Efficiency and transparency of Spanish football clubs: A non parametric approach. *Managerial and Decision Economics, 43*(6), 1850-1860. https://doi.org/10.1002/mde.3492

Cleland, J. A. (2010). From passive to active: the changing relationship between supporters and football clubs. *Soccer & Society*, *11*(5), 537-552. https://doi.org/10.1080/14660970.2010.497348

Cooke, P., Nunes, S., Oliva, S., & Lazzeretti, L. (2022). Open innovation, soft branding and green influencers: Critiquing 'fast fashion'and 'overtourism'. *Journal of Open Innovation: Technology, Market, and Complexity, 8*(1), 52. https://doi.org/10.3390/joitmc8010052

Солнцев, И., Алексеева, А., & Сусов, Я. (2022). New Financial Tools in Sport: NFTs and Fan Tokens. *Journal of Corporate Finance Research*, *16*(2), 107-119. https://doi.org/10.17323/j.jcfr.2073-0438.16.2.2022.107-119

Daddi, T., Khan, O., Marrucci, L., & Iraldo, F. (2024). Investigating the role of stakeholders in leveraging sustainability strategies in sports. *European Sport Management Quarterly*, 1-20. https://doi.org/10.1080/16184742.2024.2317784

Daddi, T., Todaro, N. M., Iraldo, F., & Frey, M. (2021). Institutional pressures on the adoption of environmental practices: a focus on European professional football. *Journal of Environmental planning and management*, 1-23. https://doi.org/10.1080/09640568.2021.1927679

Demir, E., Ersan, O., & Popesko, B. (2022). Are fan tokens fan tokens?. *Finance Research Letters*, *47,* 102736. https://doi.org/10.1016/j.frl.2022.102736

Deng, S., Zhu, Y., Yu, Y., & Huang, X. (2024). An integrated approach of ensemble learning methods for stock index prediction using investor sentiments. *Expert Systems with Applications*, *238*, 121710. https://doi.org/10.1016/j.eswa.2023.121710

Dhingra, B., Batra, S., Aggarwal, V., Yadav, M., & Kumar, P. (2024). Stock market volatility: a systematic review. *Journal of Modelling in Management, 19*(3), 925-952. https://doi.org/10.1108/JM2-04-2023-0080

Ersan, O., Demir, E., & Assaf, A. (2022). Connectedness among fan tokens and stocks of football clubs. *Research in International Business and Finance*, *63*, 101780. https://doi.org/10.1016/j.ribaf.2022.101780

Evans, S. (2021, March 2). *Blockchain sports firm Chiliz to invest $50 million in U.S expansion*. Reuters. https://www.reuters.com/technology/soccer-blockchain-sports-firm-chiliz-invest-50-million-us-expansion-2021-03-02/

Fathy, D., Elsharnouby, M. H., & AbouAish, E. (2022). Fans behave as buyers? Assimilate fan-based and team-based drivers of fan engagement. *Journal of Research in Interactive Marketing, 16*(3), 329-345. https://doi.org/10.1108/JRIM-04-2021-0107

Freeman, R. E., & Phillips, R. A. (2002). Stakeholder Theory: A Libertarian Defense. *Business Ethics Quarterly*, *12*(3), 331-349. https://doi.org/10.2307/3858020

Fühner, J., Schmidt, S. L., & Schreyer, D. (2021). Are diversified football clubs better prepared for a crisis? First empirical evidence from the stock market. *European Sport Management Quarterly, 21*(3), 350-373. https://doi.org/10.1080/16184742.2020.1862273

García, B., & Welford, J. (2015). Supporters and football governance, from customers to stakeholders: A literature review and agenda for research. *Sport Management Review*, *18*(4), 517-528. https://doi.org/10.1016/j.smr.2015.08.006

Giulianotti, R. (2021). Styling Glocalization. In *Globalization/Glocalization: Developments in Theory and Application* (pp. 203-217). Brill. https://doi.org/10.1163/9789004500365_012

Glebova, E. & Madsen, D. Ø. (2024). Twin transformation as a strategic approach in sport management: the synergy of digitalization and sustainability in sports. *Frontiers in Sports and Active Living,* 6. https://orcid.org/10.3389/fspor.2024.1403793

Gödker, K., & Mertins, L. (2018). CSR Disclosure and Investor Behavior: A Proposed Framework and Research Agenda. *Behavioral Research in Accounting*, *30*(2), 37-53. https://doi.org/10.2308/bria-51976

Hallmann, K., Heikkinen, S., & Vehmas, H. (Eds.). (2024). *Management of sport organizations at the crossroad of responsibility and sustainability: Perceptions, Practices, and prospects around the World* (Vol. 25). Springer Nature. https://doi.org/10.1007/978-3-031-52489-9

Hamil, S., & Walters, G. (2010). Financial performance in English professional football: "an inconvenient truth". *Soccer & Society*, *11*(4), 354-372. https://doi.org/10.1080/14660971003780214

Hasan Gözkonan, Ü., Yıldız, S. B., & Bayram, E. (2022). The Impact of COVID-19 on Football Industry: Implications and Future Perspectives. In *Industry 4.0 and Global Businesses* (pp. 153-161). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80117-326-120211011

Houben, R., van de Vijver, A., Appermont, N., & Verachtert, G. (2021, October). Taxing professional football in the EU - A comparative and EU analysis of a sector with tax gaps. *Publication for the Economic and Monetary Affairs Subcommittee on Tax Matters (FISC), Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament*. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695451/IPOL_STU(2021)695451_EN.pdf

Hugaerts, I., Scheerder, J., Helsen, K., Corthouts, J., Thibaut, E., & Könecke, T. (2021), Sustainability in participatory sports events: The development of a research instrument and empirical insights. *Sustainability*, *13*(11), 1-16. https://doi.org/10.3390/su13116034

Hyatt, C. G., Sutton, W. A., Foster, W. M., & McConnell, D. (2013). Fan involvement in a professional sport team's decision making. *Sport, Business and Management: An International Journal*, *3*(3), 189-204. https://doi.org/ 10.1108/SBM-Aug-2011-0071

Ingrassia, M., Bellia, C., Giurdanella, C., Columba, P., & Chironi, S. (2022). Digital influencers, food and tourism – A new model of open innovation for businesses in the Ho. Re. Ca. sector. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(1), 50. https://doi.org/10.3390/joitmc8010050

Inoue, Y., Mahan III, J. E., & Kent, A. (2013). Enhancing the benefits of professional sport philanthropy: The roles of corporate ability and communication strategies. *Sport Management Review, 16*(3), 314-324. https://doi.org/10.1016/j.smr.2012.10.003

Jaeger, J. (2021). Football fans and stakeholder theory – A qualitative approach to classifying fans in Germany. *Sport, Business and Management: An International Journal*, *11*(5), 598-619. https://doi.org/10.1108/SBM-11-2020-0127

Jenkins, H., & James, L. (2012). *It's not just a game: community work in the UK football industry and approaches to corporate social responsibility.* Centre for Business Relationships Accountability Sustainability and Society.

Juventus. (2023). *Sustainability.* http://www.juventus.com/en/club/sustainability/

Kihl, L., Babiak, K., & Tainsky, S. (2014). Evaluating the Implementation of a Professional Sport Team's Corporate Community Involvement Initiative. *Journal of Sport Management*, *28*(3), 324-337. https://doi.org/10.1123/jsm.2012-0258

Kolyperas, D., & Sparks, L. (2011). Corporate social responsibility (CSR) communications in the G-25 football clubs. *International Journal of Sport Management and Marketing*, *10*(1-2), 83-103. https://doi.org/10.1504/IJSMM.2011.043612

Kugler, L. (2021). Non-fungible tokens and the future of art. *Communications of the ACM*, *64*(9), 19–20. https://doi.org/10.1145/3474355

Kulczycki, W., & Koenigstorfer, J. (2016). Doing good in the right place: city residents' evaluations of professional football teams' local (vs. distant) corporate social responsibility activities. *European Sport Management Quarterly*, 16(4), 502-524. https://doi.org/10.1080/16184742.2016.1164736-

Manoli, A. E. (2015). Promoting Corporate Social Responsibility in the Football Industry. *Journal of Promotion Management*, *21*(3), 335-350. https://doi.org/10.1080/10496491.2015.1021501

Manoli, A. E., & Hodgkinson, I. R. (2021). Exploring internal organisational communication dynamics in the professional football industry. *European Journal of Marketing*, *55*(11), 2894-2916. https://doi.org/10.1108/EJM-05-2019-0422

Marrucci, L., Daddi, T., & Iraldo, F. (2023). *Sustainable Football: Environmental Management in Practice*. Routledge. https://doi.org/10.4324/9781003228271

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of who and What Really Counts. *Academy of Management Review*, *22*(4), 853-886. https://doi.org/10.2307/259247

Morrow, S. (2023). Football Clubs: Who Are the People? In *The People's Game?* (pp. 163–209). Palgrave Macmillan. https://doi.org/10.1007/978-3-031-20932-1_4

Myung, W. (2024). Conceptualization of ESG Management Values of Professional Sports Clubs: From Consumers' Perspective. *Sustainability*, *16*(17), 7257. https://doi.org/10.3390/su16177257

Numerato, D., & Giulianotti, R. (2018). Citizen, consumer, citimer: The interplay of market and political identities within contemporary football fan cultures. *Journal of Consumer Culture, 18*(2), 336-355. https://doi.org/10.1177/1469540517744692

Pal Singh, G., Chakraborty, A., & Arora, S. D. (2023). Uncovering the knowledge structure of the fan-sporting object relationship: a bibliometric analysis. *Sport Management Review*, *26*(2), 181-202. https://doi.org/10.1080/14413523.2021.2014183

Palma-Ruiz, J. M., Castillo-Apraiz, J., & Gómez-Martínez, R. (2020). Socially Responsible Investing as a Competitive Strategy for Trading Companies in Times of Upheaval Amid COVID-19: Evidence from Spain. *International Journal of Financial Studies*, *8*(3), 41. https://doi.org/10.3390/ijfs8030041

Pandita, D., & Vapiwala, F. (2023). Waving the flames of fan engagement: strategies for coping with the digital transformation in sports organizations. *Journal of Strategy and Management*, *17*(3), 427-443. https://doi.org/10.1108/JSMA-02-2022-0041

Plumley, D., Wilson, R., & Ramchandani, G. (2017). Towards a model for measuring holistic performance of professional Football clubs. *Soccer & Society, 18*(1), 16-29. https://doi.org/10.1080/14660970.2014.980737

Preget, L. (2023). A conceptual framework for understanding the learning processes integral to the development of responsible management practice. *Journal of Management Development*, *42*(2), 125-140. https://doi.org/10.1108/JMD-07-2022-0181

Raimo, N., Vitolla, F., Nicolò, G., & Tartaglia Polcini, P. (2021). CSR disclosure as a legitimation strategy: evidence from the football industry. *Measuring Business Excellence*, *25*(4), 493-508. https://doi.org/10.1108/MBE-11-2020-0149

Rao, A., Gupta, M., Sharma, G. D., Mahendru, M., & Agrawal, A. (2022). Revisiting the financial market interdependence during COVID-19 times: a study of green bonds, cryptocurrency, commodities and other financial markets. *International Journal of Managerial Finance*, *18*(4), 725-755. https://doi.org/10.1108/IJMF-04-2022-0165

Ribeiro, J., Branco, M. C., & Ribeiro, J. A. (2019). The corporatisation of football and CSR reporting by professional football clubs in Europe. *International Journal of Sports Marketing and Sponsorship*, *20*(2), 242-257. https://doi.org/10.1108/IJSMS-05-2017-0039

Rodriguez-Pomeda, J., Casani, F., & Alonso-Almeida, M. D. M. (2017). Emotions' management within the Real Madrid football club business model. Soccer & Society, *18*(4), 431-444. https://doi.org/10.1080/14660970.2014.980736

Rohde, M., & Breuer, C. (2017). The market for football club investors: a review of theory and empirical evidence from professional European football. *European Sport Management Quarterly*, *17*(3), 265-289. https://doi.org/10.1080/16184742.2017.1279203

Romero-Jara, E., Solanellas, F., López-Carril, S., Kolyperas, D., & Anagnostopoulos, C. (2024). The more we post, the better? A comparative analysis of fan engagement on social media profiles of football leagues. *International Journal of Sports Marketing and Sponsorship, 25*(3), 578-599. https://doi.org/10.1108/IJSMS-12-2023-0252

Romero-Jara, E., Solanellas, F., Muñoz, J., & López-Carril, S. (2023). Connecting with fans in the digital age: an exploratory and comparative analysis of social media management in top football clubs. *Humanities and Social Sciences Communications, 10*, 858. https://doi.org/10.1057/s41599-023-02357-8

Senaux, B. (2008). A stakeholder approach to football club governance. *International Journal of Sport Management and Marketing*, *4*(1), 4–17. https://doi.org/10.1504/IJSMM.2008.017655

Shtudiner, Z., Tohar, G., & Kantor, J. (2022). The effect of identification with a sports team and its performance on the willingness of fans to pay for team products. *Managerial and Decision Economics, 43*(3), 607-615. https://doi.org/10.1002/mde.3405

Tachis, S., & Tzetzis, G. (2015). The Relationship Among Fans' Involvement, Psychological Commitment, and Loyalty in Professional Team Sports. *International Journal of Sport Management, Recreation* and *Tourism*, *18*, 1-25. https://doi.org/10.5199/IJSMART-1791-874X-18A

Tapp, A. (2004). The loyalty of football fans – We'll support you evermore? *Journal of Database Marketing* and *Customer Strategy Management*, 11, 203-215. https://doi.org/10.1057/palgrave.dbm.3240221

Tettamanzi, P., Grazioli, F., & Murgolo, M. (2024). The quest for sustainable sports management: evidence from the football industry. Sport, Business and Management: An International Journal, *14*(2), 261-286. https://doi.org/10.1108/SBM-04-2023-0048

Uhrich, S. (2021). Antecedents and consequences of perceived fan participation in the decision making of professional European football clubs. *European Sport Management Quarterly*, *21*(4), 504-523. https://doi.org/10.1080/16184742.2020.1757734

Vale, L., & Fernandes, T. (2018). Social media and sports: driving fan engagement with football clubs on Facebook. *Journal of Strategic Marketing*, *26*(1), 37-55. https://doi.org/10.1080/0965254X.2017.1359655

Walker, M., & Kent, A. (2009). Do Fans Care? Assessing the Influence of Corporate Social Responsibility on Consumer Attitudes in the Sport Industry. *Journal of Sport Management*, *23*(6), 743-769. https://doi.org/10.1123/jsm.23.6.743

Walker, M., & Parent, M. M. (2010). Toward an integrated framework of corporate social responsibility, responsiveness, and citizenship in sport. *Sport Management Review*, *13*(3), 198-213. https://doi.org/10.1016/j.smr.2010.03.003

Walters, G., & Chadwick, S. (2009). Corporate citizenship in football: delivering strategic benefits through stakeholder engagement. *Management Decision*, *47*(1), 51-66. https://doi.org/10.1108/00251740910929696

Walters, G., & Tacon, R. (2010). Corporate social responsibility in sport: Stakeholder management in the UK football industry. *Journal of Management* and *Organization*, *16*(4), 566-586. https://doi.org/10.5172/jmo.2010.16.4.566

Wilson, R., Plumley, D., & Ramchandani, G. (2013). The relationship between ownership structure and club performance in the English Premier League. *Sport, Business and Management: An International Journal*, *3*(1), 19-36. https://doi.org/10.1108/20426781311316889

Zeimers, G., Anagnostopoulos, C., Zintz, T., & Willem, A. (2019). Corporate social responsibility (CSR) in football. In S. Chadwick, D. Parnell, P. Widdop, & C. Anagnostopoulos (Eds.), *Routledge Handbook of Football Business and Management* (pp. 114-130). Routledge. https://doi.org/10.4324/9781351262804

APPENDIX

OLS models estimated for H1

Model 1: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_PORTO

	Coefficient	Std. error	t statistic	p value
Const	0.6936200	0.7246610	0.9572	0.3407
R_PORTO_FT	−0.0507253	0.0500070	−1.0140	0.3128

Mean dependent var	0.664712	S.D. dependent var	7.385440
Sum squared resid	5561.999	S.E. of regression	7.384403
R-cuadrado	0.009987	Adjusted R-squared	0.000281
F(1, 102)	1.028934	P value (F)	0.312809
Log-likelihood	−354.4943	Akaike criterion	712.9887
Schwarz criterion	718.2775	Crit. de Hannan-Quinn	715.1313
Rho	−0.424421	Durbin–Watson	2.828240

Source: Authors' own research.

Model 2: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_LAZI

	Coefficient	Std. error	t statistic	p value
Const	−0.2368070	0.2777580	−0.8526	0.3959
R_LAZI_FT	0.0493726	0.0191876	2.5730	0.0115**

Mean dependent var	−0.228846	S.D. dependent var	2.908676
Sum squared resid	818.3025	S.E. of regression	2.832415
R-cuadrado	0.060956	Adjusted R-squared	0.051750
F(1, 102)	6.621118	P value (F)	0.011516
Log-likelihood	−254.8373	Akaike criterion	513.6747
Schwarz criterion	518.9635	Hannan-Quinn	515.8173
Rho	−0.296269	Durbin–Watson	2.580803

Source: Authors' own research.

Model 3: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_JUV

	Coefficient	Std. error	t statistic	p value
Const	−0.1116350	0.5583460	−0.1999	0.8419
R_JUV_FT	0.0193179	0.0492561	0.3922	0.6957

Mean dependent var	−0.123077	S.D. dependent var	5.662852
Sum squared resid	3298.020	S.E. of regression	5.686258
R-cuadrado	0.001506	Adjusted R-squared	−0.008283
F(1, 102)	0.153816	P value (F)	0.695733
Log-likelihood	−327.3173	Akaike criterion	658.6346
Schwarz criterion	663.9234	Hannan-Quinn	660.7773
Rho	−0.084281	Durbin–Watson	2.163598

Source: Authors' own research.

Model 4: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_GALA

	Coefficient	Std. error	t statistic	p value
Const	1.583220	0.8569750	1.847	0.0676*
R_GALA_FT	0.128464	0.0711605	1.805	0.0740*

Mean dependent var	1.572115	S.D. dependent var	8.834554
Sum squared resid	7790.179	S.E. of regression	8.739239
R-cuadrado	0.030962	Adjusted R-squared	0.021461
F(1, 102)	3.258985	P value (F)	0.073983
Log-likelihood	−372.0135	Akaike criterion	748.0270
Schwarz criterion	753.3157	Hannan-Quinn	750.1696
Rho	−0.012729	Durbin–Watson	2.020212

Source: Authors' own research.

Model 5: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_TRA

	Coefficient	Std. error	t statistic	p value
Const	0.0404255	0.6857880	0.05895	0.9531
R_TRA_FT	0.1400930	0.0485897	2.88300	0.0048***

Mean dependent var	−0.052885	S.D. dependent var	7.229644
Sum squared resid	4977.893	S.E. of regression	6.985905
R-cuadrado	0.075356	Adjusted R-squared	0.066291
F(1, 102)	8.312749	P value (F)	0.004802
Log-likelihood	−348.7249	Akaike criterion	701.4498
Schwarz criterion	706.7386	Hannan-Quinn	703.5925
Rho	0.000250	Durbin–Watson	1.914165

Source: Authors' own research.

Model 6: OLS, using observations 2022-01-03:2023-12-25 (T = 104)
Dependent variable: R_FB

	Coefficient	Std. error	t statistic	p value
Const	1.832030	0.837190	2.188	0.0309**
R_FB_FT	0.336796	0.117391	2.869	0.0050***

Mean dependent var	1.494038	S.D. dependent var	8.744433
Sum squared resid	7287.792	S.E. of regression	8.452747
R-cuadrado	0.074672	Adjusted R-squared	0.065601
F(1, 102)	8.231241	P value (F)	0.005005
Log-likelihood	−368.5470	Akaike criterion	741.0940
Schwarz criterion	746.3828	Hannan-Quinn	743.2366
Rho	−0.050768	Durbin–Watson	2.087183

Source: Authors' own research.

OLS models estimated for H2

Model 7: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_PORTO

	Coefficient	Std. error	t statistic	p value
Const	0.636158	0.733331	0.8675	0.3877
R_PORTO_FT_1	0.0384218	0.0503621	0.7629	0.4473

Mean dependent var	0.658544	S.D. dependent var	7.421285
Sum squared resid	5585.511	S.E. of regression	7.436537
R-squared	0.005730	Adjusted R-squared	−0.004115
F(1, 101)	0.582035	P value (F)	0.447294
Log-likelihood	−351.8006	Akaike criterion	707.6012
Schwarz criterion	712.8706	Hannan-Quinn	709.7355
Rho	−0.434075	Durbin–Watson	2.737715

Source: Authors' own research.

Model 8: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_LAZI

	Coefficient	Std. error	t statistic	p value
Const	−0.237463	0.2881510	−0.8241	0.4118
R_LAZI_FT_1	−0.0170633	0.0198099	−0.8614	0.3911

Mean dependent var	−0.240388	S.D. dependent var	2.920505
Sum squared resid	863.6496	S.E. of regression	2.924207
R-squared	0.007292	Adjusted R-squared	−0.002537
F(1, 101)	0.741924	P value (F)	0.391085
Log-likelihood	−255.6622	Akaike criterion	515.3245
Schwarz criterion	520.5939	Hannan-Quinn	517.4588
Rho	−0.312775	Durbin–Watson	2.612893

Source: Authors' own research.

Model 9: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_JUV

	Coefficient	Std. error	t statistic	p value
Const	−0.1746700	0.5622140	−0.3107	0.7567
R_JUV_FT_1	−0.0241300	0.0493718	−0.4887	0.6261

Mean dependent var	−0.160874	S.D. dependent var	5.677346
Sum squared resid	3279.933	S.E. of regression	5.698647
R-squared	0.002359	Adjusted R-squared	−0.007518
F(1, 101)	0.238867	P value (F)	0.626085
Log-likelihood	−324.3844	Akaike criterion	652.7688
Schwarz criterion	658.0383	Hannan-Quinn	654.9031
Rho	−0.072747	Durbin–Watson	2.140069

Model 10: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_GALA

	Coefficient	Std. error	t statistic	p value
Const	1.559880	0.8646130	1.804	0.0742*
R_GALA_FT_1	0.131142	0.0715020	1.834	0.0696*

Mean dependent var	1.554466	S.D. dependent var	8.875912
Sum squared resid	7776.730	S.E. of regression	8.774812
R-squared	0.032233	Adjusted R-squared	0.022651
F(1, 101)	3.363955	P value (F)	0.069582
Log-likelihood	−368.8450	Akaike criterion	741.6900
Schwarz criterion	746.9595	Hannan-Quinn	743.8244
Rho	0.004859	Durbin–Watson	1.985062

Source: Authors' own research.

Model 11: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_TRA

	Coefficient	Std. error	t statistic	p value
Const	−0.152509	0.6678570	−0.2284	0.8198
R_TRA_FT_1	0.134802	0.0470953	2.8620	0.0051***

Mean dependent var	−0.240680	S.D. dependent var	7.005460
Sum squared resid	4630.209	S.E. of regression	6.770794
R-squared	0.075031	Adjusted R-squared	0.065873
F(1, 101)	8.192857	P value (F)	0.005113
Log-likelihood	−342.1405	Akaike criterion	688.2811
Schwarz criterion	693.5505	Hannan-Quinn	690.4154
Rho	0.039302	Durbin–Watson	1.899367

Source: Authors' own research.

Model 12: OLS, using observations 2022-01-10:2023-12-25 (T = 103)
Dependent variable: R_FB

	Coefficient	Std. error	t statistic	p value
Const	1.709710	0.853714	2.003	0.0479**
R_FB_FT_1	0.279342	0.119658	2.334	0.0215**

Mean dependent var	1.445146	S.D. dependent var	8.772896
Sum squared resid	7448.390	S.E. of regression	8.587574
R-squared	0.051197	Adjusted R-squared	0.041802
F(1, 101)	5.449867	P value (F)	0.021549
Log-likelihood	−366.6234	Akaike criterion	737.2468
Schwarz criterion	742.5163	Hannan-Quinn	739.3811
Rho	0.037005	Durbin–Watson	1.914914

Source: Authors' own research.

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Exploring the Frontier: Generative AI Applications in Online Consumer Behavior Analytics

Explorando la frontera: Aplicaciones generativas de la IA en el análisis del comportamiento de los consumidores en línea

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ABSTRACT

This paper presents a systematic review of the application of generative artificial intelligence (AI) in online consumer behavior analytics (OCBA). With the advent of e-commerce and social media, consumer behavior increasingly occurs online, generating vast amounts of data. This shift necessitates advanced analytical tools, and generative AI emerges as a pivotal technology. Generative AI, distinct from traditional AI, can autonomously generate new content based on learned data patterns, offering innovative approaches to OCBA. Based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology and data synthesis method proposed by Webster and Watson (2002), this study analyzes 28 peer-reviewed papers, focusing on how generative AI is applied in OCBA and how it can enhance OCBA performance. The findings show that generative adversarial networks (GANs) are the most used, followed by variational autoencoders (VAEs) and autoregressive models. This review categorizes the application areas of generative AI in OCBA and examines how these technologies enhance OCBA's effectiveness and efficiency. Furthermore, the paper discusses the challenges associated with generative AI, emphasizing the need to consider ethical issues, such as bias and data privacy. This comprehensive review contributes to a deeper understanding of generative AI's role in OCBA, outlining its applications and functionalities from a technical perspective. It guides future research and practice, highlighting areas for further exploration and improvement in leveraging generative AI for consumer behavior analytics.

Keywords: Generative artificial intelligence, Generative adversarial network, Variational autoencoders, Autoregressive model, Generative pre-trained transformer, Online consumer behavior analytics.

RESUMEN

Este artículo presenta una revisión sistemática de la aplicación de la IA generativa en el Análisis del Comportamiento del Consumidor Online (OCBA). Con la llegada del comercio electrónico y las redes sociales, el comportamiento de los consumidores se produce cada vez más en línea, lo que genera enormes cantidades de datos. Este cambio requiere herramientas analíticas avanzadas, y la IA generativa emerge como una tecnología fundamental. La IA generativa, distinta de la IA tradicional, puede generar de forma autónoma nuevos contenidos basados en patrones de datos aprendidos, ofreciendo enfoques innovadores a la OCBA. Basado en la metodología PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) y el método de síntesis de datos propuesto por Webster y Watson (2002), este estudio analiza 28 artículos revisados por pares, centrándose en cómo se aplica la IA generativa en OCBA y cómo puede mejorar el rendimiento de OCBA. Los resultados muestran que las redes generativas adversariales (GAN) son las más utilizadas, seguidas de los autocodificadores variacionales (VAE) y los modelos autorregresivos. La revisión clasifica las áreas de aplicación de la IA generativa en OCBA y examina cómo estas tecnologías mejoran la eficacia y la eficiencia de OCBA. Además, el artículo analiza los retos asociados a la IA generativa, haciendo hincapié en la necesidad de tener en cuenta cuestiones éticas como la parcialidad y la privacidad de los datos. Esta revisión contribuye a una comprensión más profunda del papel de la IA generativa en la OCBA, esbozando sus aplicaciones y funcionalidades desde una perspectiva técnica.

Palabras clave: Inteligencia artificial generativa, Redes generativas adversariales, Autocodificadores variacionales, Modelo autorregresivo, Transformador generativo preentrenado, Análisis del comportamiento del consumidor online..

1. INTRODUCTION

With the rise of e-commerce and the proliferation of social media, consumer behavior is increasingly taking place online. This trend was accelerated by the COVID-19 pandemic (Sajid *et al.*, 2022). Online purchasing decreases consumers' travel time, and offers wider product choice and easier price comparisons (Jiang *et al.*, 2013). As online consumption becomes increasingly common, businesses need to discover patterns in online consumer behavior and accurately predict future behavior to make optimal offers at the right time to maximize profits.

Online consumer behavior includes touchpoints such as web searches, social media interactions, and posting online reviews. These activities rapidly generate vast amounts of data on consumer behavior. The data can be used to discern consumer behavior patterns, predict future consumer behavior, and form strategies tailored to specific audiences (Anshari *et al.*, 2019). Thus, organizational competence for online consumer behavior analytics (OCBA), an analytic method to discover patterns in online consumer behavior, can determine an organization's competitiveness.

The emergence of generative Artificial Intelligence (AI) has been touted as the most thrilling innovation in AI in history. The release of ChatGPT in 2023 focused the public's attention on generative AI and dramatically raised the profile of AI in general. While traditional AI excels at analysis and prediction based on existing data, generative AI marks a revolutionary shift in AI's creative capabilities. It autonomously generates new content based on patterns found in the data it is trained on.

The use of generative AI in OCBA has previously been discussed in the literature and research on generative AI algorithms for OCBA is ongoing. However, prior research has yet to provide a systematic view of how generative AI algorithms and their core technologies are utilized in OCBA and how they contribute to improving the performance of these analytic methods. Therefore, this paper systematically reviews prior research on using generative AI in OCBA from a technical perspective. Specifically, we review the OCBA areas where generative AI has been developed and applied in previous studies. We also systematically identify the mechanisms by which generative AI enhances the effectiveness and efficiency of OCBA.

The subsequent chapters of this paper are organized as follows. Chapter 2 outlines the differences between generative AI and traditional AI, describes the main generative AI algorithms, and presents the research questions this review addresses. Chapter 3 describes the methodology of the systematic review. Chapter 4 answers the research questions using a systematic synthesis of previous studies. Chapter 5 summarizes the findings and discusses the limitations of this study and implications for future research and practice.

2. GENERATIVE AI FOR OCBA

2.1. Machine learning and its application to OCBA

Consumer behavior research has traditionally been conducted through observational studies, focus groups, and questionnaire-based surveys. A drawback of observational studies and focus groups is that they are time-consuming and expensive to conduct (Breen, 2006; Grove & Fisk, 1992). Furthermore, these methods often have small sample sizes, so the results may not represent populations. In contrast, questionnaire surveys are quicker and cheaper, allowing for large sample sizes. However, because questionnaires are generally self-reported, they are subject to social desirability bias that may prevent participants from giving honest and accurate responses (Kimura, 2023).

As more and more consumer behavior occurs online, new opportunities for consumer behavior analytics have emerged. Every click, purchase, and online interaction on online platforms generates enormous amounts of data. Additionally, companies can now collect continuously generated and updated data in real-time. Moreover, the collected data is not limited to numerical information but can include diverse modes such as language, images, audio, and video. This variety and volume of data have enabled and increased the importance of data-driven decision-making.

Machine learning, an artificial intelligence (AI) technique, enables machines to learn from data without detailed programming (Samuel, 1959). Machine learning technologies can learn from massive amounts of data, gain meaningful insights, and make predictions and decisions. The most notable strength of machine learning compared to traditional statistical analysis is its adaptable autonomous learning ability. In traditional statistical analysis, the analyst must formulate a mathematical model in advance based on a hypothesis or research question. In contrast, machine learning models can autonomously find patterns in the data and discover relationships among variables that were not apparent *a priori*. This strength of machine learning is critical when there are complex, nonlinear relationships among variables and when the data is unstructured.

Because of its dynamic nature, machine learning can obtain insights from continuously (sometimes real-time) updated data. Thus, machine learning has been applied to various consumer behavior analytics such as customer segmentation, customer churn prediction, sentiment analysis, and personalized recommendation (Ngai & Wu, 2022; Policarpo *et al.*, 2021).

2.2. Generative AI

The emergence of generative AI has brought about recent innovations in OCBA (Baek, 2023). Generative AI is a program that can create new content, such as text, images, music, and videos, after being trained on large datasets. Generative AI differs from traditional AI in that it can go beyond data analysis and prediction and generate novel creations. There are various algorithms for developing generative AI. Popular options include energy-based models (EBMs), generative adversarial networks (GANs), variational autoencoders (VAEs), autoregressive models, and normalizing flows (Bond-Taylor *et al.*, 2022).

A. EBMs

An EBM is a generative model that learns underlying data distribution from a sample dataset and generates similar data-

sets. The critical components of EBMs are an energy function and a partition function (Sun *et al.*, 2021). The energy function is a scalar function that assigns an energy value to each possible configuration of the input data. The energy value represents the compatibility between the observed and latent variables. If the energy value is large, the configuration of the observed and latent variables is less compatible. The energy function is trained to assign low energy values to the actual data and high energy values to the generated data, whereas, the partition function is trained to normalize the energy values.

B. GANs

GANs are neural networks that can generate new data by learning from existing data (Goodfellow *et al.*, 2020). GANs consist of two networks: a generator and a discriminator (Pan *et al.*, 2019). The generator network is trained to generate new data similar to the existing data, whereas the discriminator network is trained to distinguish between the existing and generated data. These networks are trained together in an adversarial process, where the generator network tries to create improved data, and the discriminator network tries to identify the generated data. As the network's training proceeds, the generator gets better at generating fake data that is hard to distinguish from real data, and the discriminator becomes more proficient at identifying the fake data.

C. VAEs

VAEs are generative AIs that merge elements from statistics and information theory with the flexibility of deep neural networks to address the generation problem for high-dimensional data (Asperti *et al.*, 2021). VAEs are a type of autoencoder that learn from a compressed representation of the input data, called the latent space, and generate new data by sampling it. By compressing the input data into a lower-dimensional representation, VAEs learn from an efficient and compact representation of the input data, which can be used to generate new data similar to the training data. VAEs are trained using a probabilistic approach, where the model learns to maximize the likelihood of the training data, that is, achieve a good approximation of the true posterior distribution (Notin *et al.*, 2021).

D. Autoregressive models

Autoregressive models generate new data by modeling each data point as a function of the previous data points in the sequence (Postolache *et al.*, 2023). They define a probability distribution over a data-point sequence and then sample it to generate new data points. The probability distribution is learned by maximizing the likelihood of the training data. Unlike GANs and VAEs, autoregressive models do not require any additional networks or representations. They model each data point as a function of the previous data points in the sequence.

The generative pre-trained transformer (GPT) is an autoregressive model that generates new text by modeling each token in the sequence as a function of the previous tokens (Floridi & Chiriatti, 2020). Its foundation lies in the transformer (Vaswani *et al.*, 2017), which enables the prediction model to focus on different parts of the input sequence (Radford *et al.*, 2018). More specifically, the self-attention mechanism in the transformer architecture enables the model to capture dependencies between different tokens in the input sequence, which is crucial for generating coherent and meaningful text.

E. Normalizing flows

Normalizing flows generate new data by transforming a simple base distribution into a complex target distribution using a series of invertible transformations (Papamakarios *et al.*, 2021). These transformations are designed to be computationally efficient and can be used to model complex distributions accurately. Unlike other generative models such as GANs and VAEs, normalizing flows learn a probability distribution over the sequence of data points and then sample it to generate new data points. The probability distribution is learned by maximizing the likelihood of the training data.

2.3. Research gaps and research questions

As noted above, there has been a pronounced interest in applying AI to various OCBA areas, such as personalization and recommendation systems (Kashyap *et al.*, 2022; Necula & Păvăloaia, 2023; Viktoratos & Tsadiras, 2021), sentiment analysis (Almahmood & Tekerek, 2022, Bawack *et al.*, 2022), virtual try-on (Goti *et al.*, 2023), and fraud detection (Policarpo *et al.*, 2021). However, a comprehensive mapping of what generative AI technologies are being utilized in what areas of OCBA has yet to be provided. Moreover, there needs to be a more systematic discussion on how generative AI technologies are expected to enhance the effectiveness of OCBA. Therefore, this paper addresses the following research questions through a systematic literature review.

Research Question 1: In what OCBA areas are generative AI algorithms applied?

Research Question 2: How does the use of generative AI benefit each OCBA area?

3. METHOD

3.1. Review methodology

For the systematic review, this study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology (Rethlefsen *et al.*, 2021). PRISMA is a validated framework that ensures a consistent, reproducible, and high-quality review process. Following the PRISMA guidelines, the systematic review was conducted in several phases (Figure 1), each of which is elaborated upon in the subsequent sections.

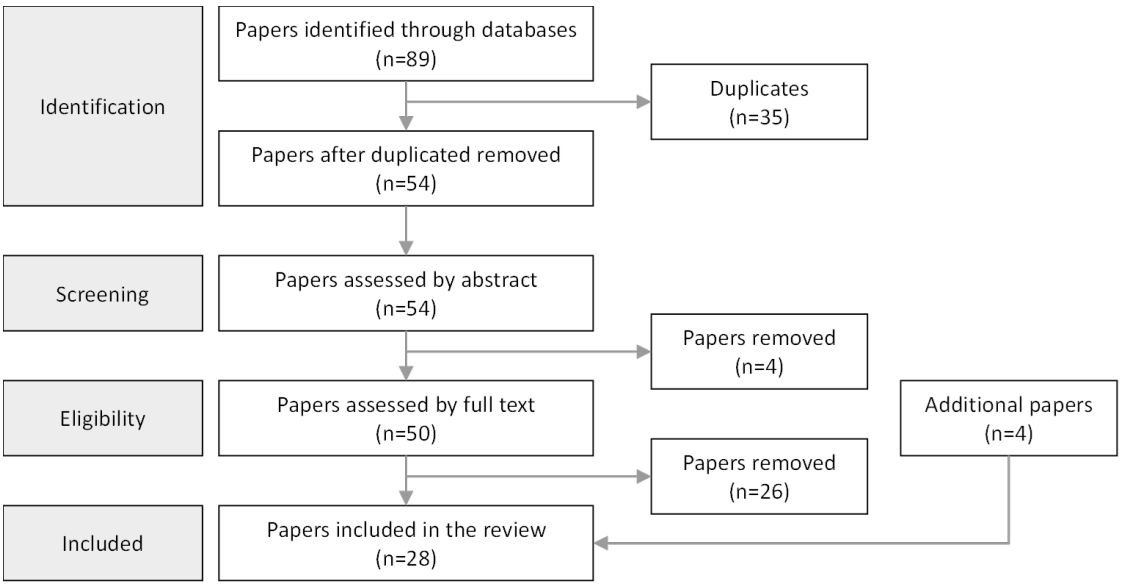

Figure 1
Diagram of identification, screening, and inclusion of studies
Source: This workflow follows (PRISMA) methodology (Rethlefsen *et al.*, 2021).

3.2. Inclusion and exclusion criteria

To provide a structured and exhaustive review, it is pivotal that the studies included are relevant and that non-relevant studies are systematically excluded. The inclusion and exclusion criteria were meticulously crafted to ensure the research questions were addressed adequately.

While various techniques and applications of generative AI have been studied extensively, it is not easy to comprehensively review them in a single paper. Therefore, this study includes only studies that explicitly relate to OCBA. Because of the rapid advancements in generative AI, only papers published within the past five years (i.e., 2019-2023) were included to ensure the review is grounded in contemporary methodologies and insights. Studies had to be published in a peer-reviewed journal to ensure that the current review is based on high-quality and credible research. In addition, the study had to be written in English, the predominant language for scientific communication in this field.

Because the objective of this study was to produce a primary review of model development and evaluation of generative AI for OCBA, theoretical papers, review papers, and editorials were excluded from this review. For the same reason, empirical and experimental research that does not contain generative AI model development was excluded. Further, consistent with the inclusion criteria, conference proceedings, and papers not written in English were excluded.

3.3. Information sources and search strategy

To ensure comprehensive coverage of relevant studies, the review sources in this study were set according to the DARE criteria proposed by the York University Centre for Reviews and Dissemination (CDR). The DARE criteria recommend searching four or more digital libraries and adding additional searches. Therefore, this study conducted article searches using Scopus, Web of Science, IEEE Xplore, and ACM Library, the major article databases in AI research. In addition, articles identified during the review process and meeting this study's objectives were added to the body of work to be reviewed.

In the search, conducted on October 22, 2023, three keywords were used to identify studies related to OCBA: "e-commerce," "online shopping," and "online consumer." To find studies related to generative AI, "energy-based model," "generative adversarial network," "variational autoencoder," "autoregressive model," "normalizing flow," "generative model," "transformer-based model," "transformer architecture," "generative pre-trained transformer," "generative neural network," "generative AI," and "generative artificial intelligence" were used as keywords.

Search formulas were compiled using Boolean operators, with the condition for review inclusion of at least one of the keywords related to OCBA and at least one related to generative AI in either the title, keywords, or abstract. The query was structured as follows:

> ("e-commerce" OR "online shopping" OR "online consumer") AND "energy-based model" OR "generative adversarial network" OR "variational autoencoder" OR "autoregressive model" OR "normalizing flow" OR "transformer-based model" OR "transformer architecture" OR "generative pre-trained transformer" OR "generative model" OR "generative neural network" OR "generative AI" OR "generative artificial intelligence")

3.4. Screening

A total of 89 papers were extracted following the search. The 89 papers were screened to ensure the selected literature was relevant to the research questions. The screening was implemented as a multi-step process to refine the initial pool into a curated set of relevant studies.

First, duplicates, which were single articles extracted from multiple sources, were removed. This step removed 35 duplicates, leaving 54 papers. The next step was to read the abstracts of the remaining articles. At this stage, studies that were unrelated or did not address the integration of generative AI with OCBA were removed. Two editorials and two literature reviews were removed at this stage.

The remaining 50 articles that survived the initial screening were then subjected to a full-text review. Each study was evaluated using the inclusion and exclusion criteria. Of the 50 articles included in the full-text review, 16 did not concern generative AI, and 10 were studies not directly related to OCBA. Following their exclusion, 24 articles were selected for the next step, quality assessment.

3.5. Quality assessment

Quality assessment was conducted using the 14 evaluation items for quantitative studies proposed by Kmet *et al.* (2004). Of these 14 items, five items (3, 4, 5, 6, 7), suitable for clinical trials and controlled experiments but not relevant to AI model development, were excluded. Following the author's scoring method, the remaining nine items were rated on a scale from 0 to 18, with 2 points for Yes, 1 for Partial, and 0 for No for each item. A score of 13 or higher, corresponding to a scoring rate of at least 70% of the 18 points, was set as the cutoff score value for inclusion.

All 24 articles rated as relevant to the full-text review achieved a score above the cutoff in the quality assessment. In addition, four articles were included following reference-list searches, resulting in 28 articles in total for the final review. All of the newly added articles were registered in the Scopus database.

3.6. Data extraction and synthesis

Data extraction and synthesis followed the methodology of Webster and Watson (2002). First, an author matrix was created for each article. The author matrix included the author's name, article title, journal title, publication year, generative AI algorithm, and application area (e.g., recommender system, sentiment analysis). We then created multiple concept matrices based on each research question. The concept matrix summarizes the information extracted from the author matrix and the full-text review.

4. RESULTS

Table 1 groups reviewed papers by the generative AI algorithms used in those papers. Among the 28 papers analyzed, 20 employed GANs, six used VAEs, and three utilized autoregressive models. Notably, Ding *et al.* (2023) combined GANs and VAEs to create VAEGANs. The table outlines the specific areas of OCBA where generative AI was applied and the role of generative AI in enhancing OCBA's effectiveness in each area. The upcoming sections delve into the application areas of each generative AI algorithm (Research Question 1) and the ways in which generative AI improves OCBA in these areas (Research Question 2).

Table 1
Author matrix

Generative AI Algorithm	Papers
GAN	Du *et al.* (2023), Fincato *et al.* (2022), Fiore *et al.* (2019), Guo *et al.* (2023), Hao *et al.* (2022), Li *et al.* (2023), Lu *et al.* (2022), Nabeel *et al.* (2019), Rabbi *et al.* (2023), Roy *et al.* (2022), Singh *et al.* (2020), Terzioğlu *et al.* (2022), Wang *et al.* (2020), Wang & Yang (2021), Wei *et al.* (2023), Zhang, Sun *et al.* (2020), Zhang Sun *et al.* (2021), Zhang, Wang *et al.* (2020), Zhao *et al.* (2020)
VAE	Laenen & Moens (2022), Li *et al.* (2022), Nguyen & Cho (2020), Yu & Grauman (2020), Zhang, Wong *et al.* (2021)
Autoregressive model	Deshai & Bhaskara Rao (2023), Han *et al.* (2023), Perez-Castro *et al.* (2023)
GAN and VAE	Ding *et al.* (2023)

Source: Own elaboration.

4.1. Application areas of generative AI

Table 2 organizes the reviewed studies by algorithm and application area in OCBA. Generative AI was developed and validated in the following 14 OCBA areas.

A. Ad creative generation

Ad creative generation is the process of automatically creating marketing messages and visuals for advertising campaigns. It uses generative AI algorithms to craft ad copy relevant to a product that resonates with the target audience. The ad creative generation process is a text summarization task, where information from product landing pages is condensed into compelling ad copy. This process utilizes abstractive summarization to include novel phrases not found on the landing page but relevant to the content.

B. Anomaly detection

In e-commerce settings, anomaly detection models are developed to detect unusual consumer patterns, which could indicate fraud or market shifts. For instance, Guo *et al.* (2023) developed and tested a generative AI model to identify unusual patterns or outliers in dynamic graphs, which can be observed in activities in social networks and e-commerce. In another study, Li *et al.* (2022) addressed outlier detection, where the model tries to identify data points that significantly deviate from the norm.

Table 2
Application areas of generative AI in OCBA

Application Area	Algorithm		
	GAN	VAE	Autoregressive model
Ad creative generation	Terzioğlu *et al.* (2022)		
Anomaly detection	Guo *et al.* (2023)	Li *et al.* (2022)	
Credit card fraud detection	Ding *et al.* (2023) Fiore *et al.* (2019)	Ding *et al.* (2023)	
Customer behavior prediction	Hao *et al.* (2022)		
Dialogue generation	Nabeel *et al.* (2019)		
Fake review detection (& generation)			Deshai & Bhaskara Rao (2023) Perez-Castro *et al.* (2023)
Identification of authentic product	Rabbi *et al.* (2023)		
Image-based product retrieval	Zhang, Sun *et al.* (2020) Zhan, Sun *et al.* (2021) Zhang, Wang *et al.* (2020)		
Multi-human parsing	Zhao *et al.* (2020)		
Online review summarization			Han *et al.* (2023)
Recommendation system	Lu *et al.* (2022) Singh *et al.* (2020) Wang *et al.* (2020)	Laenen & Moens (2022) Nguyen & Cho (2020) Yu & Grauman (2020) Zhang, Wong *et al.* (2021)	
Sales prediction	Wang & Yang (2021)		
User identity alignment prediction	Wei *et al.* (2023)		
Virtual try-on	Du *et al.* (2023) Fincato *et al.* (2022) Li *et al.* (2023) Roy *et al.* (2022)		

Source: Own elaboration.

C. Credit card fraud detection

Credit card fraud detection can identify fraudulent activities in credit card transactions. This type of fraud can be seen as a binary classification problem, where the model classifies a transaction as fraudulent or non-fraudulent. It is usually an imbalanced classification problem where fraudulent transactions are rare compared to non-fraudulent transactions.

D. Customer behavior prediction

In a study on consumer behavior prediction, Hao *et al.* (2002) developed a model that predicted four customer behaviors: browsing, commenting, reposting, and another unspecified type. These behaviors are influential in the promotion of product information in e-commerce marketing.

E. Dialogue generation

A dialogue management system is a system that manages a conversation with a user, handling tasks like online shopping and booking. The quality of dialogues generated by the system can influence user experience and purchase decision-making.

F. Fake review detection and generation

Fake review detection refers to identifying and classifying reviews that are not genuine or have been manipulated to mislead consumers. The fake review detection model uses machine learning and natural language processing techniques to analyze online reviews for authenticity. In contrast, fake review generation is the creation of misleading opinions that do not reflect the genuine opinion of the author. Improvements in fake review generation by novel generative AI make it increasingly difficult to detect fake reviews.

G. Identification of authentic products

This image-processing task involves verifying the authenticity of a product to prevent fraud. It is especially important in e-commerce where consumers cannot physically examine products.

H. Image-based product retrieval

Image-based product retrieval is a technique to retrieve products from images. It uses computer vision and machine learning techniques to analyze the visual features of images and retrieve visually-similar products. The studies reviewed here processed images to detect and retrieve clothing items from images containing human models.

I. Multi-human parsing

Multi-human parsing is a computer vision task that separates and identifies different persons and objects within an image. Multi-human parsing can enhance the accuracy of product recommendations by analyzing the clothing items worn by people in online images.

J. Online review summarization

Online review summarization refers to the systematic generation of concise summaries of online user reviews that retain essential information. In OCBA, the process is used to extract key themes and sentiments from user feedback to inform product design and development stages.

K. Recommendation system

The recommendation system provides personalized recommendations to customers based on their past behavior, interest, and preferences. The goal of recommendation systems is to improve user experience by providing relevant and useful recommendations tailored to the users' needs.

L. Sales prediction

Sales prediction is a practice of time series forecasting that estimates the future sales volumes of products or services based on historical data and other influencing factors. It can inform business decisions such as inventory management and marketing strategies.

M. User identity alignment prediction

User identity alignment prediction refers to matching users' accounts across e-commerce platforms. It enables a comprehensive view of a user's activities, improving personalized marketing and user experience.

N. Virtual try-on

Virtual try-on is a technique that enables users to try on products digitally using their phones or tablets. It aims to enable clothing trials on e-commerce websites by generating a rendition of a person wearing the clothes that they are viewing on line. Virtual try-on can be used to improve the accuracy of product recommendations by analyzing the clothing items worn by people in the images.

4.2. How generative AI improves OCBA

Table 3 summarizes the generative AI functions that improve the model's performance in each OCBA area. In Table 3, the rows represent the functionality, the columns are the algorithms used in each study, and the application areas and references are noted in the cells. As shown here, the relationship between functionality and algorithm is not one-to-one but many-to-many. One functionality is utilized in multiple application areas and vice versa. The current review identified 12 functionalities. In other words, generative AI can provide 12 OCBA-specific benefits. The following subsections explain these 12 generative AI functionalities, summarizing findings and insights obtained in the review process.

A. Abstractive summarization

Abstractive summarization is a method that leverages language models to generate text in an advanced fashion, similar to human interpretation, rather than simply extracting and linking key sentences or paragraphs from the original text (Nallapati *et al.*, 2016). Han *et al.* (2023) applied a transformer-based model called T5 (text-to-text transfer transformer) to online review summarization. The model leverages a synthetic dataset for fine-tuning, enabling it to handle various granularities and polarities in summarization. In their study, T5 was fine-tuned to generate abstractive summaries that capture user opinions from online reviews, aiding in product design and development.

B. Alleviation of data sparsity problem

Data sparsity refers to a situation where a large proportion of the data is missing or zero. The data sparsity problem can lead to poor model performance because a lack of data can lead to inaccurate predictions (Guo *et al.*, 2022). Notably, collaborative filtering, one of the most popular methods for building recommendation systems, suffers from data sparsity problems (Hu *et al.*, 2023; Margaris *et al.*, 2022).

Lu *et al.* (2022) applied GANs to develop a recommendation system. In their study, GANs created denser datasets by generating samples from the original dataset to enhance the data space, compensating for the lack of information. In another study, Wang *et al.* (2020) applied GANs to improve the prediction of links between items. GAN-based link prediction generates new links in the training data to alleviate data sparsity with synthetic data.

Yu and Grauman (2020) and Zhang, Wong *et al.* (2021) utilized VAEs to address data sparsity problems in building a recommendation system. Like GANs, VAEs were used to generate synthetic training data to compensate for data sparsity. Yu and Grauman (2020) developed Conditional VAE (CVAE) that incorporates conditional variables into the encoder and decoder, enabling it to generate data specific to given conditions. Unlike traditional VAEs, CVAEs can generate targeted data modifications, making them suitable for tasks like attribute manipulation in images. Zhang, Wong *et al.* (2021) developed a hybrid VAE (HVAE), which is an integration of VAE and collaborative filtering. Unlike traditional VAEs that may focus on one-sided content information, HVAE jointly learns the latent representations of content information for both users and items.

Data sparsity can also be a problem in user identity alignment prediction. Wei *et al.* (2023) developed Double-GAN to address data sparsity. Their model utilized data from a base platform and also from heterogeneous e-commerce platforms. Its two-layer iterative mechanism enabled the model to match users' accounts across different platforms effectively, enhancing cross-platform consumer behavior analysis.

Table 3
Major Functionalities of Generative AI

Functionality	GANs	VAEs	Autoregressive model
Abstract summarization			Online review summarization (Han *et al.*, 2023)
Alleviation of data sparsity problem	Recommendation system (Lu *et al.*, 2022; Wang *et al.*, 2020) User identity alignment prediction (Wei *et al.*, 2023)	Recommendation system (Yu & Grauman, 2020; Zhang, Wong *et al.*, 2021)	
Alleviation of exposure bias problem	Ad creative generation (Terzioğlu *et al.*, 2022)		
Controllable image generation	Virtual Try-On (Du *et al.*, 2023; Fincato *et al.*, 2022; Li *et al.*, 2023; Roy *et al.*, 2022)		
Cross-domain retrieval	Image-based product retrieval (Zhang, Sun *et al.*, 2020, 2021; Zhang, Wang *et al.*, 2020)		
Feature extraction		Anomaly detection (Li *et al.*, 2022)	Fake review detection (Deshai & Bhaskara Rao, 2023)
Identification of independent generative factors		Recommendation system (Laenen & Moens, 2022)	
Learning of Normal Data Distribution	Anomaly detection (Guo *et al.*, 2023) Customer behavior prediction (Hao *et al.*, 2022) Authentic product identification (Rabbi *et al.*, 2023) Sales forecasting (Wang & Yang, 2021)"	Recommendation system (Nguyen & Cho, 2020)	Fake review generation (Perez-Castro *et al.*, 2023)
New item generation	Recommendation system (Singh *et al.*, 2020)		
Optimal policy selection	Dialogue generation (Nabeel *et al.*, 2019)		
Rebalancing dataset	Credit card fraud detection (Ding *et al.*, 2023; Fiore *et al.*, 2019)	Credit card fraud detection (Ding *et al.*, 2023)	
Regularization for realistic output	Multi-human parsing (Zhao *et al.*, 2020)		

Source: Own elaboration.

C. Alleviation of exposure bias problem

Exposure bias is a problem where a machine learning model performs well on the training data but poorly on the testing data because there is a large discrepancy between the distribution of training data and that of test data (Yang *et al.*, 2022). In a setting of ad creative generation, Terzioğlu *et al.* (2022) applied GAN and reinforcement learning to address the exposure bias problem. GAN enables the generator to create results by learning to confuse the discriminator, reducing reliance on ground truth data for generating outputs. Moreover, reinforcement learning addresses the exposure bias problem by using rewards instead of ground truth data, further lessening the generator's dependence on it.

D. Controllable image generation

Controllable image generation is the ability of a machine learning model to manipulate and control specific aspects of an image, such as the appearance and location of objects, in order to generate desired outputs (Casanova *et al.*, 2023). In OCBA, controllable image generation can be applied to virtual try-on. A notable challenge for a virtual try-on system is accurately detecting and tracking the user's body and facial features. In a virtual try-on setting, controllable image generation allows customers to generate images of themselves with specific attributes or features, such as the position of the eyes, nose, mouth, and the shape of the face. It can be useful in generating realistic object images and creating personalized content.

Du *et al.* (2023) and Fincato *et al.* (2022) applied GAN to develop a virtual try-on system. GAN can achieve high-quality controllable image generation by providing specific inputs to the generator network to generate images with specific attributes or features. Roy *et al.* (2022) proposed landmark guided virtual try-on (LGVTON), which uses GAN to approximate data distribution, leading to better output in a virtual try-on system. Li *et al.* (2023) developed precise outfit visualization net (POVNet), which uses GANs for learned rendering procedures that ensure the accurate reflection of fine details like shading. In POVNet, adversarial loss from GANs is applied to ensure high-resolution rendering and fine shading accuracy.

E. Cross-domain retrieval

Cross-domain retrieval is a task to find relevant data in one domain using a query from another (Zhou *et al.*, 2022). For example, if we have an image from one domain and want to retrieve similar images from another, we can use cross-domain retrieval techniques. For instance, when analysts have a dataset of cloth images and need to retrieve similar cloth images from a separate dataset, they can use cross-domain retrieval techniques to identify similar images. Cross-domain retrieval is a challenging problem because the data in different domains can differ in distributions and feature representations.

Previous studies have utilized GAN-based models for cross-domain retrieval to translate clothes from the human body to a tiled image. Zhang, Wang *et al.* (2020) used GAN to transform images of clothes worn on human bodies into tiled clothing images, resulting in high accuracy and efficiency in clothing item retrieval. Zhang, Sun *et al.* (2020) applied CascadeGAN (Cas-GAN) in a similar task and showed that Cas-GAN outperformed traditional methods by generating higher-quality images that improved clothing retrieval performance. A notable strength of their model is that it requires only a single human body image for one-to-one clothing image translation, simplifying the retrieval process.

Zhang, Sun *et al.* (2021) proposed and applied triple supervised GAN (TripleGAN), which consists of three components: a generator, a discriminator, and a classifier. The model used triplet loss in the discriminator to ensure the generated images are more similar to the real images than fake ones. Their experiment showed that the TripleGAN model outperforms other GAN models in generating images with delicate details, which is beneficial for cross-domain clothing retrieval.

F. Feature extraction

Feature extraction is a technique to reduce the number of resources required for processing data without losing important information. It involves selecting and transforming relevant features from raw data to create new features that can be used to train machine learning models. It can improve the efficiency and accuracy of machine learning models by reducing the amount of redundant data. Therefore, it is highly beneficial when dealing with large datasets, as it can help reduce the computational complexity of machine learning algorithms. It can also help improve the interpretability of prediction models by identifying the most important predictor variables.

Li *et al.* (2022) proposed a variational autoencoder and genetic algorithm (VAEGA), an integration of VAEs and genetic algorithm (GA) for anomaly detection. In VAEGA, VAEs create a probabilistic dimensionality reduction, encoding high-dimensional data into a lower-dimensional latent space. The latent space characterizes the high-dimensional inputs, effectively capturing the data's essential features. A GA is then applied to analyze the abnormal subspace of outliers, enhancing the interpretability of the detection results. Their experiment showed that VAEGA outperforms principal component analysis (PCA) and other traditional dimensionality reduction methods. The VAE's ability to capture nonlinear relationships and analyses of abnormal subspace by GA are not inherent in PCA.

Deshai and Bhaskara Rao (2023) applied GPT to fake review detection. GPT captures deep contextualized word representations, enhancing the semantic understanding of review texts. Attention mechanisms enable GPT to focus on relevant parts of the text, improving the feature extraction process. Additionally, by leveraging its pre-trained knowledge, GPT can better distinguish between genuine and deceptive language patterns commonly found in fake reviews. Moreover, the model's ability to generate embeddings reflecting language nuances leads to accurate review detection.

G. Identification of independent generative factors

Independent generative factors are the underlying variables that can be manipulated to change specific attributes of data observations without affecting others (Laenen & Moens, 2022). These factors are the building blocks of the data set and, therefore, determine the specific attributes of the data. In OCBA, identifying these factors allows for more interpretable and explainable recommendation systems.

Laenen and Moens (2022) employed an explainable VAE framework (E-VAE), a variant of VAE. The E-VAE uses a two-level alignment to steer the disentanglement process toward discovering relevant factors of variations, including fine-grained attributes, and to ignore irrelevant visual variations. The E-VAE also aligns visual and textual attributes, ensuring an accurate and fine-grained visual contextualization of the textual attributes. The authors showed that the E-VAE can improve e-commerce search and recommendation systems through explainable and interpretable item representations.

H. Learning of normal data distribution

Generative AI can approximate probability distributions of the original data so that the model improves its performance by learning the distribution of normal data. GANs and VAEs are two popular models used for this purpose. While GANs are particularly useful for generating high-quality data similar to the original, VAEs are better suited for tasks requiring more structured and interpretable data representations.

Guo *et al.* (2023) applied GANs to anomaly detection to enable the model to learn the distribution of normal data, which aids in generating data similar to non-anomalies for more effective anomaly detection. They developed and used a novel graph GANs called RegraphGAN, which incorporated encoders to map real data to latent space, improving the training stability and efficiency.

Rabbi *et al.* (2023) employed GAN to identify authentic tribal products. In their study, GANs augment the dataset with synthetic images that resemble authentic tribal dresses. The augmented data improved the model's ability to identify tribal dresses accurately. In another study, Wang and Yang (2021) proposed M-GAN-XGBoost, which is a combination of LSTM, GAN, and XGBoost. They applied the model to sales forecasting, where GANs are used to replicate the distribution of consumer traffic data, aiming to produce data that resembles real user behavior patterns. In this process, GANs minimize the difference between generated and actual traffic data, refining the model's ability to predict consumer actions. Hao *et al.* (2022) applied deep convolutional generative adversarial nets (DCGAN; Radford *et al.*, 2015) to customer behavior prediction. The generator in DCGAN generates synthetic data that is distributed similarly to the real user behavior data, which is categorized into four types. Different patterns in the data represent the four types of user behaviors. By mimicking these patterns, the generator predicts the likelihood of each behavior type. In addition, the model creates a 2D color image representing user behaviors, facilitating visual analysis and prediction of emerging behaviors. In a further study, Nguyen and Cho (2020) introduced a mixture model for online behavior recommendation as a new approach to social media mining. Their model integrates VAE to capture the latent preferences of users based on their online activity data. It learns the underlying distribution of user behaviors, including repeat and new activities, to enhance recommendation quality. In a separate study, Perez-Castro *et al.* (2023) applied GPT to fake online review generation, highlighting the challenge that fake reviews generated by AI pose to existing fake review detection classifiers. They utilized GPT to generate text that closely resembles human writing. The model's effectiveness in mimicking the input text demonstrates its ability to learn from normal data distributions.

I. New item generation

One of the strengths of generative AI is its ability to generate new and unique outputs based on the training data. In developing a recommendation system, non-generative AI models typically rely on existing data to make recommendations but cannot generate new data. GANs can learn the patterns and characteristics of the existing data and generate new data similar to the existing data but with unique variations. It allows GANs to provide highly diverse and personalized recommendations to users. Singh *et al.* (2020) proposed a GAN-based model to generate new clothes by combining the latest fashion trends with the user's previous purchases. It allows for a highly personalized and tailored recommendation for each user. Moreover, the proposed method can establish cross-domain relationships between different types of clothes, such as vintage and new fashion clothes. It enables the model to generate new clothes that combine features from both domains, resulting in unique and fashionable designs.

J. Optimal policy selection

A policy, as a technical term in machine learning, refers to a function that maps the current state of the environment to an action. Reinforcement learning aims to find the optimal policy that maximizes the expected cumulative reward. In the development of a dialogue management system, Nabeel *et al.* (2019) applied GAN in dialogue generation to improve the fluency and diversity of generated dialogues. They proposed Cascade GAN (Cas-GAN), which combines GAN and reinforcement learning to model the relations between dialogues utilizing graph convolutional networks.

K. Rebalancing dataset

An imbalanced dataset is a dataset that consists of one or more classes that are significantly underrepresented in the training data (Kuhn & Johnson, 2013). When classification models are used on such data, they tend to undervalue the minority classes, resulting in a higher misclassification rate of minority class samples than those from majority classes (Sun *et al.*, 2009). Previous studies have used the synthetic minority oversampling technique (SMOTE) and its extensions to address the class imbalance problem (Kimura, 2022). SMOTE oversamples the minority class by creating synthetic samples from the minority class instead of creating copies of existing samples (Chawla *et al.*, 2002). Although less popular than SMOTE as an oversampling method, GAN and VAE can also be used for oversampling because they can generate more credible and varied synthetic examples that are indistinguishable from real data. Fiore *et al.* (2019) applied GAN to credit card fraud detection and showed that the GAN-based model outperforms previous methods like SMOTE regarding sensitivity and f-1 score. Ding *et al.* (2023) proposed VAEGAN, which integrates VAE and GAN. VAEGAN uses VAE's ability to learn a latent space representation and GAN's adversarial training to generate more realistic data. This combination enhances the generation of realistic and diverse minority-class data for imbalanced datasets. According to their results, VAEGAN outperforms previous methods, such as GAN, VAE, and SMOTE, in terms of precision, f1-score, and other indicators.

L. Regularization for realistic output

Overfitting occurs when a machine learning model learns the training data too well and fails to generalize to new data. In GAN, overfitting means that the generator network produces data that is too similar to the training data and not sufficiently

diverse. GAN uses the adversarial losses as auxiliary regularization terms to prevent overfitting. The regularization enforces the generator network to learn the underlying distribution of the real data, which leads to more diverse and realistic output. Zhao *et al.* (2020) applied GAN to multi-human parsing. Multi-human parsing is a challenging task because it involves multiple people interacting with each other. Auxiliary regularization in GAN can help refine the realism of the multi-human parsing results by acting as a regularization term in the adversarial learning process. This approach can improve the quality of the generated images.

5. DISCUSSION

5.1. Summary of findings

Generative AI is currently utilized in various areas of OCBA and can improve OCBA performance. This review identified 14 utilization areas and 12 functions of generative AI in OCBA. These 12 functions can be grouped into three broader functions: personalization, prediction accuracy, and modeling efficiency.

Generative AI algorithms are better at personalization than traditional machine learning because they can create entirely new data, while traditional machine learning models rely on pre-existing data for making predictions. The distinct feature of generative AI in crafting new data is pivotal to produce effective personalization. It enables the model to produce data specifically tailored to individual users, moving away from the constraints of using existing data that might not be relevant or accurate for the user. This tailored approach can achieve high levels of personalization, improving the customer experience and increasing customer engagement.

Generative AI techniques such as GAN and VAE improve prediction accuracy compared to traditional machine learning because they can generate synthetic samples that mimic real data distribution. This ability of generative AI improves prediction performance in various ways, such as rebalancing datasets, learning normal data distribution, feature extraction, and addressing data sparsity and exposure bias problems.

Generative Al algorithms can develop more efficient and cost-effective models compared to traditional machine learning methods because generative AI decreases the need for human intervention. Traditional methods often require manual work to label and annotate data, which can be time-consuming and expensive. For instance, Han *et al.* (2023) noted that generative AI with pre-trained language models can automate the generation of synthetic training data, eliminating the need for manual annotation.

5.2. Limitations

It must be stated that this review has several limitations. First, the studies examined in this review are not exhaustive. Only articles published in peer-reviewed journals were included and so conference proceedings and book chapters were excluded. Therefore, this review may not capture some of the state-of-the-art methods. However, this study focused on rigorously scrutinized, high-quality studies to draw conclusions from robust findings.

The application areas of generative AI identified in this review did not include popular consumer behavior analytics, such as customer churn prediction and segmentation. Although this study collected a wide range of articles from four databases using various search terms, some studies may have been missed because the search was conducted without specifying the areas of OCBA. Because this study aimed to conduct an exploratory review of the use of generative AI in OCBA, we did not search for papers focusing on specific practices. Future studies can review the use of generative AI in specific OCBA domains, such as customer churn prediction and customer segmentation.

5.3. Implications

In future research and practice, analysts can develop generative AI models for popular OCBAs, such as customer segmentation, market basket analysis, customer lifetime value prediction, and customer churn prediction. In these analytics, traditional machine learning models face problems such as high-dimensional data handling, data sparsity, and class imbalance. These problems make it difficult for machine learning models to achieve high performance. Additionally, in supervised learning, collecting a large amount of labeled data is usually difficult, and the manual labeling process is arduous. Furthermore, there is a cold start problem where models cannot make inferences about customers or items for which sufficient data has yet to be obtained. Generative AI can address these problems by generating synthetic data that is similar to but slightly different from the original data.

Future research could also examine the impact of generative AI in OCBA on consumer experience from more diverse perspectives. The studies reviewed in this study assumed that generative AI models provide customers with positive experiences, such as high levels of satisfaction and fulfillment of needs. However, using generative AI can also result in negative customer experiences. For example, prior research suggests that customers prefer interacting with humans rather than virtual agents (Oshrat *et al.*, 2022). This tendency has been shown to intensify when customers perceive dissatisfaction with their interactions with virtual agents (Ashfaq *et al.*, 2020). Therefore, whether advanced generative AI enables virtual assistants to provide higher-quality services, and if so, do customers have positive attitudes toward their interactions with virtual agents, are questions that should be addressed in future research.

Since Open AI released ChatGPT in November 2022, public attention on generative AI seems to have concentrated on information gathering, sentence generation, and chatting with AI using large-scale language models. However, as this study has shown, generative AI has various functions contributing to OCBA. Practitioners can explore ways to make OCBA more effective in the future by integrating these various functions of generative AI with other disruptive technologies.

For example, in the medical industry, virtual reality is being used to train for surgery (Lungu *et al.*, 2021), and in the construction industry, augmented reality simulations of three-dimensional spaces are used to design buildings (Adebowale, &

Agumba, 2022). These technologies give consumers a more realistic experience of using those products and services. Consumer responses to this realistic experience can be used as high-quality data for OCBA by generative AI. Such integration would contribute to developing more effective recommendation systems and producing more attractive advertisements. Besides, generative AI will also contribute to efficiently generating virtual and augmented reality.

Although generative AI has much potential for OCBA, researchers and practitioners should be aware of the challenges related to its use. First, generative AI is not bias-free. If trained on biased data, a generative AI model will produce biased outcomes, resulting in unreliable predictions, potentially unfair and raising ethical concerns. Additionally, as generative AI's use in OCBA grows, there could be an increase in consumer resistance to the continuous data collection in online platforms. To address this, businesses must establish and communicate clear data privacy policies. These policies should detail how consumer data is collected, shared, and used, ensuring the protection of consumer privacy. It is also crucial for businesses to provide consumers with options regarding their data contribution, including mechanisms to opt-out of data sharing and requests for data deletion.

6. REFERENCES

Adebowale, O. J., & Agumba, J. N. (2022). Applications of augmented reality for construction productivity improvement: a systematic review. *Smart and Sustainable Built Environment*, (ahead-of-print). https://doi.org/10.1108/SASBE-06-2022-0128

Almahmood, R. J. K., & Tekerek, A. (2022). Issues and solutions in deep learning-enabled recommendation systems within the e-commerce field. *Applied Sciences*, *12*(21), 11256. https://doi.org/10.3390/app122111256

Anshari, M., Almunawar, M. N., Lim, S. A., & Al-Mudimigh, A. (2019) Customer relationship management and big data enabled: Personalization & customization of services. *Applied Computing and Informatics*, *15*(2), 94-101. https://doi.org/10.1016/j.aci.2018.05.004

Ashfaq, M., Yun, J., Yu, S., & Loureiro, S. M. C. (2020). I, Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telematics and Informatics*, *54*, 101473. https://doi.org/10.1016/j.tele.2020.101473

Asperti, A., Evangelista, D., & Loli Piccolomini, E. (2021). A survey on variational autoencoders from a green AI perspective. *SN Computer Science*, *2*(4), 301. https://doi.org/10.1007/s42979-021-00702-9

Baek, T. H. (2023). Digital advertising in the age of generative AI. *Journal of Current Issues and Research in Advertising*, *44*(3), 249-251. https://doi.org/10.1080/10641734.2023.2243496

Bawack, R. E., Wamba, S. F., Carillo, K. D. A., & Akter, S. (2022). Artificial intelligence in e-commerce: A bibliometric study and literature review. *Electronic Markets*, *32*(1), 297-338. https://doi.org/10.1007/s12525-022-00537-z

Bond-Taylor, S., Leach, A., Long, Y., & Willcocks, C. G. (2022). Deep generative modelling: A comparative review of vaes, gans, normalizing flows, energy-based and autoregressive models. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *44*(11), 7327-7347. https://doi.org/10.1109/TPAMI.2021.3116668

Breen, R. L. (2006). A practical guide to focus-group research. *Journal of Geography in Higher Education*, *30*(3), 463-475. https://doi.org/10.1080/03098260600927575

Casanova, A., Careil, M., Romero-Soriano, A., Pal, C. J., Verbeek, J., & Drozdzal, M. (2023). *Controllable image generation via collage representations. arXiv preprint arXiv:2304.13722*.

Chawla, N. V., Bowyer, K. W., Hall, L. O., & Kegelmeyer, W. P. (2002). SMOTE: synthetic minority over-sampling technique. *Journal of Artificial Intelligence Research*, *16*, 321-357. https://doi.org/10.1613/jair.953

Deshai, N., & Bhaskara Rao, B. (2023). Unmasking deception: A CNN and adaptive PSO approach to detecting fake online reviews. *Soft Computing*, 27(16), 11357-11378. https://doi.org/10.1007/s00500-023-08507-z

Ding, Y., Kang, W., Feng, J., Peng, B., & Yang, A. (2023). Credit card fraud detection based on improved Variational Autoencoder Generative Adversarial Network. *IEEE Access*, 11, 83680-83691. https://doi.org/10.1109/ACCESS.2023.3302339

Du, C., Yu, F., Jiang, M., Hua, A., Wei, X., Peng, T., & Hu, X. (2023). Vton-scfa: A virtual try-on network based on the semantic constraints and flow alignment. *IEEE Transactions on Multimedia*, *25*, 777-791. https://doi.org/10.1109/TMM.2022.3152367

Fincato, M., Cornia, M., Landi, F., Cesari, F., & Cucchiara, R. (2022). Transform, warp, and dress: A new transformation-guided model for virtual try-on. *ACM Transactions on Multimedia Computing, Communications, and Applications*, *18*(2), 1-24. https://doi.org/10.1145/3491226

Fiore, U., De Santis, A., Perla, F., Zanetti, P., & Palmieri, F. (2019). Using generative adversarial networks for improving classification effectiveness in credit card fraud detection. *Information Sciences*, *479*, 448-455. https://doi.org/10.1016/j.ins.2017.12.030

Floridi, L., & Chiriatti, M. (2020). GPT-3: Its nature, scope, limits, and consequences. *Minds and Machines*, *30*(4), 681-694. https://doi.org/10.1007/s11023-020-09548-1

Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., & Bengio, Y. (2020). Generative adversarial networks. *Communications of the ACM*, *63*(11), 139-144. https://doi.org/10.1145/3422622

Goti, A., Querejeta-Lomas, L., Almeida, A., de la Puerta, J. G., & López-de-Ipiña, D. (2023). Artificial intelligence in business-to-customer fashion retail: A literature review. *Mathematics*, *11*(13), 2943. https://doi.org/10.3390/math11132943

Grove, S. J., & Fisk, R. P. (1992). Observational data collection methods for services marketing: An overview. *Journal of the Academy of Marketing Science*, *20*(3), 217-224. https://doi.org/10.1007/BF02723408

Guo, D., Liu, Z., & Li, R. (2023). RegraphGAN: A graph generative adversarial network model for dynamic network anomaly detection. *Neural Networks*, *166*, 273-285. https://doi.org/10.1016/j.neunet.2023.07.026

Guo, J., Zheng, C., Li, S., Jia, Y., & Liu, B. (2022). BiInfGCN: Bilateral information augmentation of graph convolutional networks for recommendation. *Mathematics*, *10*(17), 3042. https://doi.org/10.3390/math10173042

Han, Y., Nanda, G., & Moghaddam, M. (2023). Attribute-sentiment-guided summarization of user opinions from online reviews. *Journal of Mechanical Design*, *145*(4), 041402. https://doi.org/10.1115/1.4055736

Hao, Y., Zhao, D., Li, H., Ip, W. H., & Liu, Y. (2022). User Behavior Prediction Based on DCGAN: The Case of Sina Weibo. *Journal of Internet Technology*, 23(6), 1367-1376. https://doi.org/10.53106/160792642022112306019

Hu, K., Qiu, L., Zhang, S., Wang, Z., Fang, N., & Zhou, H. (2023). A novel neighbor selection scheme based on dynamic evaluation towards recommender systems. *Science Progress*, *106*(2), 368504231180090. https://doi.org/10.1177/00368504231180090

Jiang, L. A., Yang, Z., & Jun, M. (2013). Measuring consumer perceptions of online shopping convenience. *Journal of Service Management*, *24*(2), 191-214. https://doi.org/10.1108/09564231311323962

Kashyap, D. A. K., Sahu, I., & Kumar, D. A. (2022). Artificial intelligence and its applications in e-commerce —A review analysis and research agenda. *Journal of Theoretical and Applied Information Technology*, *100*(24), 7347-7465.

Kimura, T. (2022). Customer churn prediction with hybrid resampling and ensemble learning. *Journal of Management Information & Decision Sciences*, *25*(1).

Kimura, T. (2023). Assessment of personal values for data-driven human resource management. *Data Science Journal*, *22*. https://doi.org/10.5334/dsj-2023-022

Kmet, L., M., Lee, R., C., Cook, L., & S. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Alberta Heritage Foundation for Medical Research (Alberta Heritage Foundation for Medical Research).

Kuhn, M., & Johnson, K. (2013). *Applied predictive modeling* (26th ed). Springer.

Laenen, K., & Moens, M. F. (2022). Learning explainable disentangled representations of e-commerce data by aligning their visual and textual attributes. *Computers*, *11*(12), 182. https://doi.org/10.3390/computers11120182

Li, J., Zhang, J., Bah, M. J., Wang, J., Zhu, Y., Yang, G., Li, L., & Zhang, K. (2022). An auto-encoder with genetic algorithm for high dimensional data: Towards accurate and interpretable outlier detection. *Algorithms*, *15*(11), 429. https://doi.org/10.3390/a15110429

Li, K., Zhang, J., & Forsyth, D. (2023). POVNet: Image-based virtual try-on through accurate warping and residual. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 45(10), 12222-12235. https://doi.org/10.1109/TPAMI.2023.3283302

Lu, X., Liu, J., Gan, S., Li, T., Xiao, Y., & Liu, Y. (2022). Recommendation model based on dynamic interest group identification and data compensation. *IEEE Transactions on Network and Service Management*, *19*(1), 89-99. https://doi.org/10.1109/TNSM.2021.3112702

Lungu, A. J., Swinkels, W., Claesen, L., Tu, P., Egger, J., & Chen, X. (2021). A review on the applications of virtual reality, augmented reality and mixed reality in surgical simulation: an extension to different kinds of surgery. *Expert Review of Medical Devices*, 18(1), 47-62. https://doi.org/10.1080/17434440.2021.1860750

Margaris, D., Vassilakis, C., & Spiliotopoulos, D. (2022). On producing accurate rating predictions in sparse collaborative filtering datasets. *Information*, *13*(6), 302. https://doi.org/10.3390/info13060302

Nabeel, M., Riaz, A., & Zhenyu, W. (2019). Cas-gans: An approach of dialogue policy learning based on gan and rl techniques. *International Journal of Advanced Computer Science and Applications*, *10*(7). https://doi.org/10.14569/IJACSA.2019.0100766

Nallapati, R., Zhou, B., Gulcehre, C., & Xiang, B. (2016). *Abstractive text summarization using sequence-to-sequence rnns and beyond. arXiv preprint arXiv:1602.06023*.

Necula, S. C., & Păvăloaia, V. (2023). AI-driven recommendations: A systematic review of the state of the art in e-commerce. *Applied Sciences*, *13*(9), 5531. https://doi.org/10.3390/app13095531

Ngai, E. W., & Wu, Y. (2022). Machine learning in marketing: A literature review, conceptual framework, and research agenda. Journal of Business Research, 145, 35-48. https://doi.org/10.1016/j.jbusres.2022.02.049

Nguyen, M. D., & Cho, Y. S. (2020). A variational autoencoder mixture model for online behavior recommendation. *IEEE Access*, *8*, 132736-132747. https://doi.org/10.1109/ACCESS.2020.3010508

Notin, P., Hernández-Lobato, J. M., & Gal, Y. (2021). Improving black-box optimization in VAE latent space using decoder uncertainty. *Advances in Neural Information Processing Systems*, *34*, 802-814.

Oshrat, Y., Aumann, Y., Hollander, T., Maksimov, O., Ostroumov, A., Shechtman, N., & Kraus, S. (2022). *Efficient customer service combining human operators and virtual agents. arXiv preprint arXiv:2209.05226*.

Pan, Z., Yu, W., Yi, X., Khan, A., Yuan, F., & Zheng, Y. (2019). Recent progress on generative adversarial networks (GANs): A survey. *IEEE Access*, *7*, 36322-36333. https://doi.org/10.1109/ACCESS.2019.2905015

Papamakarios, G., Nalisnick, E., Rezende, D. J., Mohamed, S., & Lakshminarayanan, B. (2021). Normalizing flows for probabilistic modeling and inference. *Journal of Machine Learning Research*, *22*(1), 2617-2680.

Perez-Castro, A., Martínez-Torres, M. R., & Toral, S. L. (2023). Efficiency of automatic text generators for online review content generation. *Technological Forecasting and Social Change*, *189*, 122380. https://doi.org/10.1016/j.techfore.2023.122380

Policarpo, L. M., da Silveira, D. E., da Rosa Righi, R., Stoffel, R. A., da Costa, C. A., Barbosa, J. L. V., ... & Arcot, T. (2021). Machine learning through the lens of e-commerce initiatives: An up-to-date systematic literature review. Computer Science Review, 41, 100414. https://doi.org/10.1016/j.cosrev.2021.100414

Postolache, E., Mariani, G., Mancusi, M., Santilli, A., Cosmo, L., & Rodola, E. (2023). *Latent autoregressive source separation. arXiv preprint arXiv:2301.08562*.

Rabbi, M. F., Sultan, M. N., Hasan, M., & Islam, M. Z. (2023). Tribal dress identification using convolutional neural network. *Journal of Information Hiding and Multimedia Signal Processing*, *14*(3), 72-80.

Radford, A., Metz, L., & Chintala, S. (2015). *Unsupervised representation learning with deep convolutional generative adversarial networks. arXiv preprint arXiv:1511.06434*.

Radford, A., Narasimhan, K., Salimans, T., & Sutskever, I. (2018). *Improving language understanding by generative pretraining*.

Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., & Koffel, J. B. (2021). PRISMA-S: An extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic Reviews*, *10*, 1-19.

Roy, D., Santra, S., & Chanda, B. (2022). LGVTON: A landmark guided approach for model to person virtual try-on. *Multimedia Tools and Applications*, *81*(4), 5051-5087. https://doi.org/10.1007/s11042-021-11647-9

Sajid, S., Rashid, R. M., & Haider, W. (2022). Changing trends of consumers' online buying behavior during COVID-19 pandemic with moderating role of payment mode and gender. *Frontiers in Psychology*, *13*, 919334. https://doi.org/10.3389/fpsyg.2022.919334

Samuel, A. L. (1959). Some studies in machine learning using the game of checkers. *IBM Journal of Research and Development*, *3*(3), 210-229. https://doi.org/10.1147/rd.33.0210

Singh, M., Bajpai, U., V., V., & Prasath, S. (2020). Generation of fashionable clothes using generative adversarial networks: A preliminary feasibility study. *International Journal of Clothing Science and Technology*, *32*(2), 177-187.

Sun, R., Dai, H., Li, L., Kearnes, S., & Dai, B. (2021). Towards understanding retrosynthesis by energy-based models. *Advances in Neural Information Processing Systems*, *34*, 10186-10194.

Sun, Y., Wong, A. K. C., & Kamel, M. S. (2009). Classification of imbalanced data: A review. *International Journal of Pattern Recognition and Artificial Intelligence*, *23*(4), 687-719. https://doi.org/10.1142/S0218001409007326

Terzioğlu, S., Çoğalmış, K. N., & Bulut, A. (2022). Ad creative generation using reinforced generative adversarial network. *Electronic Commerce Research*, 1-17. https://doi.org/10.1007/s10660-022-09564-6

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention is all you need. *Advances in Neural Information Processing Systems*, *30*.

Viktoratos, I., & Tsadiras, A. (2021). Personalized advertising computational techniques: A systematic literature review, findings, and a design framework. *Information*, *12*(11), 480. https://doi.org/10.3390/info12110480

Wang, S., & Yang, Y. (2021). M-GAN-XGBOOST model for sales prediction and precision marketing strategy making of each product in online stores. *Data Technologies and Applications*, *55*(5), 749-770. https://doi.org/10.1108/DTA-11-2020-0286

Wang, X. W., Chen, Y., & Liu, Y. Y. (2020). Link prediction through deep generative model. *iScience*, *23*(10), 101626. https://doi.org/10.1016/j.isci.2020.101626

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, xiii-xxiii.

Wei, S., Zhou, X., An, X., Yang, X., & Xiao, Y. (2023). A heterogeneous e-commerce user alignment model based on data enhancement and data representation. *Expert Systems with Applications*, *228*, 120258. https://doi.org/10.1016/j.eswa.2023.120258

Yang, Y., Ding, H., Liu, Q., & Quan, X. (2022). *UBARv2: Towards mitigating exposure bias in task-oriented dialogs. arXiv preprint arXiv:2209.07239*.

Yu, A., & Grauman, K. (2020). Densifying supervision for fine-grained visual comparisons. *International Journal of Computer Vision*, *128*(10-11), 2704-2730. https://doi.org/10.1007/s11263-020-01344-9

Zhang, H., Sun, Y., Liu, L., & Xu, X. (2020). CascadeGAN: A category-supervised cascading generative adversarial network for clothes translation from the human body to tiled images. *Neurocomputing*. Cascade, *382*, 148-161. https://doi.org/10.1016/j.neucom.2019.11.085

Zhang, H., Wang, X., Liu, L., Zhou, D., & Zhang, Z. (2020). Warpclothingout: A stepwise framework for clothes translation from the human body to tiled images. *IEEE Multimedia*, *27*(4), 58-68. https://doi.org/10.1109/MMUL.2020.3014037

Zhang, H., Wong, R. K., & Chu, V. W. (2021). Hybrid variational autoencoder for recommender systems. *ACM Transactions on Knowledge Discovery from Data*, *16*(2), 1-37. https://doi.org/10.1145/3470659

Zhang, X., Sun, Y., & Liu, L. (2021). An improved generative adversarial network for translating clothes from the human body to tiled image. *Neural Computing and Applications*, *33*(14), 8445-8457. https://doi.org/10.1007/s00521-020-05598-9

Zhao, J., Li, J., Liu, H., Yan, S., & Feng, J. (2020). Fine-grained multi-human parsing. *International Journal of Computer Vision*, *128*(8-9), 2185-2203. https://doi.org/10.1007/s11263-019-01181-5

Zhou, X., Han, X., Li, H., Wang, J., & Liang, X. (2022). Cross-domain image retrieval: Methods and applications. *International Journal of Multimedia Information Retrieval*, *11*(3), 199-218. https://doi.org/10.1007/s13735-022-00244-7

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Improving guest satisfaction by identifying hotel service micro-elements failures through Deep Learning of online reviews

Mejora de la satisfacción del cliente mediante la identificación de fallos en los microelementos del servicio hotelero mediante el Deep Learning de las reseñas online

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ABSTRACT

This study thoroughly examines often-overlooked micro-service elements within the broader spectrum of hotel services, aiming to improve hospitality services and ensure guest satisfaction. To achieve this, this research developed a methodological framework, integrating (a) the VADER text sentiment analysis framework, (b) a robust logistic regression procedure to pinpoint specific hotel service components culprit for guest frustration, and (c) the application of semantic network analysis to yield guest insights contextualised within the realm of underperforming hotel service micro-elements.

Research findings highlight fifty specific service micro-elements identified as triggers of negative sentiment and subsequent degrees of diminished guest satisfaction. Furthermore, this study zooms into the top ten underperforming service micro-elements by employing semantic network analysis to uncover the roots of typical guest frustrations with their hotel experiences. Though identified within hotel reviews, certain service malfunctions have relevance within the broader domain of destination management.

The outcomes of this study suggest a valuable resource for managers in detecting and rectifying inadequately performing hotel service micro-elements, which are pivotal for elevating guest satisfaction within their respective hotel properties. Additionally, the findings provide impetus for hotel and destination managers to implement tailored strategies to increase guest satisfaction across hotels and destinations.

Keywords: hotel service elements, online reviews, natural language processing, big data, tourist satisfaction policy, eWOM.

R E S U M E N

Este estudio examina en profundidad los elementos de microservicios a menudo pasados por alto dentro del amplio espectro de servicios hoteleros, con el objetivo de mejorar la hospitalidad y garantizar una mayor satisfacción de los huéspedes. Para lograrlo, se desarrolló un marco metodológico que integra (a) el análisis de sentimiento de texto VADER, (b) un procedimiento robusto de regresión logística para identificar los componentes específicos del servicio hotelero que causan frustración a los huéspedes, y (c) el análisis de redes semánticas para generar información matizada sobre los huéspedes, contextualizada dentro del ámbito de los microelementos de servicio hotelero de bajo rendimiento.

Los resultados de la investigación destacan cincuenta microelementos de servicio específicos que desencadenan sentimientos negativos y una disminución subsecuente en la satisfacción de los huéspedes. Además, este estudio se enfoca en los diez microelementos de servicio de menor rendimiento, utilizando el análisis de redes semánticas para descubrir las causas principales de las frustraciones comunes de los huéspedes con sus experiencias hoteleras. Algunos fallos en el servicio, aunque se identifican en las reseñas de hoteles, son relevantes también en el ámbito más amplio de la gestión de destinos.

Los hallazgos de este estudio sugieren un recurso valioso para los gerentes en la detección y corrección de microelementos de servicio hotelero que funcionan de manera inadecuada, fundamentales para elevar la satisfacción de los huéspedes en sus respectivas propiedades hoteleras. Además, los resultados incentivan a los gerentes de hoteles y destinos a implementar estrategias personalizadas destinadas a mejorar la satisfacción de los huéspedes en todos los hoteles y destinos.

Palabras clave: elementos de servicio hotelero, reseñas online, procesamiento del lenguaje natural, big data, política de satisfacción del turista, eWOM.

1. INTRODUCTION

Online reviews have become a vital channel for hotel guests to share their travel experiences (Xie *et al.*, 2014; Casalo *et al.*, 2015). These reviews are crucial in the customer journey, often representing the final stage in tourism and hospitality settings (Chatterjee, 2020). They provide valuable content for prospective hotel customers (Repovienė & Pažėraitė, 2023) and represent electronic word-of-mouth (eWOM), a digital extension of the traditional word-of-mouth (WOM) concept in the domain of conventional marketing (Butkouskaya *et al.*, 2020; Le *et al.*, 2023). As such, online reviews significantly influence hotel booking decisions, presenting immense opportunities for hospitality researchers to explore various facets of guest behaviour (Yang *et al.*, 2020). Consequently, advancements in ICT, easy access to online reviews as research data, and machine learning technologies have fueled a proliferating stream of big data-based research in tourism and hospitality (Cuesta-Valiño *et al.*, 2020).

In their reviews, hotel guests frequently comment on the services they encounter, including hotel rooms and facilities, personnel, services, location, and food (Nie *et al.*, 2020; Zarezadeh *et al.*, 2022). Simultaneously, hotel guests commonly evaluate these service macro-factors and focus on specific service micro-elements within the above-noted categories. For instance, when assessing a hotel room, guests often highlight aspects like cleanliness, bed quality, Wi-Fi, and bathroom amenities (Luo *et al.*, 2021).

Given their impact on overall guest evaluations, hotel service micro-elements are meaningful and thus require more consideration in hospitality marketing literature. We define hotel service micro-elements as specific and detailed facets of the hospitality servicescape that collectively shape the overall guest experience. Although previous research has examined micro-elements' effects on guest satisfaction (Hu *et al.*, 2020), it often used the term' attributes' without distinguishing between different levels of service elements.

In more detail, recent studies have operated with service macro factors, referred to as 'attributes', to all elements of the hotel's servicescape without making a distinction. For instance, prior literature has positioned such service elements as 'bed', 'bathroom', 'internet' and 'room' or 'drink', 'lobby' and 'bar' on the same level. However, there is an apparent hierarchy where 'room' is a higher order element comprising 'bed', 'bathroom', and 'internet'. At the same time, 'drink' belongs to 'bar', which sequentially fits in the 'lobby', a larger-scale service attribute. Without making a multi-level taxonomy between the sensual dimensions of the hotel service elements, it becomes challenging for hotel managers to determine an accurate, sometimes hidden reason for guests' disappointment with the hospitality service. Moreover, as the perception of the higher-order service elements (room, for instance) denotes a complex combination and likely implies a regressed sum of the lower-level elements (bed, air conditioning, furniture, etc.), considering guests' hotel evaluation should be multifaceted and non-linear given from this perspective also.

Despite some amount of extant research on guest satisfaction using advanced techniques of text mining and natural language processing (NLP) applied to online guest reviews as a data source(e.g., Hu & Yang, 2021; Shin *et al.*, 2021), the above-noted limitations generate a significant research gap that is awaiting academic attention. Apart from confusion due to the noted service elements failures examination without considering the elements' hierarchy, prior studies have also often been limited to specific destinations, such as China. Consequently, the literature must still address the research findings' generalisation issues. Moreover, studies in the field of hospitality customer behaviour should also provide better in-depth and more concrete insights into the reasons for negative sentiments discovered in guest reviews.

Addressing negative customer feedback is crucial, as negatively tinted reviews significantly impact hotel perceptions of prospective customers (Hu *et al.*, 2020). Grounded in the accumulated research, its above-noted accomplishments and gaps determined in the extant body of literature, this study poses the following research question:

RQ: According to online reviews, which specific hotel service micro-elements generate the most negative sentiment, lead to poor customer experiences, and disrupt guest satisfaction?

To address the posed RQ, this exploratory study aims to (1) use deep learning and text mining to identify hotel service micro-elements that contribute to negative guest sentiment in online reviews across eleven popular tourist destinations and (2) determine the failing service micro-elements and explore the context of these poorly delivered services to understand the underlying causes of guest dissatisfaction. By addressing the posited RQ, this study makes two significant contributions: First, in the realm of hospitality marketing literature, it determines the top failing hotel service micro-elements and their contexts overlooked by prior studies. Second, this research provides hotel managers with information on specific service flaws requiring their attention. Also, this study bestows detailed practical recommendations to improve service quality and guest experiences.

The remaining manuscript is organised as follows. First, we review the literature that underpins our research rationale and supports the posed RQ. Next, this paper presents the research methodology, explicating the developed approach to data collection and analysis procedures. Then, the narrative presents the findings and discusses the implications for hospitality marketing theory and hotel management practices. Finally, we outline research limitations and propose future research directions, concluding with a summary of our key findings.

2. LITERATURE REVIEW

2.1. Online guest reviews and hotel service failures

As previously noted, several researchers indicated that online guest reviews are a practical data source for collecting guests' insights to evaluate a customer's perception of the hotel service quality (Berezina *et al.*, 2016; Song *et al.*, 2022; Zarezadeh *et al.*, 2022). Hotel guests share their experiences with other users by posting reviews to social media, portals of online travel agencies (OTAs) or review-specialised platforms (Khan *et al.*, 2022; Vieira *et al.*, 2023). Online reviews denote a piece of user-generated content (UGC) commonly comprising both

qualitative (review text) and quantitative (guest-assigned hotel rating score) data (Mariani *et al.*, 2019). As a valuable source of public data, online reviews help enact analytical techniques such as social media listening, big data analytics and text mining (Hu & Yang, 2021).

Negative reviews posted by hotel guests are of particular research interest because they allow hotel managers to identify service failures and, thus, find opportunities to improve services delivered by their property (Son *et al.*, 2022). Researchers argue that hotel service failure refers to situations when the hotel services do not comply with the guests' expectations, leading to a significant deviation from the expected service standards (Sann *et al.*, 2021). An extant body of amassed research has used text mining and determined several factors guests associate with hotel service failures (e.g., Huang *et al.*, 2022; Nie *et al.*, 2020; Ying *et al.*, 2020).

In this vein, researchers first pointed to room cleanliness as the critical micro-element predisposing negative low guest satisfaction (Park *et al.*, 2019). Prior research has also noted hotel facilities in online reviews concerning service failures (Ying *et al.*, 2020). Furthermore, according to the literature, guests indicate customer service provided by hospitality personnel in their negative reviews as a factor disrupting their satisfaction with the hotel (Nie *et al.*, 2020).

2.2. Hotel service micro-elements

Various marketing researchers have explored how customers perceive service elements across receiving customer experiences and satisfaction with service products (Bueno *et al.*, 2019; Roy, 2018). In hospitality literature, amassed research has determined drivers influencing guest satisfaction with hotel services (Lee *et al.*, 2020). In this vein, as previously noted, several researchers pointed to the hotel room as the critical factor predisposing negative sentiment and, thus, low guest satisfaction (Padma & Ahn, 2020; Park *et al.*, 2019). Next, Latinopoulos (2020) attributed hotel location and exterior as a highly influential element of the hotel service. Furthermore, guests indicate food quality as a factor sculpting their satisfaction with the hotel (Philips *et al.*, 2017; Zarezadeh *et al.*, 2022).

Simultaneously with the established research focusing on the overarching service factors relevant to guest satisfaction, a growing body of literature delves into the finer or micro-elements of hotel service elements. In this regard, Nie *et al.* (2020) revealed sleep quality as a hotel room's micro-element, which is significant to the guests. Later, Hu *et al.* (2021) echoed these findings but unveiled an extended range of hotel micro-services influencing guest satisfaction, including room rate, lobby bar, reception staff, breakfast, and wi-fi signal quality. Simultaneously, Luo *et al.* (2021) noted service micro-elements of the wi-fi signal, air conditioning, bed, noise, towels, hairdryers, and slippers priorly examined as bigger 'room' or 'room facilities' factor by other researchers (Alnawas & Hemsley-Brown, 2018). More recently, Song *et al.* (2022) used the Latent Dirichlet Allocation (LDA) algorithm to extract topics from more than 50 000 guest reviews. In that study, LDA extracted five topics that matter to guest satisfaction, including Service, Room, Cleanliness, Location, and Value (Song *et al.*, 2022). Prior researchers have widely implemented sentiment analysis, discussed below, as a text mining technique to obtain these findings. By employing sentiment analysis, they extracted negative guest reviews first and, by applying additional scrutiny, found the above-noted hotel service failure factors that commonly reduce guest satisfaction with the hotel (Huang *et al.*, 2022).

2.3. Sentiment analysis in hospitality research

Sentiment analysis is a text mining procedure researchers use to narrow down a rich palette of human emotions, including happiness, pleasure, apathy, annoyance, rage, etc., into three distinct categories of negative, neutral or positive polarity (Kirilenko *et al.*, 2018; Luo *et al.*, 2021). Online guest reviews denote a big data solution for hospitality researchers that allows them to gauge review sentiment more accurately and depict review polarity with a precise numeric value. Online guest reviews benchmark a substantial move forward in hospitality analytics and gradually replace conventional methods of data collection, e.g. surveys, required for obtaining customer sentiment data (Hu *et al.*, 2020). By applying the text mining technique and fundamental sentiment analysis procedures, hospitality researchers look for specific words or complete phrases in customer reviews which determine a guest's positive or negative sentiment. Accordingly, several studies have exhibited visually impressive word cloud models grounded in content frequency analysis of reviews (Hu & Yang, 2021; Shin *et al.*, 2021).

Sentiment analysis is a part of the Natural Language Processing (NLP) algorithms family, which is a ramification of the broader machine learning procedures constellation. Thanks to its versatile benefits, lexicon-based sentiment analysis has received recognition as a robust methodology in academia. It has set the momentum for an emerging tourism and hospitality research stream. In this vein, Yadav and Roychoudhury (2019) applied sentiment analysis to investigate hotel attributes that travellers perceive as essential when planning their trip in different travel modes (leisure, business, single, couple, family, etc.). Similarly to these findings, a study by Berezina *et al.* (2016) revealed common categories used in positive and negative reviews by applying text mining techniques to analyse online customer reviews. Moreover, several studies utilised sentiment analysis to develop predictive models for computing numerical rating scores missing in the review dataset (Geetha *et al.*, 2017; Kim & Im, 2018).

Next, sentiment analysis demonstrated its cogent capabilities to determine the linkage between the importance, performance, and customer satisfaction of hotel service attributes, according to Hu *et al.* (2020). Furthermore, in this regard, Luo *et al.* (2021) invoked sentiment analysis in examining economy hotels in China and determined hotel service elements that negatively influence customer experience. Another notable study by Nie *et al.* (2020) suggested a unique approach to building a hotel recommendation system grounded in blending multiple criteria decision-making (MCDM), sentiment analysis, and latent Dirichlet allocation (LDA). These noted studies have demonstrated that sentiment analysis proved a robust and reliable text mining and analytical tool in hospitality research to examine and determine the antecedents of hotel guest satisfaction.

3. RESEARCH METHODOLOGY

To address the posed RQ and meet this exploratory study's aims, the developed research methodology comprised five sequential data collection and engineering phases, applying a series of data analysis procedures and visualising the results. Figure 1 depicts the developed methodology and the logic we followed in this research.

3.1. Sampling procedure

This research used a simple random sampling (SRS) procedure to establish a research setting for this study. It is assumed that SRS cannot tackle notorious generalisation issues because destinations, hotel service attributes, and, thus, guest experiences may vary (Malina *et al.*, 2011). Nevertheless, such an approach complies with the accuracy of the empirical study design in a single setting to get generalisable customer insights into the hotel services belonging to a particular tourist destination (Mariani *et al.*, 2019).

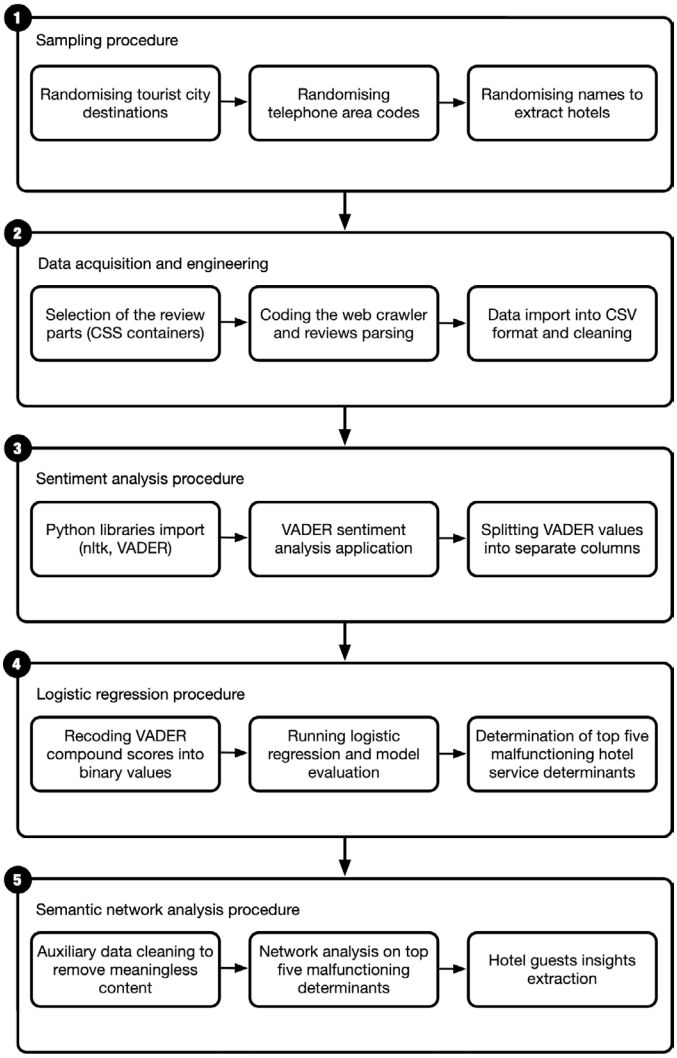

Figure 1
Research methodology scheme
Source: Own elaboration.

The present study employed a four-stage SRS procedure. For this purpose, we first applied an online random digit generator (https://random.org/) to pick the number between 5 and 20 out of the 100 most visited tourist city destinations in 2022. One hundred cities were considered because the tourism analysis literature commonly employs this particular number of top performers in calculating the city destinations index (Popova, 2023). Also, it was assumed that most visited cities were a good source of sufficient guest review availability required for analysis. The generator had returned 11, so this research collected data from eleven destinations to be defined further by SRS. As Baltes and Ralph (2022) suggested for SRS procedures, we used a random draw from the city area phone codes of 100 popular destinations to determine 11 cities for data collection (Table 1). Next, the random digit generator picked 4-star hotels from the 2-5 stars option. We then opted for booking.com as a custom data source platform commonly utilised in hospitality research (Sann *et al.*, 2021).

3.2. Data collection

This research employed Python *requests, beautifulsoup*, and *lxml* libraries to scrape and parse the hotel guest reviews and build a review text corpus for further analysis. We configured the crawler to scrape the significant parts of reviews to originate the variables and their respective values required according to the developed research design. The targeted data included hotel name, country of a reviewing guest, hotel rating score given by the reviewer, and review text itself — its 'positive' and 'negative' parts, as booking.com splits the guest review form into these two categories. The web crawler was programmed to search and scrap reviews relevant to four-star hotels in all written languages in eleven destinations. Next, according to the suggestions of Mariani *et al.* (2019), the crawler was set to skip blank or incomplete reviews where the text length was less than 15 words. The year 2022 was a period to be considered by the web crawler. After its run, the crawler scraped N=109715 hotel guest reviews to a tabulated dataset from 11 city destinations determined by the SRS procedure (Table 1).

Table 1
City destinations and number of scrapped reviews

##	Destination	Country	n of reviews
1	Bordeaux	France	2270
2	Dubai	OAE	10550
3	Hawaii	USA	10352
4	Khurgada	Egypt	12902
5	Las Vegas	USA	11429
6	London	UK	11556
7	Malaga	Spain	10156
8	Munich	Germany	3345
9	New York	USA	17978
10	Prague	Czech Rep.	8880
11	Qatar	Qatar	10297
	Total n of reviews:		**109715**

Source: Own elaboration.

As the design of this study required the text parts of the reviews solely to complete sentiment analysis, the country of the reviewer and hotel rating score variables were discarded from the current analysis for the needs of future studies. The obtained data required auxiliary data engineering to receive a complete dataset ready for analytical procedures. In this vein, as the research design required the sentiment of the entire guest review to be gauged, we first concatenated columns in the retrieved dataset containing available text parts into a single variable representing the full guest review (Figure 2).

```
B [7]: data.head(10)
```

Out[7]:

	Hotel	review	country	score
0	soho_boutique_las_vegas_malaga	An enjoyable stay with great staff, breakfast ...	Spain	8.0
1	soho_boutique_las_vegas_malaga	Very good The room I had was a little dated bu...	Spain	8.0
2	soho_boutique_las_vegas_malaga	Considering we are in a pandemic, we had a lov...	UK	9.0
3	soho_boutique_las_vegas_malaga	Superior As it was our daughters birthday they...	Ireland	9.0
4	soho_boutique_las_vegas_malaga	Fabulous short break sun sea culture very beau...	Ireland	9.0
5	soho_boutique_las_vegas_malaga	Great location and nice hotel. Great location ...	UK	9.0
6	soho_boutique_las_vegas_malaga	This hotel is really handy for the city but al...	UK	9.0
7	soho_boutique_las_vegas_malaga	Very good Location to the beach There was a lo...	UK	8.0
8	soho_boutique_las_vegas_malaga	Nice friendly place in pleasant location. Very...	UK	8.0
9	soho_boutique_las_vegas_malaga	Very good Nice little hotel. Good location, cl...	UK	8.0

Figure 2
Parsed data set fragment (dataset with concatenated review before removal of unnecessary data columns)
Source: Own elaboration.

The mined guest reviews were written in different national languages. Whereas Python natural language processing (NLP) frameworks demonstrate their best capabilities when applied to texts in English, it was essential to translate review texts into this particular language. Python NLP VADER sentiment analysis library, applied in this research and which we depict below in this section, provides such translation options. VADER executes text translation to English by utilising a pre-trained Google Cloud Translate API base with a high level of translation accuracy, according to literature Wang, L., & Kirilenko, A. P. (2021). On top of that, we additionally employed two other online translators, IBM Watson Language Translator and Yandex.Translate to ensure a correct translation on ten randomly selected reviews for every language found in the dataset. This procedure helped verify no loss of meaning, as all tested texts had the same denotation in English.

3.3. *Text data preprocessing*

Almost all the machine learning tasks relevant to NLP require additional procedures to engineer collected text data for subsequent analysis. These procedures, at first, help to split text data into smaller chunks, referred to as tokens, and then apply auxiliary techniques to ensure the precision of the research results (Perkins, 2014). This research employed ordinary data preprocessing procedures relevant to NLP, as Alam and Yao (2019) suggested. These essential NLP procedures can be run by the *nltk* (referred to as *Natural Language Toolkit*) Python framework, recognised as an industry-standard solution for text data mining procedures.

We commenced the application of NLP preprocessing techniques with text tokenisation (also known as *lexing*) to convert words into measurement units, or tokens, by removing punctuation and whitespaces, making them ready for analytical manipulations. For this purpose, we favoured the UPPipe tokeniser, which is noted as a versatile and reliable tool for text tokenisation according to the extant body of literature (Straka & Straková, 2017). Furthermore, after tokenisation, we sequentially utilised three procedures, namely, (a) text transformation by eliminating letter accents found in some words; (b) text normalisation where we ran stemming geared by the UDPipe lemmatiser (Straka *et al.*, 2016); and (c) text filtering to discard regular expressions and stop-words from the text. These procedures were essential to reduce bias and attain more precise results for analysing the reviews' text data.

3.4. *Data analysis procedures*

This study utilised three sequential data analytical techniques comprising sentiment analysis, logistic regression and semantic network analysis (Figure 1). Sentiment analysis was significant for this research to sort out and zoom in on the negative reviews that would serve as a source to reveal the original guests' insights on their hotel experiences. These insights were essential to discern service elements that routinely caused negative customer experiences in the sampled hotels.

For sentiment analysis, this study has applied VADER (Valence Aware Dictionary for Sentiment Reasoning), a lexicon-based solution in NLP capable of gauging polarity and its valence simultaneously. Thanks to these advantages, the researcher receives more precise sentiment score values. This is plausible because the VADER framework is not limited to relying solely on a lexicon while making its computations; it is also a rule-based application. In summary, this means that VADER reckons sentiment valence by the context of a specific word while computing its sentiment and considering capitalisation and even *emojis* if they accompany words or are standalone in the analysed text. These VADER's capabilities make it a more reliable approach to receiving precise sentiment values than the other frameworks (Hutto & Gilbert, 2014).

Next, the subsequent data analysis stage applied the logistic regression technique. It was necessary to reveal the most impactful hotel service elements that precipitate low guest satisfaction. As logistic regression requires a binary dependent variable, we normalised VADER's continuous compound sentiment score to 0 and 1 to meet this requirement. A value of «0» represented a negative guest review sentiment, while «1» denoted a positive sentiment in the updated dataset. Although the logistic regression helps highlight the hotel service micro-elements causing bad guest experiences, it still provides a paucity of information for generating proper insights into service failures.

Conversely, the uncovered context of the found service micro-elements is a practical means to obtain more information on the antecedents of guest frustrations and discern the details

of hotel service failures. For this reason, this research employed semantic network analysis (Oh & Kim, 2020) to shed more light on the context of malfunctioning hotel service micro-elements. By aiming to obtain a more precise comprehension of such context, we implemented semantic network analysis solely on the reviews with negative sentiment scores following a suggestion from prior literature (Bachleda & Berrada-Fathi, 2016; Israeli *et al.*, 2019). Such reviews were sorted from the initial dataset and put into a subsample of n = 23135. The next section of this paper depicts the results attained after applying semantic network analysis and the rest of the above-explicated data analysis procedures.

4. RESULTS

4.1. Guest review sentiment analysis

As noted earlier, this study has employed the VADER framework to implement sentiment analysis. VADER algorithm analyses text and returns four sentiment scores: negative, neutral, positive, and compound. These scores have values in the range of —1 to 1. VADER computes the compound sentiment value by normalising the sum of the other three score values (Hutto & Gilbert, 2014). The outcomes of the VADER procedure application for sentiment analysis are depicted in Figure 3.

```
B [20]: data.head()
```

Out[20]:

	Hotel	review	country	score	vader_scores	vader_compound	vader_pos	vader_neg	vader_neu
0	soho_boutique_las_vegas_malaga	An enjoyable stay with great staff, breakfast ...	Spain	8.0	{'neg': 0.057, 'neu': 0.701, 'pos': 0.242, 'co...	0.9573	0.242	0.057	0.701
1	soho_boutique_las_vegas_malaga	Very good The room I had was a little dated bu...	Spain	8.0	{'neg': 0.0, 'neu': 0.608, 'pos': 0.392, 'comp...	0.9919	0.392	0.000	0.608
2	soho_boutique_las_vegas_malaga	Considering we are in a pandemic, we had a lov...	UK	9.0	{'neg': 0.05, 'neu': 0.759, 'pos': 0.191, 'com...	0.9835	0.191	0.050	0.759
3	soho_boutique_las_vegas_malaga	Superior As it was our daughters birthday they...	Ireland	9.0	{'neg': 0.0, 'neu': 0.685, 'pos': 0.315, 'comp...	0.8881	0.315	0.000	0.685
4	soho_boutique_las_vegas_malaga	Fabulous short break sun sea culture very beau...	Ireland	9.0	{'neg': 0.035, 'neu': 0.605, 'pos': 0.36, 'com...	0.9344	0.360	0.035	0.605

Figure 3

Reviews dataset excerpt with VADER sentiment analysis output values.

Note: This figure represents the first five rows of the entire dataset, demonstrating the output of running the VADER procedure.

Legend: 'Hotel' – hotel to which guest review was posted; 'review' – guest review text displayed partially due to the Python client limitations; 'country' – country of guest nationality; 'score' – hotel rating score set by guests; 'vader_scores' – Python variable of dictionary type {'key': 'value'} containing computed sentiment values for each guest review; 'vader_compound' - a normalised sum of VADER's positive, neutral and negative sentiment score value; 'vader_pos' - VADER's positive sentiment score value; 'vader_neg' - VADER's negative sentiment score value; 'vader_neu' - VADER's neutral sentiment score value.

Source: Own elaboration.

As indicated previously in the methodology section, obtaining sentiment score values facilitated a generation of the dependable binary variable, making it possible to implement logistic regression.

4.2. Logistic regression

The applied logistic regression was set to Ridge (L2) regularisation type, cost strength C=1, sampling cross-validation with 10 folds, and balance class distribution to reveal positive coefficient values for the hotel service elements that imply a reason for a negative review sentiment. The resulting logistic regression model unveiled adequate model evaluation statistics (Table 2).

Table 2

Logistic regression model evaluation

Model	Precision	Recall*	AUC**	CA***	F1****
Logistic Regression	0.928	0.960	0.936	0.909	0.943

Note: * — in the domain of Error type I, this value denotes the proportion of true positive values among all positive observations of the dataset;** — represents the square area below the prediction ROC (Receiver Operating Curve, Figure 4); *** — implies classification accuracy, e.g., the share of instances that were adequately classified; **** — denotes a mean of precision and recall weighted harmonically $\left(F1_{score} = 2 \cdot \frac{(Precision \cdot Recall)}{(Precision + Recall)}\right)$.

Source: Own elaboration.

ROC analysis is a cogent tool utilised to verify the accuracy of the developed model (Fawcett, 2006). It compares the model's false positive (FP) rate or specificity with the maximum probability that targets 1 while the actual value = 0 with the model's true positive (TP) sensitivity where probability targets 1 while true value = 1. Figure 4 visualises the model evaluation results using the ROC analysis. According to Fawcett (2006), the model accuracy is evident when the curve is above the dashed line representing the non-discriminatory test and near the graph's left and top borders. The ROC curve complies with this requirement, providing further evidence of the high degree of the developed model accuracy (Figure 4).

Logistic regression returned 281 tokens in the dataset as independent variables. Many of these variables needed a meaningful sense and thus were not valuable for further data analysis. To discard them, we implemented an NLP procedure known as POS-tagging to extract nouns from the variable list. As a part of speech (POS), nouns commonly represent the hotel service elements in guest reviews (Geetha *et al.*, 2017). We extracted tokens relevant to the noun POS and received 50 variables solely pursuant to the hotel service micro-elements that generate guest resentment with the hotel (Annex I).

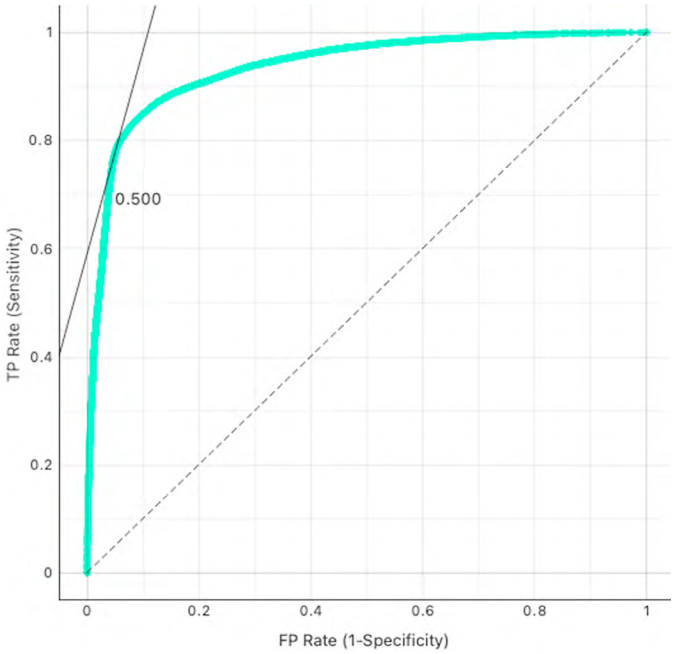

Figure 4
Logistic regression evaluation with the ROC analysis
Source: Own elaboration.

Finally, we highlighted the top ten independent variables representing failing service micro-elements to scrutinise their context and analyse the reasons for their origination (Table 3).

Table 3
Top ten hotel service elements precipitating negative review sentiment (logistic regression coefficient (β) values)

Target variable value = 0 (negative sentiment score)			
Regression intercept	**0.068**	**negative reviews count:* n = 23135**	**TF-IDF scoring μ:****
Failing service micro-elements	**β value**		
(air) conditioning	0.365	458	0.003
carpet	0.358	767	0.003
gym	0.356	162	0.001
kettle	0.331	373	0.002
table	0.307	300	0.001
luggage	0.300	902	0.004
pay	0.295	352	0.002
internet	0.268	306	0.002
pictures	0.254	399	0.002
tv	0.228	1019	0.003

* — n of guest reviews containing the service element;

** — denotes a mean of the token relevant to a hotel service micro-element computed with TF-IDF (*Term Frequency-Inverse Document Frequency*) metric that is a statistical method used to determine the significance of a word concerning a document within a set of documents.

Source: own elaboration

4.3. Semantic network analysis

At the final stage of data analytical procedures application, this research applied network analysis for the top ten poorly operated hotel service elements retrieved from logistic regression (Table 3). Before running semantic network analysis, executing an NLP technique of Concordance to build a context around the token representing a specific service microelement is essential. Concordance requires a setting of *N*-gram range, namely the number of tokens surrounding an analysed service microelement in every guest review where it can be found. This study employed an *N*-gram range of 6, meaning three tokens before and three tokens after the service microelement, to generate ample context around it to be analysed further.

The in-depth scrutiny of the semantic network analysis applied to the principal dysfunctional hotel service micro-elements reveals several findings. At first, the logistic regression application indicated that (air) conditioning (β = 0.365) is the top service microelement which deteriorates guest satisfaction. The network map (Annex II, Figure 1) divulges the details accompanying guest frustrations, including no air conditioning availability in hotel rooms and dirty, noisy, broken or improperly working appliances. Second, hotel and hallway room carpets (β = 0.358) received many guest complaints, according to our findings (Annex II, Figure 2). Guests pointed to the old, stained, dirty, worn, smelly carpeting in their hotel reviews. Third, hotel guests were dissatisfied with the gym facilities (β = 0.356). In this line, small, dirty, poorly equipped facilities and the swimming pool are reasons for guests' irritation (Annex II, Figure 3). Next, the kettle was ranked the fourth microelement contributing to the negative perception of the hotel services (β = 0.331). Semantic maps point to the kettle's unavailability in the room, faulty or broken appliances, and limited or no availability of cups, mugs, and tea sachets (Annex II, Figure 4). A hotel room furniture piece such as a table was the fifth top complaint noted in hotel reviews (β = 0.307). In this regard, guests highlighted the absence of tables or chairs and mentioned dirt found on this furniture item (Annex II, Figure 5).

Furthermore, the outcomes of this study point to luggage as the sixth top-ranked microelement, predisposing guest disappointment toward hotel services (β = 0.300). Online reviews with a negative sentiment indicate that guests may experience difficulties with luggage storage service at the reception and little help from the staff to carry heavy luggage to the hotel room (Annex II, Figure 6). Concerning payment (β = 0.295), guests' dissatisfaction arise from extra payments, need for money deposits, high pricing of the supplementary services and incorrectly charged bank cards (Annex II, Figure 7). Payment is followed by internet (β = 0.268) which generates a reduction in guest satisfaction because of wi-fi unavailability or poor, slow, and inadequate connection in the hotel room (Annex II, Figure 8). Interestingly, guests pointed to one item which is not directly linked to the hotel product consumption but pertains to the initial stage of the customer journey in hospitality. This item is relevant to pictures (β = 0.254) that hotels employ in their online marketing. Concerning pictures, hotel guests massively noted a discrepancy between the online hotel photos and the actual views they see in the hotel (Annex II, Figure 9). Finally, a service microelement

of TV emerged as the tenth top reason for guests' resentment expressed in their reviews (β = 0.228). In this domain, guests routinely complained of non-working, broken or unavailable remote control, small screen size, old TV sets and limited channel choices (Annex II, Figure 10).

5. Discussion

By employing sentiment and semantic network analyses on 109715 hotel reviews with the application of machine learning techniques for big data from online reviews collected from eleven city destinations, this study has exposed and distinguished the causes of low guest satisfaction. Consequently, this research has determined fifty hotel micro-service elements that may commonly induce hotel service failures (Annex I). Simultaneously, a prior mainstream body of research has tended to illuminate groups of hotel service elements or factors rather than particular service elements. In line with the prior studies, this research highlights specific hotel-guest touch points and determines hotel service attributes requiring immediate managerial focus.

In this vein, our study confirms the prior research findings, which revealed significant micro-elements of possible service failures arising from guests' low satisfaction in the domain of the hotel room factor. These micro-elements comprise air conditioning, bed, noise, towels (Luo *et al.*, 2021), wifi (internet) signal quality (Hu *et al.*, 2021), cleanness (Zarezadeh *et al.*, 2022), and hairdryer (Park *et al.*, 2019). However, our research goes beyond the extant corpus of studies as it has revealed a broader range of service micro-elements relevant to service failures under the hotel room factor. Complimentary to prior literature, failing service micro-elements determined by this study comprise room carpet, kettle, table, TV, walls, mattress, room space, shower, tub, sink, smell, fridge, furniture and balcony. Interestingly, the findings of our study point to the hotel room as the key factor in guest satisfaction reduction and, thus, the most frequent area of hotel service failures, as 28 out of 50 service micro-elements are pertinent to the hotel room. In addition, applying the semantic network analysis has made it possible to delve into the context of the hotel service micro-elements. It helped to reveal deeper underlying reasons and roots of guest frustration with particular hotel service micro-elements.

Similarly to Latinopoulos (2020), the completed study confirmed the significance of the hotel location and exterior as a factor of guest satisfaction. On top of that, our study has revealed additional micro-elements relevant to this factor, namely, area, parking, and (hotel) buildings. In the realm of hotel facilities factor, whereas extant research has highlighted solely the impact of their overall functionality on perceived service failures (Ying *et al.*, 2020), this study concretely points to the hotel gym as a micro-element of service failure.

In earlier studies, the role of hotel personnel in contributing to hotel service failures has been widely acknowledged (Nie *et al.*, 2020). Building upon these research findings, this study delves deeper into identifying specific activities that highlight areas where guests often experience frustrations related to hotel personnel. These areas include luggage handling, reception service, shuttle bus service, and animation in resort hotels. Furthermore, our study aligns with the findings of the studies, which highlighted the significance of food and beverage (F&B) in influencing hotel guest satisfaction (Nie *et al.*, 2020; Philips *et al.*, 2017). Surprisingly, our research reveals a relatively lower significance of hotel service micro-elements related to F&B in this respect. According to our findings, only four relevant items, namely 'food', 'drinks', 'breakfast', and 'restaurant', were identified as contributing to service failures. Notably, these items were kept from the top ten micro-elements list, and their positions, based on the log regression coefficient values, were 16, 26, 34, and 39, respectively, in the whole 50 micro-elements range.

5.1. Theoretical implications

The completed study contributes to the hotel marketing theory in several ways. First, grounded on the customer's insights from the hotel reviews, this research has zoomed in on malfunctioning hotel services and determined singular service micro-elements representing service failures that cause negative customer experiences and low guest satisfaction. Our research has extended and systemised a set of service micro-elements previously scattered among various studies. We posit that highlighting hotel service factors, or 'attributes', in guest experience research, rather than micro-elements, can lead to a biased understanding of the real reasons for hotel guest dissatisfaction. As previously noted, each hotel service factor typically amalgamates several service micro-elements. Each of them is more or less significant for the hotel guest experience. Hence, we assert that zooming in on the micro-elements is way more significant for the hospitality marketing research than doing so on the hotel service macro factors.

Second, building upon the above point, this study provides a deeper understanding and expands the range of hotel service micro-elements identified in previous literature. In alignment with prior research, our findings corroborate that the internet or Wi-Fi connection is among the top micro-elements that generate negative guest experiences and subsequent dissatisfaction. Additionally, our study highlights the significant role of air conditioning in shaping guests' perceptions of hotel service quality. Notably, Wi-Fi connection and air conditioning emerge as consistent top ten micro-elements in the present research and previous studies.

Moreover, although our findings align with prior research regarding the less significant service micro-elements ranked 11-50 (Table A.1.1.), this study identifies additional service micro-elements that play a crucial role in shaping guest dissatisfaction with the hotel and significantly contribute to the overall understanding of hotel service failures. Our study substantially contributes to the existing literature by uncovering these previously undocumented micro-elements. In summary, this research improves the understanding of the mix of hotel service micro-elements and expands its scope by capturing overlooked factors and highlighting their impact on guest satisfaction. Including these novel findings adds valuable insights to the literature and deepens our comprehension of the multifaceted nature of hotel service failures.

Thirdly, this study extends the understanding of guest dissatisfaction with hotel service quality by shifting the focus towards exploring service micro-elements in eleven diverse city destina-

tions. By examining these micro-elements in randomly selected city destinations, a more comprehensive and holistic understanding of hotel service failures as perceived by hotel guests is achieved. This approach ensures that the findings of this study address the generalisability issue that has been a standard limitation in prior research, which often focused on scrutinising hotel service factors in a single destination. Therefore, this study expands the knowledge regarding the origins of guest dissatisfaction and provides a broader perspective on hotel service failures across different city destinations.

Next, our findings pinpoint specific service micro-elements within the hotel room that are the primary sources of guest complaints. These micro-elements have emerged as significant factors, securing six positions in the list of top-ten service failures (Table A.1.1). Prior research has overlooked the importance of some of these micro-elements relevant to guest satisfaction. Furthermore, our findings highlight that most top service failures are associated with the hotel room, underscoring its paramount role in shaping the guest experience and satisfaction. These insights shed light on the critical influence of the hotel room micro-elements on guest perceptions and emphasise the need for attention and improvement in these areas to enhance overall guest satisfaction.

Finally, in conjunction with the above point, this study has determined and ranked a wide range of hotel service elements and revealed a specific contextual environment pertaining to the failing hotel service micro-elements. Such an approach has yet to be profoundly implemented in the extant body of research. However, it delivers more efficacy in understanding the natural causes of guests' complaints and dissatisfaction with the hotel, as we demonstrated earlier in presenting the results of this study in the previous manuscript sections. Also, evaluating the failing service micro-elements through the semantic network analysis of their context engenders a 360º evaluation of the hotel service micro-elements. It instantly facilitates uncovering the details and contexts behind hotel service failures. The application of this comprehensive approach not only fills a gap in the current body of literature but also enables a more nuanced analysis of hotel service failures. Through this approach, we gain valuable insights into the factors contributing to guest dissatisfaction and provide a more accurate assessment of the prevalent and critical hotel service failures.

5.2. Methodological implications

The present study has several methodological implications. First, grounded in the sentiment analysis and logistic regression procedure synthesis, the present research suggests a multivariate model capable of gauging hotel service components that prompt negative customer emotions and lead to low satisfaction. Hotel guests utilise numeric (rating scores) and textual (review texts) expressions to share their accumulated customer experience. However, quantitative low hotel rating scores cannot alone elucidate the reasons for a negative guest experience. Simultaneously, the hotel reviews dataset, typically containing thousands of lines, belongs to a big data domain and is challenging to analyse nomologically. Hence, developing and availing a workable model solution for hotel review research and analytics is significant.

Secondly, the present research suggests a robust novel methodology for obtaining precise guest insights on the hotel and destination service elements that cause negative customer experiences. The methodology developed for this study is grounded in the instruments suggested and applied in prior studies relevant to the explored topic (Berezina *et al.*, 2016; Kim & Im, 2018; Yadav & Roychoudhury, 2019). As depicted in Figure 1, it encompasses five stages of online guest review data collection, data preprocessing and engineering, sentiment analysis, logistic regression, and semantic network analysis. This developed methodology further develops and advances the accumulated approaches suggested by previous research by (a) introducing the VADER NLP sentiment analysis framework (Hutto & Gilbert, 2014) in hospitality settings, (b) applying a reliable logistic regression procedure to extract singular hotel service elements generating guest frustration, and (c) by implementing semantic network analysis (Israeli *et al.*, 2019; Oh & Kim, 2020) to procure more precise guest insights grounded in the context of poorly operated hotel services. To our knowledge, such blending of the guest review data collection and analysis techniques represents a unique methodological approach to investigating eWOM and hotel guest satisfaction in hospitality research.

5.3. Managerial implications

The accomplished study has several significant implications for hotel management in improving service delivery policies and blueprints. First, in line with the recent research on similar topics relevant to eWOM in hospitality, this study stresses the importance of examining online guest reviews for hotel managers. Online reviews imply a dependable data source that has succeeded conventional data collection techniques implemented in the realm of service evaluation. These canonical models require customer questionnaire-based surveying with several known limitations, including necessary costs, time, and adequate sample size.

Second, our study demonstrates that hotel services can jointly generate guest experience and predispose the tonality of online reviews. That said, poorly operated hotel services commonly engender negative online reviews for the destination. Thereby, it is pivotal for the hotel and DMO managers to work more closely on identifying and improving the poorly operated services negatively evaluated by guests travelling to a tourist destination. Such a combined effort may lead to a rise in the business performance of the destination and its hotels as an entire ecosystem (Henche *et al.*, 2020) through guest satisfaction and loyalty.

Third, our study develops and suggests a practical approach that is effective for examining online reviews and obtaining guest insights to maintain the quality of hotel services. In line with the above-noted implication from the proposed research methodology that is significant for academia, the same approach is fully functional and feasible for implementation by hospitality practitioners. IT developers can produce and market software applications grounded in the algorithm suggested in this study to automate the analytical procedures of eWOM and guest feedback for received customer experiences.

Fourth, the most prominent managerial implication is relevant to hotel services micro-elements representing a particular

area of the managers' concern. According to the findings from our research, several hotel service micro-elements may require immediate consideration and improvement. We recommend that hotel managers focus primarily on the hotel service micro-elements that generate higher negative sentiment but simultaneously are manageable. This study determined that such hotel service micro-elements as air conditioning, carpets, gym, kettle, table, luggage, payment, internet, pictures, and TV may reduce and even eliminate guest satisfaction and thus should receive immediate attention from hotel managers. The results of the semantic network analysis employed in this study may help understand the origins of guest dissatisfaction with particular service dysfunctions.

In this domain, hotel managers can undertake several practical steps focused on the critical micro-elements identified by this study. First, regular inspection and maintenance of air conditioning units is paramount. Providing clear instructions on using the thermostat can make a big difference, and upgrading to smart thermostats might be worth considering for the added mutual convenience of the guest and the hotel. Next, keeping up a regular deep-cleaning schedule will keep carpets looking fresh and clean. Quickly addressing any stains or damage and using high-quality, stain-resistant materials can help maintain a spotless appearance. In addition, the hotel must have a working policy regulating carpet replacement when needed.

According to our findings, the hotel gym was another significant managerial concern. In this respect, ensuring the equipment is functional, modern, and well-maintained is essential. The availability of sanitising materials (sprays, wipes, etc.) will encourage guests to clean the equipment before and after use. It also demonstrates that hotel management cares about their guests' health and safety. In upscale hotels, offering complimentary free or paid short fitness classes or personal training sessions can further improve customer experience. Then, hotel housekeeping employees have to check the condition of kettles in guest rooms. Kettles should be cleaned or replaced to ensure they are always in good working condition, given the fragility of this appliance. Various complimentary tea and instant coffee options and clear instructions can please guests more with this service micro-element.

Continuing, hotel managers may consider installing multi-functional tables in the guest rooms. This modern piece of furniture adds flexibility and comfort by allowing guests to use it for dining, working, or relaxing. Regular inspections to fix any wobbling or damage will ensure a seamless experience. The payment process should be straightforward and convenient. Multiple payment options, such as credit/debit cards, mobile payments, and online payments, will cater to different preferences. Clear upfront communication of all charges amid check-in and providing detailed receipts can prevent misunderstandings and build trust with the guests.

Another area for hotel managers to focus on is the luggage storage service. It is essential to ensure ample luggage space in guest rooms and provide assistance with carrying luggage to and from the guest room, as this can significantly improve the guest experience. Upgrading the hotel's internet hardware to provide fast and reliable Wi-Fi signal quality throughout the property is crucial in meeting modern guests' expectations. Offering complimentary high-speed internet access and ensuring the login process is easy and hassle-free is a must in today's digital age.

Next, managers have to ensure that the digital images accompanying the hotel page in OTAs and social media platforms and placed on the hotel web page convey a realistic visualisation of the hotel property without embellishing it. Guests tend to get frustrated when they are misguided by online visualisation as the property needs to meet their expectations. Then, managers should also ensure that guest rooms are equipped with modern, high-definition TV sets that offer a variety of channels in many world spoken languages. Regarding TV, ensuring proper remote control panel work, easy-to-follow TV usage guides, and access to additional content typically make guests' stay more enjoyable. By focusing on these problematic service micro-elements, hotel managers can steer common frustrations and significantly improve the overall guest experience, leading to higher guest satisfaction. Moreover, this study's findings reveal a list of 50 micro-elements noted by guests in their online reviews. Hotel managers should also not overlook the remaining service micro-elements to ensure hotel service quality.

Finally, based on our findings, hotel managers must prioritise the housekeeping and property management departments in their properties. As the majority of identified micro-elements associated with hotel service failures pertain to the hotel room, it is imperative for managers to direct their closest attention to these departments. By focusing on the upkeep and maintenance of the rooms, managers can address the primary sources of service failures and guest frustrations and ensure a more satisfactory experience for their guests.

6. LIMITATIONS, FUTURE RESEARCH, CONCLUSIONS

The present study has some limitations requiring future researchers' consideration when planning their respective studies in the same or similar scope of research. First, the employed SRS procedure facilitated a research scope on hotels operated in eleven tourist destinations. Simultaneously, the literature argues that every tourist destination has specific features and properties (Ostovskaya & Pavlenko, 2018). Therefore, future research may focus on comparative studies between hotels in various city destinations, as scoped by this study, to document differences and similarities in hotel service micro-elements that engender guest dissatisfaction. Moreover, in this regard, the present research is still not without generalisation issues since it evinces poorly operated hotel elements from the perspective of destinations examined in this study. To mitigate the generalisation issues, we recommend that future researchers investigate hotels located in other tourist destinations and determine services affecting guest satisfaction using the methodology suggested by the present study.

Second, in line with the previous research limitation, we suggest that academia contemplate a cultural dimension in their research. Also, we suggest future researchers secure a more even sample in data mining of hotel reviews for cross-cultural studies because the web crawler robot returned a different number

of guest reviews per destination in our study due to numerous blank reviews in some destinations and the eventual errors that occurred during the process of reviews collection. As the completed study is relevant to the exploratory type and employs a large sample of qualitative data, such data collection output does not affect the attained findings (Cooksey, 2020).

However, a more even sample will prevent the so-called 'clumping' effect in the sampling procedure, where one descriptive statistic outnumbers other descriptive statistics in the same sample (Peterson, 1975). A strong 'clumping' effect may lead to bias in data distribution and incorrect inferences following the data analysis in comparative studies of city destinations. Thus, we propose that fellow researchers consider a cultural dimension and ensure a balanced sample in their studies. It would generate empirical grounds for comparative and taxonomy studies, delivering intriguing findings.

Lastly, from the standpoint of the research methodology in this study, the literature points to the limitations of the lexicon-based sentiment analysis algorithms employed in our research (Huang *et al.*, 2020). Even though the lexicon-based method is a better solution to gauge sentiment in the guest reviews written in English, as we noted earlier, using the deep machine learning approach employing the CNN technique could benefit future research (Yang *et al.*, 2020). In addition, researchers may investigate opportunities to use alternative machine learning methods for sentiment analysis and causal modelling, including SVM, Naïve Bayes, Random Forest, Stochastic Gradient Boosting, a combination of exploratory factor analysis and linear regression, and others in their studies.

Summarising, this study has revealed and discerned the roots of the negative hotel guest experience by applying sentiment and semantic network analyses with the help of machine learning methods for big data online reviews collected from eleven city destinations. As a result of the application of the methodological procedures, this research extracted fifty hotel service micro-elements that exert guest dissatisfaction with the hotel. The top ten failing micro-elements received a deep examination of their context to spot the origins of guest disappointment. Moreover, the present research suggests a reliable methodology to identify the reasons for low guest satisfaction with hotel services. We hope the developed approach will persuade academia and hotel managers to utilise the suggested methodology in their respective studies to reveal guests' insights on hotel service quality using big data. The findings from this future research will allow managers to detect and revamp poorly operated hotel services in the hotel management domain. Capitalising on the inferences achieved in these future studies will further improve hotel guest satisfaction and, ultimately, the business performance of hospitality organisations.

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7. REFERENCES

Ahn, J., Back, K. J., Barišić, P., & Lee, C. K. (2020). Co-creation and integrated resort experience Croatia: The application of service-dominant logic. *Journal of Destination Marketing and Management*, 17, 100443. https://doi.org/10.1016/j.jdmm.2020.100443

Alam, S., & Yao, N. (2019). The impact of preprocessing steps on the accuracy of machine learning algorithms in sentiment analysis. *Computational and. Mathematical Organization Theory*, 25(3), 319-335. https://doi.org/10.1007/s10588-018-9266-8

Alnawas, I., & Hemsley-Brown, J. (2018). The differential effect of cognitive and emotional elements of experience quality on the customer-service provider's relationship. *International Journal of Retail and Distribution Management*, 46(2), 125-147. https://doi.org/10.1108/IJRDM-03-2017-0058

Alrawadieh, Z., & Law, R. (2019). Determinants of hotel guests' satisfaction from the perspective of online hotel reviewers. *International Journal of Culture, Tourism and Hospitality Research*, 13(1), 84-97. https://doi.org/10.1108/IJCTHR-08-2018-0104

Bachleda, C., & Berrada-Fathi, B. (2016). Is negative eWOM more influential than negative pWOM? *Journal of Service. Theory and Practice*, 26(1), 109-132. https://doi.org/10.1108/JSTP-11-2014-0254

Baltes, S., & Ralph, P. (2022). Sampling in software engineering research: A critical review and guidelines. *Empirical Software Engineering*, 27(4), 94. https://doi.org/10.1007/s10664-021-10072-8

Berezina, K., Bilgihan, A., Cobanoglu, C., & Okumus, F. (2016). Understanding satisfied and dissatisfied hotel customers: Text mining of online hotel reviews. *Journal of Hospitality Marketing and Management*, 25(1), 1-24. https://doi.org/10.1080/19368623.2015.983631

Bueno, E. V., Weber, T. B. B., Bomfim, E. L., & Kato, H. T. (2019). Measuring customer experience in service: A systematic review. *The Service Industries Journal*, 39(11-12), 779-798. https://doi.org/10.1080/02642069.2018.1561873

Butkouskaya, V., Romagosa, F., & Noguera, M. (2020). Obstacles to sustainable entrepreneurship amongst tourism students: A gender comparison. *Sustainability*, 12(5), 1812. https://doi.org/10.3390/su12051812

Caceres, R. C., & Paparoidamis, N. G. (2007). Service quality, relationship satisfaction, trust, commitment and business-to-business loyalty. *European Journal of Marketing*, 41(7/8). https://doi.org/10.1108/03090560710752429

Casalo, L. V., Flavian, C., Guinaliu, M., & Ekinci, Y. (2015). Do online hotel rating schemes influence booking behaviors? *International Journal of Hospitality Management*, 49, 28-36. https://doi.org/10.1016/j.ijhm.2015.05.005

Chang, Y. C., Ku, C. H., & Chen, C. H. (2020). Using deep learning and visual analytics to explore hotel reviews and responses. *Tourism Management*, 80, 104129. https://doi.org/10.1016/j.tourman.2020.104129

Chatterjee, S. (2020). Drivers of helpfulness of online hotel reviews: A sentiment and emotion mining approach. *International Journal of Hospitality Management*, 85, 102356. https://doi.org/10.1016/j.ijhm.2019.102356

Cooksey, R. W. (2020). Illustrating statistical procedures: Finding meaning in quantitative data. *Springer Nature.* https://doi.org/10.1007/978-981-15-2537-7_5

Cuesta-Valiño, P., Bolifa, F., & Núñez-Barriopedro, E. (2020). Sustainable, smart and Muslim-friendly tourist destinations. *Sustainability*, 12(5), 1778. https://doi.org/10.3390/su12051778

Fawcett, T. (2006). An introduction to ROC analysis. *Pattern Recognition Letters*, 27(8), 861-874. https://doi.org/10.1016/j.patrec.2005.10.010

Henche, B. G., Salvaj, E., & Cuesta-Valiño, P. (2020). A sustainable management model for cultural creative tourism ecosystems. *Sustainability*, *12*(22), 9554. https://doi.org/10.3390/su12229554

Geetha, M., Singha, P., & Sinha, S. (2017). Relationship between customer sentiment and online customer ratings for hotels-An empirical analysis. *Tourism Management*, 61, 43-54. https://doi.org/10.1016/j.tourman.2016.12.022

Hu, F., Li, H., Liu, Y., & Teichert, T. (2020). Optimizing service offerings using asymmetric impact-sentiment-performance analysis. *International Journal of Hospitality Management*, 89, 102557. https://doi.org/10.1016/j.ijhm.2020.102557

Hu, M., & B, L. (2004). Mining opinion features in customer reviews. In *Proceedings of AAAI Conference on Artificial Intelligence*, 4, 755-760.

Hu, X., & Yang, Y. (2021). What makes online reviews helpful in tourism and hospitality? A bare-bones meta-analysis. *Journal of. Hospitality Marketing and Management*, 30(2), 139-158. https://doi.org/10.1080/19368623.2020.1780178

Huang, M., Xie, H., Rao, Y., Feng, J., & Wang, F. L. (2020). Sentiment strength detection with a context-dependent lexicon-based convolutional neural network. *Information Sciences*, 520, 389-399. https://doi.org/10.1016/j.ins.2020.02.026

Huang, S., Liang, L. J., & Choi, H. C. (2022). How we failed in context: A text-mining approach to understanding hotel service failures. *Sustainability*, 14(5), 2675.

Hutto, C., & Gilbert, E. (2014). Vader: A parsimonious rule-based model for sentiment analysis of social media text. In *Proceedings of the International AAAI Conference on Web and Social Media*, 8(1), 216-225. https://doi.org/10.1609/icwsm.v8i1.14550

Israeli, A. A., Lee, S. A., & Bolden III, E. C. (2019). The impact of escalating service failures and internet addiction behavior on young and older customers' negative eWOM. *Journal of Hospitality and Tourism Management*, 39, 150-157. https://doi.org/10.1016/j.jhtm.2019.04.006

Jang, S., & Lee, J. (2015). The Impact of Hotel Attributes on Online Hotel Reviews: An Analysis of Reviewer Comments. *Journal of Hospitality Marketing & Management*, 24(3), 289-312.

Khan, F. M., Khan, S. A., Shamim, K., Gupta, Y., & Sherwani, S. I. (2022). Analysing customers' reviews and ratings for online food deliveries: A text mining approach. *International Journal of Consumer Studies*, 1, 24. https://doi.org/10.1111/ijcs.12877

Kim, J., & Im, J. (2018). Proposing a missing data method for hospitality research on online customer reviews: An application of imputation approach. *International Journal of Contemporary Hospitality Management*, 30(11), 3250-3267. https://doi.org/10.1108/IJCHM-10-2017-0708

Kirilenko, A. P., Stepchenkova, S. O., Kim, H., & Li, X. (2018). Automated sentiment analysis in tourism: Comparison of approaches. *Journal of Travel Research*, 57(8), 1012-1025. https://doi.org/10.1177/0047287517729757

Kuruuzum, A., & Koksal, C. D. (2010). The impact of service quality on behavioral intention in hospitality industry. *International journal of. Business and Management Studies*, 2(1), 9-15.

Latinopoulos, D. (2020). Analysing the role of urban hotel location in guests' satisfaction. *Anatolia*, 31(4), 636-650. https://doi.org/10.1080/13032917.2020.1808489

Le, T. D., Robinson, L. J., & Dobele, A. R. (2023). eWOM processing from receiver perspective: Conceptualising the relationships. *International Journal of Consumer Studies*, 47(1), 434-450. https://doi.org/10.1111/ijcs.12864

Lee, B. Y., & Park, S. Y. (2019). The role of customer delight and customer equity for loyalty in upscale hotels. *Journal of Hospitality and Tourism Management*, 39, 175-184. https://doi.org/10.1016/j.jhtm.2019.04.003

Lee, C. H., & Cranage, D. A. (2014). Toward understanding consumer processing of negative online word-of-mouth communication: The roles of opinion consensus and organizational response strategies. *Journal of Hospitality and Tourism Research*, 38(3), 330-360 https://doi.org/10.1177/1096348012451455

Lee, M., Cai, Y., DeFranco, A., & Lee, J. (2020). Exploring influential factors affecting guest satisfaction: Big data and business analytics in consumer-generated reviews. *Journal of Hospitality and Tourism Technology*, 11(1), 137-153. https://doi.org/10.1108/JHTT-07-2018-0054

Lee, M., Lee, S., & Koh, Y. (2019). Multisensory experience for enhancing hotel guest experience: Empirical evidence from big data analytics. *International Journal of Contemporary Hospitality Management*, 31(11), 4313-4337. https://doi.org/10.1108/IJCHM-03-2018-0263

Liu, Y., Huang, K., Bao, J., & Chen, K. (2019). Listen to the voices from home: An analysis of Chinese tourists' sentiments regarding Australian destinations. *Tourism Management*, 71, 337-347. https://doi.org/10.1016/j.tourman.2018.10.004

Luo, J., Huang, S., & Wang, R. (2021). A fine-grained sentiment analysis of online guest reviews of economy hotels in China. *Journal of Hospitality Marketing and Management*, 30(1), 71-95. https://doi.org/10.1080/19368623.2020.1772163

Maimaiti, M., Liu, Y., Luan, H., & Sun, M. (2021). Enriching the transfer learning with pre-trained lexicon embedding for low-resource neural machine translation. *Tsinghua Science and Technology*, *27*(1), 150-163. https://doi.org/10.26599/TST.2020.9010029

Malina, M. A., Nørreklit, H. S., & Selto, F. H. (2011). Lessons learned: Advantages and disadvantages of mixed method research. *Qualitative Research in Accounting and Management*, 8(1), 59-71. https://doi.org/10.1108/11766091111124702

Mariani, M. M., Borghi, M., & Kazakov, S. (2019). The role of language in the online evaluation of hospitality service encounters: An empirical study. *International Journal of Hospitality Management*, 78, 50-58. https://doi.org/10.1016/j.ijhm.2018.11.012

Nie, R. X., Tian, Z. P., Wang, J. Q., & Chin, K. S. (2020). Hotel selection driven by online textual reviews: Applying a semantic partitioned sentiment dictionary and evidence theory. *International Journal of Hospitality Management*, 88, 102495. https://doi.org/10.1016/j.ijhm.2020.102495

Oh, M. M., & Kim, S. S. (2020). Dimensionality of ethnic food fine dining experience: An application of semantic network analysis. *Tourism Management Perspectives*, 35, 100719. https://doi.org/10.1016/j.tmp.2020.100719

Opoku, R. A., Atuobi-Yiadom, N., Chong, C. S., & Abratt, R. (2009). The impact of internal marketing on the perception of service quality in retail banking: A Ghanaian case. *Journal of Financial Services Marketing*, 13(4), 317-329. https://doi.org/10.1057/fsm.2008.26

Ostovskaya, A. A., & Pavlenko, I. G. (2018). Formation of the competitive strategy of development for regional tourist destinations. In F. L. Gaol, N. Filimonova, & V. Maslennikov (Eds.), *Financial and Economic Tools Used in the World Hospitality Industry* (pp. 161-165). CRC Press. https://doi.org/10.1201/9781315148762-31

Padma, P., & Ahn, J. (2020). Guest satisfaction & dissatisfaction in luxury hotels: An application of big data. *International Journal of Hospitality Management*, 84, 102318. https://doi.org/10.1016/j.ijhm.2019.102318

Parasuraman, A., V., Z., & L.L, B. (1985). A Conceptual Model of Service Quality and Its Implications for Future Research. *Journal of Marketing*, 49(4), 41-50. https://doi.org/10.1177/002224298504900403

Park, H., Kline, S. F., Kim, J., Almanza, B., & Ma, J. (2019). Does hotel cleanliness correlate with surfaces guests contact?". *International Journal of Contemporary Hospitality Management, 31(7), 2933-2950.* https://doi.org/10.1108/IJCHM-02-2018-0105

Park, J., & Lee, B. K. (2021). An opinion-driven decision-support framework for benchmarking hotel service. *Omega*, 103, 102415. https://doi.org/10.1016/j.omega.2021.102415

Peterson, C. H. (1975). The effects of clumping on sample evenness. *The American Naturalist*, 109(967), 373-377. https://doi.org/10.1086/283006

Phillips, P., Barnes, S., Zigan, K., & Schegg, R. (2017). Understanding the impact of online reviews on hotel performance: an empirical analysis. *Journal of travel research, 56*(2), 235-249. https://doi.org/10.1177/0047287516636481

Popova, N. (2023, August 3). *Top 100 City Destinations Index 2022 Highlights the Best Performers of the Year*. Euromonitor. https://www.euromonitor.com/article/top-100-city-destinations-index-2022-highlights-the-best-performers-of-the-year

Repovienė, R., & Pažėraitė, A. (2023). Content marketing towards customer value creation. *International Journal of Internet Marketing and Advertising*, *18*(2-3), 263-285. https://doi.org/10.1504/IJIMA.2023.129666

Roy, S. (2018). Effects of customer experience across service types, customer types and time. *Journal of Services Marketing*, 32(4), 400-413. https://doi.org/10.1108/JSM-11-2016-0406

Saleh, F., & Ryan, C. (1992). Conviviality-A source of satisfaction for hotel guests? An application of the Servqual model. In P. Johnson & B.Thomas (Eds.), *Choice and demand in tourism*, 107-122. Mansell Publishing.

Sann, R., Lai, P. C., & Chen, C. T. (2021). Review papers on eWOM: prospects for hospitality industry. *Anatolia*, 32(2), 177-206. https://doi.org/10.1080/13032917.2020.1813183

Shin, S., Du, Q., Ma, Y., Fan, W., & Xiang, Z. (2021). Moderating effects of rating on text and helpfulness in online hotel reviews: An analytical approach. *Journal of Hospitality Marketing and Management*, 30(2), 159-177. https://doi.org/10.1080/19368623.2020.1778596

Son, Y., Kang, K., Choi, I., & Kim, J. (2022). The Determinants of Helpful Hotel Reviews: A Social Influence Perspective. *Sustainability*, *14*(22), 14881. https://doi.org/10.3390/su142214881

Song, Y., Liu, K., Guo, L., Yang, Z., & Jin, M. (2022). Does hotel customer satisfaction change during the COVID-19? A perspective from online reviews. *Journal of Hospitality and Tourism Management*, *51*, 132–138. https://doi.org/10.1016/j.jhtm.2022.02.027

Stamolampros, P., Korfiatis, N., Kourouthanassis, P., & Symitsi, E. (2019). Flying to quality: Cultural influences on online reviews. *Journal of Travel Research*, 58(3), 496-511. https://doi.org/10.1177/0047287518764345

Straka, M., Hajic, J., & Straková, J. (2016). UDPipe: Trainable pipeline for processing CoNLL-U files performing tokenization, morphological analysis, pos tagging and parsing. In *Proceedings of* the *Tenth International Conference on Language Resources and Evaluation, LREC'16*) (pp. 4290-4297).

Straka, M., & Straková, J. (2017). Tokenizing, pos tagging, lemmatizing and parsing ud 2.0 with udpipe. In *Proceedings of the CoNLL 2017 Shared Task: Multilingual Parsing from Raw Text to Universal Dependencies,* 88-99. https://doi.org/10.18653/v1/K17-3009

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1-17. https://doi.org/10.1509/jmkg.68.1.1.24036

Vieira, B. M., Borges, A. P., & Vieira, E. P. (2023). The role of social networks for decision-making about tourism destinations. International Journal of Internet Marketing and Advertising, 18(1), 1-27. https://doi.org/10.1504/IJIMA.2023.128148

Wang, D., & Lu, L. (2017). The Impact of Hotel Characteristics on Online Hotel Reviews: Evidence from Chinese Domestic Hotels. *Asia Pacific Journal of Tourism Research*, 22(4), 375-393.

Wang, L., & Kirilenko, A. P. (2021). Do tourists from different countries interpret travel experience with the same feeling? Sentiment analysis of TripAdvisor reviews. In Information and Communication Technologies in Tourism 2021: Proceedings of the ENTER 2021 eTourism Conference, January 19-22, 2021 (pp. 294-301). Springer International Publishing. https://doi.org/10.1007/978-3-030-65785-7_27

Wong, E., Rasoolimanesh, S. M., & Sharif, S. P. (2020). Using online travel agent platforms to determine factors influencing hotel guest satisfaction. *Journal of Hospitality and Tourism Technology*, 11(3), 425-445. https://doi.org/10.1108/JHTT-07-2019-0099

Xie, K. L., Zhang, Z., & Zhang, Z. (2014). The business value of online consumer reviews and management response to hotel performance. *International Journal of Hospitality Management*, *43*, 1-12. https://doi.org/10.1016/j.ijhm.2014.07.007

Yadav, M. L., & Roychoudhury, B. (2019). Effect of trip mode on opinion about hotel aspects: A social media analysis approach. *International Journal of Hospitality Management*, 80, 155-165. https://doi.org/10.1016/j.ijhm.2019.02.002

Yang, L., Li, Y., Wang, J., & Sherratt, R. S. (2020). Sentiment analysis for E-commerce product reviews in Chinese based on sentiment lexicon and deep learning. *IEEE Access*, 8, 23522-23530. https://doi.org/10.1109/ACCESS.2020.2969854

Ying, S., Chan, J. H., & Qi, X. (2020). Why are Chinese and North American guests satisfied or dissatisfied with hotels? An application of big data analysis. *International Journal of Contemporary Hospitality Management*, 32(10), 3249-3269. https://doi.org/10.1108/IJCHM-02-2020-0129

Zaibaf, M., Taherikia, F., & Fakharian, M. (2013). Effect of perceived service quality on customer satisfaction in hospitality industry. Gronroos' Service Quality Model Development. *Journal of Hospitality Marketing and Management*, 22(5), 490-504. https://doi.org/10.1080/19368623.2012.670893

Zarezadeh, Z. Z., Rastegar, R., & Xiang, Z. (2022). Big data analytics and hotel guest experience: A critical analysis of the literature. *International Journal of Contemporary Hospitality Management*, 34(6), 2320-2336. https://doi.org/10.1108/IJCHM-10-2021-1293

Zhu, L., Lin, Y., & Cheng, M. (2020). Sentiment and guest satisfaction with peer-to-peer accommodation: When are online ratings more trustworthy? *International Journal of Hospitality Management*, 86, 102369. https://doi.org/10.1016/j.ijhm.2019.102369

APPENDIX A1.1.

Table A.1.1
Hotel service micro-elements defined by logistic regression

	Target variable value = 0 (negative sentizment score)			
	interceipt	**0.068**	**Negative reviews count: n = 23135**	**TF-IDF scoring μ:**
	Failing hotel service micro-elements:	**Log. regr. coeff. β value:**		
1	(air) conditioning	0.365	458	0.003
2	carpet	0.358	767	0.003
3	gym	0.356	162	0.001
4	kettle	0.331	373	0.002
5	table	0.307	300	0.001
6	pay	0.300	902	0.004
7	luggage	0.295	352	0.002
8	internet	0.268	306	0.002
9	(online hotel) pictures (images)	0.254	399	0.002
10	TV	0.228	1019	0.003
11	water	0.218	2246	0.007
12	building	0.215	571	0.003
13	elevator	0.213	571	0.003
14	walls	0.213	822	0.003
15	phone	0.212	492	0.002
16	food	0.204	1805	0.007
17	shower	0.201	2747	0.008
18	parking	0.183	515	0.002
19	mattress	0.180	482	0.002
20	stairs	0.179	347	0.001
21	(swimming) pool	0.173	1538	0.008
22	smell	0.170	988	0.005
23	noise	0.160	522	0.003
24	machine	0.159	282	0.002
25	location	0.153	7984	0.019
26	drinks	0.152	186	0.001
27	tub	0.150	205	0.001
28	floors	0.140	315	0.001
29	kitchen	0.140	243	0.001
30	sink	0.137	500	0.002
31	furniture	0.135	565	0.003
32	service	0.129	2541	0.010
33	bed	0.125	3490	0.009
34	breakfast	0.123	4610	0.013
35	area	0,122	1016	0.004
36	doors	0.117	339	0.001
37	room space	0.108	17800	0.022
38	light	0.103	486	0.002
39	restaurant	0.095	918	0.004
40	cleaning	0.083	836	0.004
41	pillows	0.078	436	0.002
42	towels	0.069	1065	0.004
43	bell captain	0.063	353	0.002
44	staff	0.057	6359	0.015
45	animation	0.043	82	0.000
46	reception	0.030	2091	0.006
47	fridge	0.029	367	0.002
48	balcony	0.023	330	0.001
49	slippers	0.020	253	0.002
50	shuttle	0.017	272	0.001

Source: Own elaboration.

APPENDIX A1.2.

Semantic network maps for top ten micro-elements causing hotel service failures

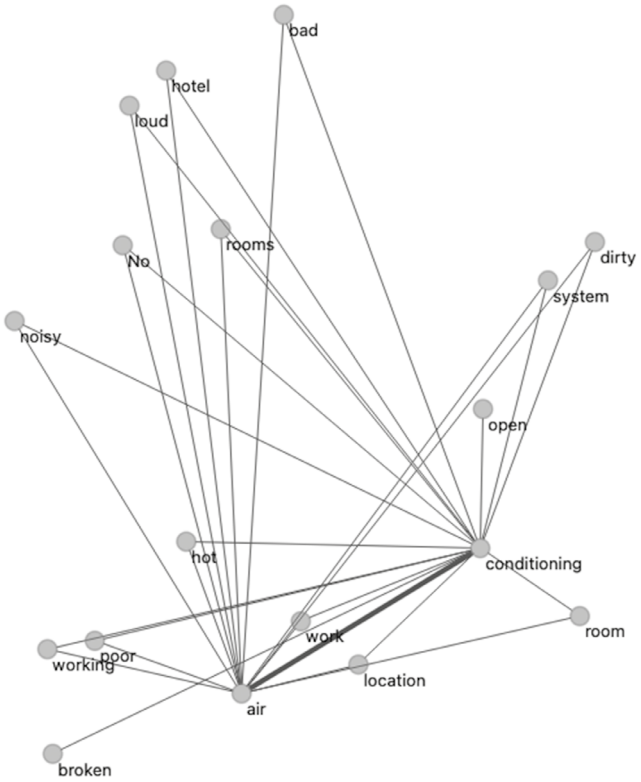

Figure A.1.2.1
Network map: Air conditioning

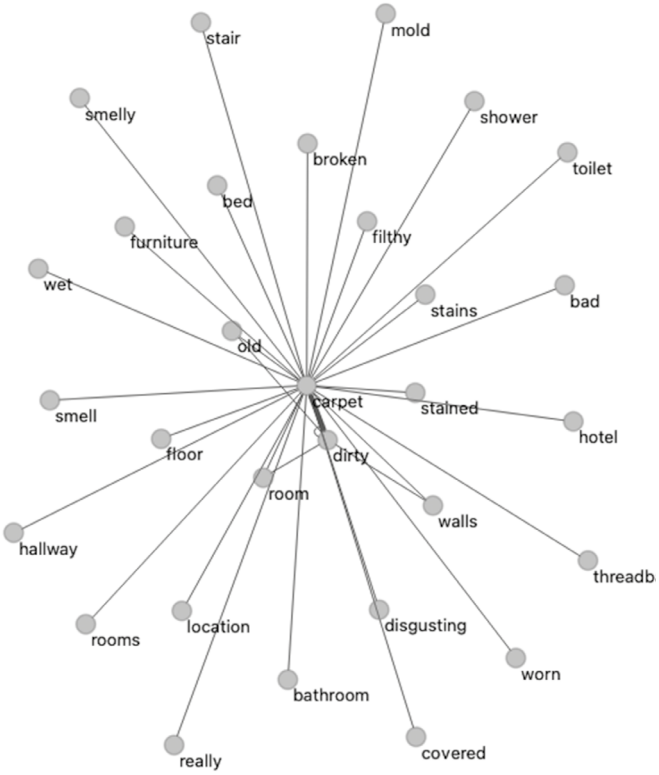

Figure A.1.2.2.
Network map: Carpet

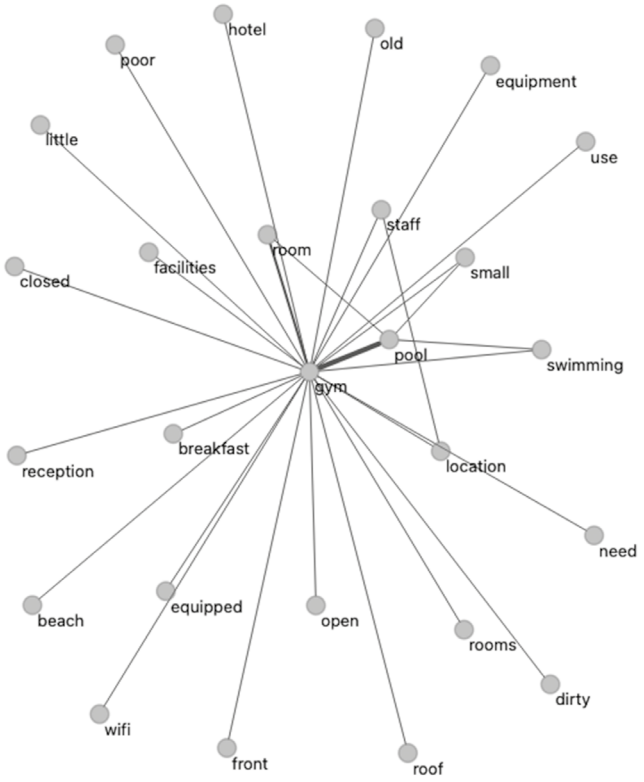

Figure A.1.2.3.
Network map: Gym

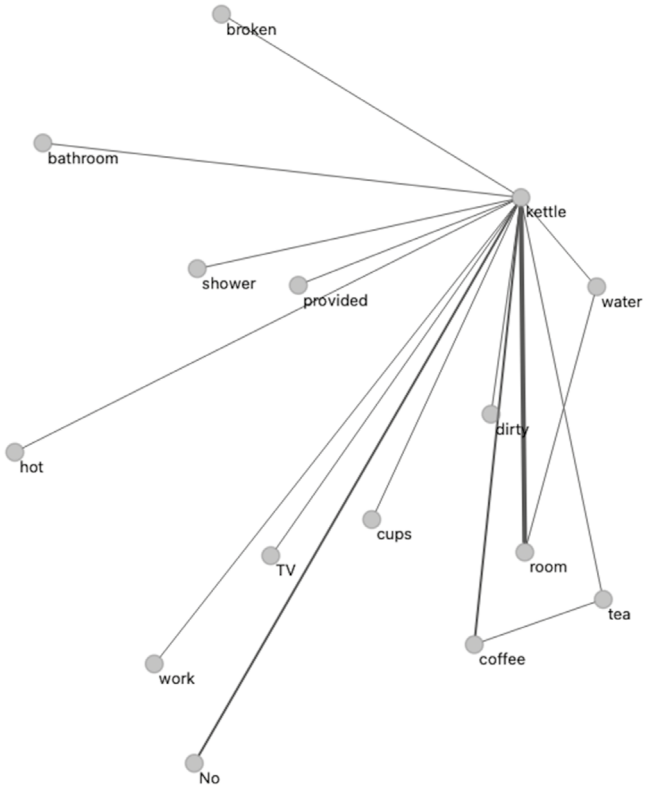

Figure A.1.2.4.
Network map: Kettle

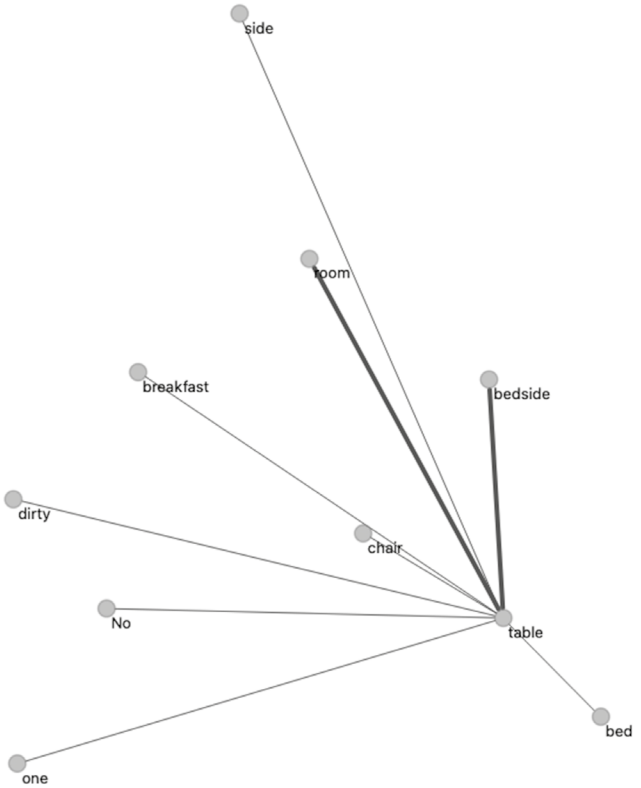

Figure A.1.2.5.
Network map: Table

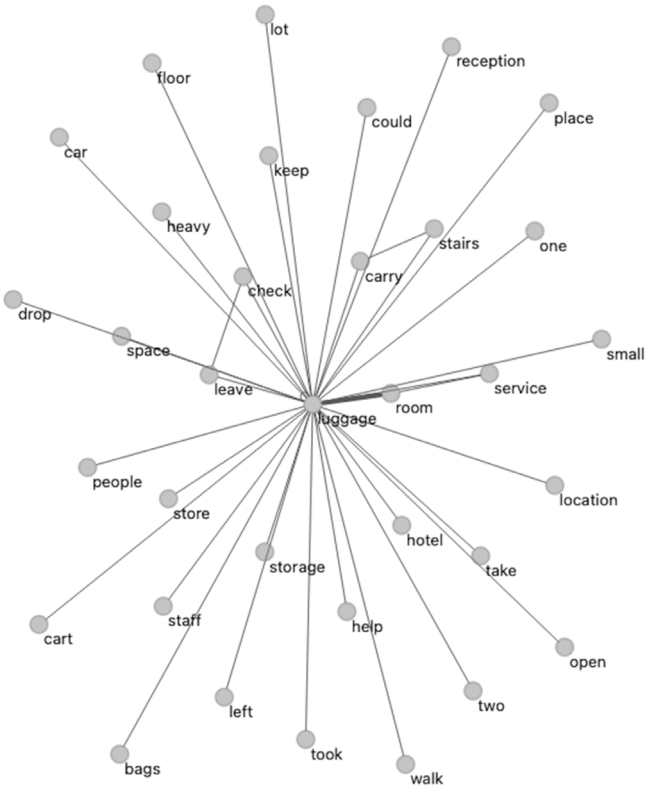

Figure A.1.2.6.
Network map: Luggage

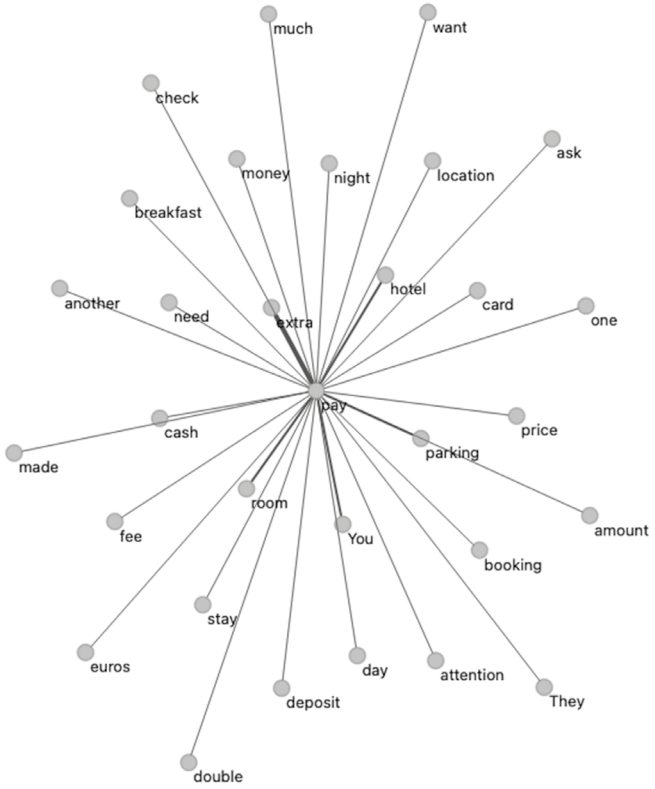

Figure A.1.2.7.
Network map: Pay

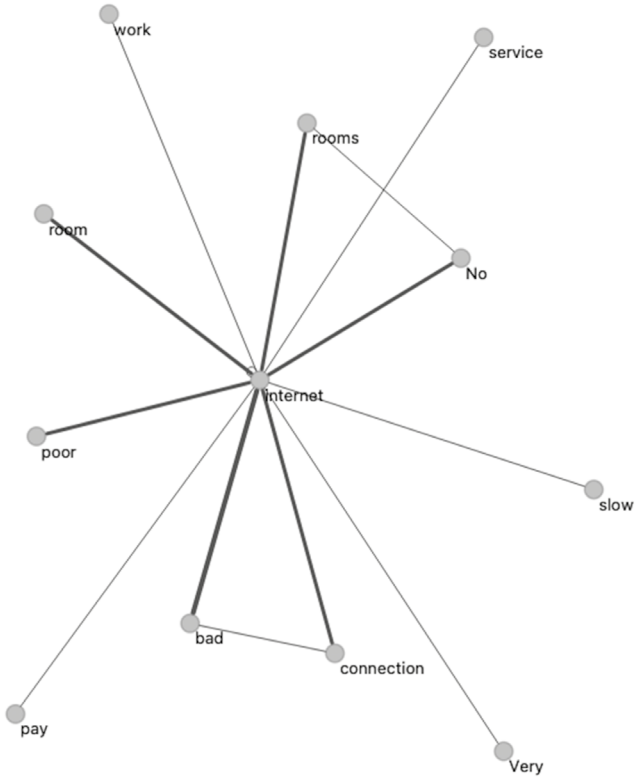

Figure A.1.2.8.
Network map: Internet

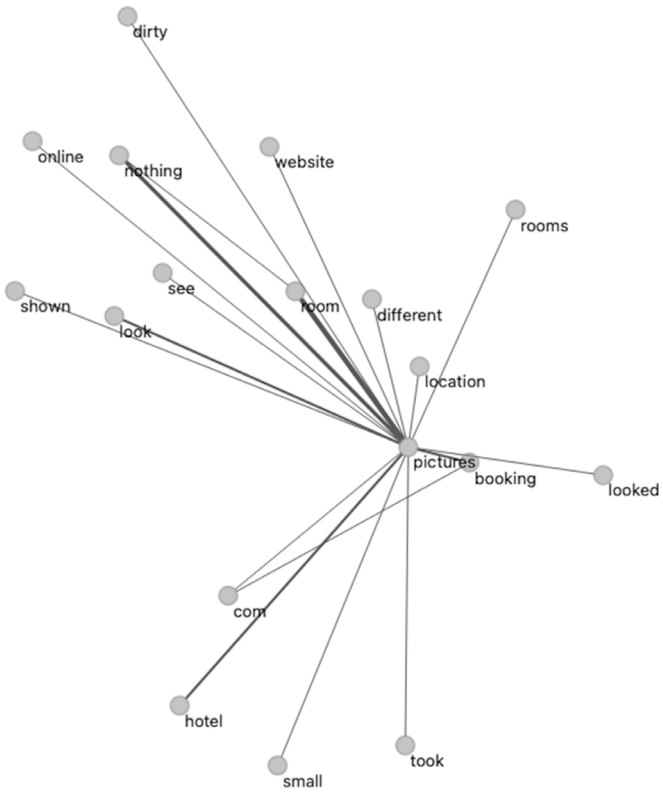

Figure A.1.2.9.
Network map: Pictures

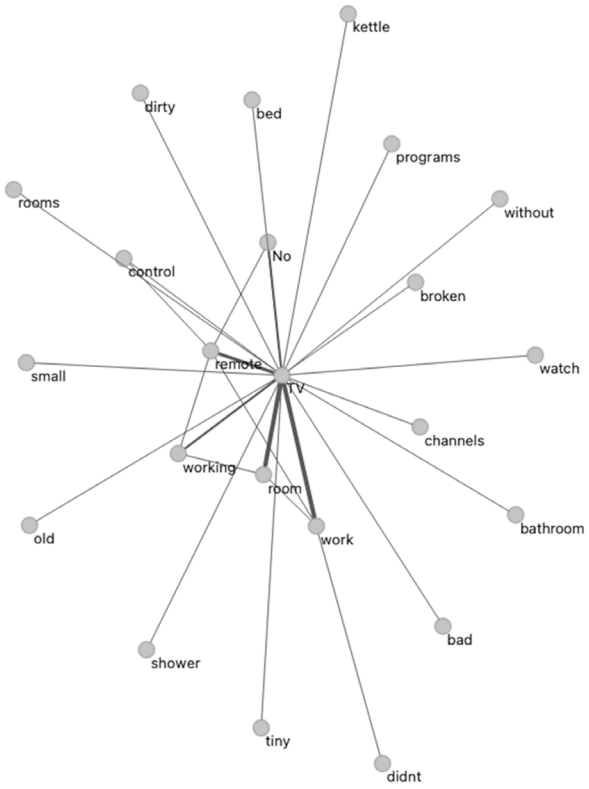

Figure A.1.2.10.
Network map: TV

Source for all figures in Appendix A1.2: Own elaboration.

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Organizational identity construction of Colombian brands of swimwear on Instagram

Construcción de identidad organizacional de marcas colombianas de vestidos de baño en Instagram

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ABSTRACT

The analysis of brand management through images on social networks has become increasingly important for companies, and this is why the purpose of this article is to analyse how visual content strategies and interactions with consumers on Instagram contribute to the construction of the organizational identity of Colombian swimwear brands through the analysis of netnography, in order to improve the understanding of key attributes of digital marketing management. As a first step in collecting the data, the netnography method was used and then the data was analysed through content analysis. In general, it was observed that organizational identity can be born and raised in two ways, a more tangible one that includes factors that describe what the organization expresses and represents; and another made up of the essence, soul, and heart of the brand, both with equal importance when building the organizational identity in social networks based on images. Human Communications are being shaped by new technologies, so this research for practice could be of great use since SNS today are gaining more and more strength as a marketing and advertising tool within organizations.

Keywords: Instagram, Social media, Brand, Identity, Images, Organization.

RESUMEN

Analizar la gestión de la marca a través de las imágenes en las redes sociales se ha vuelto cada vez más importante para las empresas y es por esto que el propósito de este artículo es analizar cómo las estrategias de contenido visual y las interacciones con los consumidores en Instagram contribuyen a la construcción de la identidad organizacional de las marcas colombianas de trajes de baño a través de un análisis netnográfico, con el fin de mejorar la comprensión de los atributos claves de gestión de marketing digital. Como primer paso para recolectar los datos se utilizó el método propuesto por la netnografía y datos fueron analizados a través del análisis de contenido. En general, se observó que la identidad organizacional puede surgir de dos maneras, una más tangible que incluye factores que describen lo que la organización expresa y representa y otra que se compone de la esencia, el alma y el corazón de la marca, ambas con igual importancia a la hora de construir la identidad organizacional en redes sociales basadas en imágenes. Las comunicaciones humanas están siendo moldeadas por las nuevas tecnologías, por lo que esta investigación para la práctica puede ser de gran utilidad ya que hoy en día las redes sociales están ganando cada vez más fuerza como herramienta de marketing y publicidad dentro de las organizaciones.

Palabras clave: Instagram, Red social, Marca, Identidad, Imágenes, Organización.

1. INTRODUCTION

In recent years, Social Networking Sites (SNS) have experienced significant growth, attracting millions of users. It is necessary to be in constant change to stand out among the various options available to online users today. Users not only consume content from the internet, but also help to create it. This indicates that our connections can become the connections of our contacts, and these contacts can alter the nature of that content or add new content, almost instantly. SNS can grow and evolve very quickly in unexpected ways (McFarland & Ployhart, 2015). Thus, online action and interaction allow consumers to display meaning, tell stories, create an extended digital self, and collectively generate an aggregate digital self (Belk, 2013).

In this vast digital world, knowing a brand and being clear about the image the brand wants to reflect is essential, since this can help a brand increase its influence and popularity within these networks. Consumer-brand relationships include emotions such as love and passion (Schembri & Lorien, 2015). Therefore, seeking to generate positive emotions in consumers is a fundamental point when creating digital content. With social interaction being one of the main motivations for using SNS, digital platforms have become a powerful place where consumers can interact and collaborate with brands and other consumers to co-create unique brand experiences (Kim & Drumwright, 2016).

In contemporary context, content based on images and videos have reached elevated levels of popularity in SNS consumers no longer see applications that simply allow them to add filters and effects, but also, look for social networks that include tools that seek to entertain their users. Interactivity has been referred to as the ability of users to influence the form or content of media (Xu & Sundar, 2016). Interactivity-driven control facilitated by social media may offer superior communication capabilities compared to traditional communication platforms (Sreejesh *et al.,* 2020). Brands possess digital tools that enable high levels of user interaction by providing access to extensive information, fostering networking and collaboration, and enhancing the efficiency and effectiveness of business processes (Kraus *et al.,* 2019).

The textile industry in Colombia, although it has had its crises, is a strong sector of the national economy, the designs and knowledge of clothing and production help to make this industry important for the country. In the case of swimwear, the director of textiles and clothing at Procolombia, an entity in charge of promoting tourism, exports, and investments at the national level, says: "We are the leading producer and exporter in South America of swimwear and number 29 in the world" (Moreno, 2018) which reflects that this sector has gained strength not only nationally but also internationally. Being situated near the Caribbean and rich in diverse fauna and flora, Colombia serves as a hub of inspiration for brands and designers. To develop products that resonate with consumers, it is crucial to understand women, their preferences, and their demands. This understanding enables the development of designs that not only utilize excellent materials but also meet the specific needs of their audience.

The big brands of swimwear in Colombia no longer respond to the national market exclusively, but they have international projections in most cases. An example is that one of the brands in this study, is among the brands that are part of L'Catterton, owned by Louis Vuitton since 2017. Therefore, due to the expansion that has taken place within the swimwear sector, it is necessary to understand how brands will reflect their identity, not only to Colombian and Latin consumers but also to consumers from all over the world without losing a clear focus on what their identity is. For brands, Instagram serves as a popular platform for promoting businesses and engaging with individuals who share similar interests and tastes (Dutta & Sharma, 2023). Additionally, it allows consumers to stay updated on day-to-day activities, with these interactions often functioning as a form of advertising. Understanding the relationship between digital engagement experiences and advertising effectiveness is crucial for brands to fully leverage the benefits that this social networking site offers (Voorveld *et al.,* 2018).

This article commences with a review of the literature, emphasizing social networking sites and organizational identity. It then presents the methodology, explaining the rationale for selecting netnography as the study's methodology. After discussing the sample and data collection methods, the data analysis is followed by a discussion. In this discussion, we developed a matrix based on Urde's corporate identity matrix, viewing the brand from three aspects: internal factors, external factors, and a combination of both. The results and conclusions of our analysis offer significant recommendations for brands, while the identified limitations of the study indicate potential directions for future research. As for contribution to the academic literature, the present work seeks to study how the construction of brand identity occurs in an SNS based on images for this case Instagram, this being a very popular network among brands, as a means of communication. This research will focus on Colombian swimwear brands, as this is a sector with immense potential for the country, and because of the great audio-visual content of their publications, it would be expected to obtain and achieve stronger and lasting connections with their consumers.

Finally, it is important to emphasize that the primary objective of this study is to identify the factors influencing the construction of the organizational identity of Colombian swimwear brands on Instagram. This analysis explores how visual content strategies, customer interactions, and the utilization of tools provided by social media platforms contribute to creating a strong and coherent brand identity. Furthermore, the study seeks to understand the elements brands use to establish emotional connections with their consumers, thereby strengthening their presence in the digital environment.

2. LITERATURE REVIEW

2.1 Social Networking Sites

Social networking sites (SNS) have emerged as one of the most significant communication phenomena, with marketing communications disseminated through these platforms proving instrumental in developing a brand image and enhanc-

ing consumer response (Raji *et al.,* 2019). New types of SNS are continually created, having in common that they all share an underlying platform that is based on Web 2.0 technology. This means they are based on an Internet structure that allows a large number of users to share in the creation, manipulation, and distribution of content (McFarland & Ployhart, 2015). Multiple SNS have been evolving to adapt to the needs of their growing number of users, specializing in the way in which content is shared between heterogeneous groups of people who can share personal tastes and preferences on the web. The purpose of these sites is to allow users to create personal profiles, share photos and information, and form online relationships with other like-minded people (Tiggemann & Barbato, 2018).

Boyd and Ellison define SNS as web-based services that allow people to (1) build a public or semi-public profile within a limited system, (2) articulate a list of other users with whom they share a connection and (3) view and navigate their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site (Boyd & Ellison, 2008). SNS not only create new ways of communicating among users but also generate changes in the way brands, products, and services can be promoted. Online users tend to accept and benefit from online information in their decision-making processes by sharing personal experiences and feelings about brands (Farzin *et al.,* 2020) Traditional marketing used to focus on two aims, such as sales and communication, among others. Digital marketing focuses primarily on engagement, which is characterized by thoughts, emotional connections, and/or consumer actions such as videos, apps, ads, or sponsored content (Scheinbaum, 2016) generating a bidirectional communication between brands and their consumers.

The interaction between brands and consumers has changed over the years. Today, consumers actively influence brand messages and meanings, consumer opinions help dictate the variety of products and services. Mobile devices represent the lines of communication, and online "chatter" serves as a crystal ball to help companies determine future product or service initiatives (Hanna *et al.,* 2011), so for brands this digital tool becomes not only a means to promote their products and services but also to obtain information from their customers. Social media engagement is fundamentally about communication. Lasswell's (1960) model of communication identified the source, content, receiver, channel, and effect as important factors in the communication process. Source factors relate to messenger characteristics such as attractiveness; content factors encompass the type of arguments and appeals in the message (Xie-Carson, 2023).

For brands, creating relationships with their consumers is part of the commitment they have with them when interacting through their SNS. In other words, engagement for brands is the act of generating an emotional bond between the company and its online community. This commitment encourages customers to interact with the company (Prado-Gascó *et al.,* 2017), which turns out to be something positive, either because strategies such as word of mouth increase their followers or for the information they receive from their consumers as a source of inspiration for future products or services. Velicia-Martin *et al.,* (2022) conducted a study with the primary objective of analyzing the factors that encourage buyers to recommend purchases via mobile devices using mobile Word of Mouth (mWOM). The study highlights the importance of online reputation, revealing that these variables capture users' perceptions of the selling company. It encompasses the overall assessment consumers make of a company based on their interactions with it, the company's publications, and their reactions to its goods and services.

It is said that a picture is worth a thousand words; sharing pictures using SNS platforms has made it more convenient and faster for people to exchange and spread information (Hu, *et al.,* 2017). SNS based on images have been modifying the interaction they generate between users, which allows them to make changes that truly adapt to what they expect. All this being a way for brands to create clearer content that adds value to their followers, where brands and consumers generate a mutual commitment through audiovisual content. "Engagement" in contrast to "satisfaction" focuses on the cognitive, emotional, and behavioral dynamics of consumers during brand-specific interactions (while satisfaction may largely emerge thereafter) (Hollebeek *et al.,* 2014) thus, brand and customer satisfaction pages can be used to gain and maintain customer loyalty (Nisar & Whitehead, 2016).

2.2. Organizational Identity

Often identity is linked to an image, in most cases brand identity elements are wide ranging and can include colors, logos, characters and taglines (Ward *et al.,* 2020), but it is not as simply as a set of physical characteristics of the organization but rather involves a whole series of behaviors that make it different from the others (Oliva & Carvajal Prieto, 2015). When thinking about how identity should be built, brands do not think of a single place or moment of exposure of this identity. In other words, not only face-to-face sites should talk about the brand, but you also have to know how to take it to the virtual world.

Identity messages refer to the exposures that an organization makes and communicates to its key audiences about itself, these can include messages that describe "who we are", "what we do", "how we do what we do", "why we do what we do" and "how we are different from other similar organizations. Similarly, identity messages, or expressions of identity, can communicate important values (core) to an organization. Identity messages can be found in content generated by the organization, such as its website content, news, published speeches, social media posts, press releases, etc. (Huang-Horowitz & Freberg, 2016).

A review of the literature reveals that an individual's identity formation involves the continual derivation or association of ("What I am") and the disassociation of ("What I am not") to the characteristics of their social context and groups of reference (Roca *et al.,* 2017). In other words, within the individual personality as well as that of brands, what must be clear is what we want to be associated with and what not.

As the literature review progressed, we discovered that the corporate brand identity matrix, proposed by Urde (2013), is composed of nine elements. Its internal component (issuer) is

described in terms of three characteristics of the organization: its "mission and vision", its "culture" and its "competencies"; the external component (receiver) comprises "value proposition", "relationships" and "position". The array is populated with three elements that are both internal and external. "Personality" describes the individual character of the corporate brand, while "expression" defines the verbal and visual manifestations of the brand. The "core brand", consisting of a brand promise and supporting core values, is at the heart of the corporate brand identity matrix (Urde, 2013).

The Corporate Brand Identity Matrix, proposed by Urde (2013), is particularly relevant for this research as it considers elements that can be evaluated within the communication strategies employed by the selected swimwear brands in our sample.

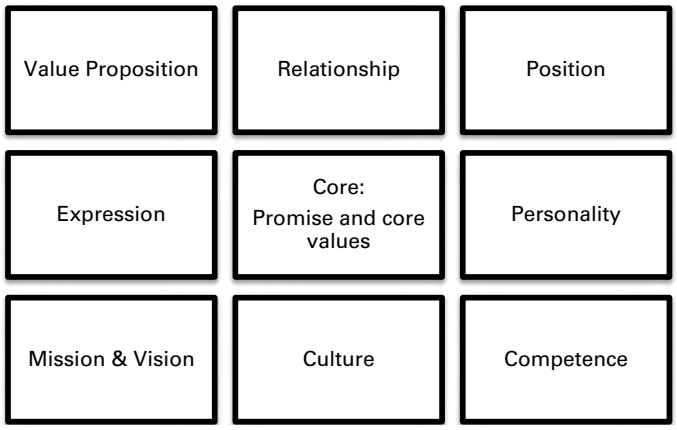

Figure 1
Corporate Brand Identity Matrix
Source: Urde (2013, p. 75)

Identity construction is linked to both position and role in the network, suggesting that a network perspective is critical to understanding identity. The way organizations perceive and are perceived by others serves as a framework through which identity construction takes place (Purchase *et al.,* 2015).

New technologies have allowed organizations to have new opportunities to develop their brand identity. When consumers are highly involved in SNS, they are more interested and willing to dedicate time and effort to use SNS to learn more about products and services. of interest. They may even use SNS as their main means of sharing their experiences or suggestions about the use of products and services (Cheung & To, 2016).

When talking about image-based SNS in some cases, the projected images could be a "genuine attempt to represent essential features of organizational identity to others"; in most cases, however, the projected images "convey a socially desirable and managed impression that emphasizes selected aspects of identity" (Zamparini & Lurati, 2017).

2.3. Identity and Branding

Over the past two decades, numerous models of brand identity have been proposed. For instance, Hankinson (2004) introduced the concept of a core brand, encompassing personality, positioning, and reality, as a representation of brand identity (Rodrigues & Schmidt, 2021). Other researchers define brand identity as a psychological state in which consumers perceive, feel, and value their sense of belonging to a brand (Lam *et al.,* 2013). Additionally, brand identity is considered a reflection of consumer perceptions and can be evaluated through the associations held in memory (Farzin *et al.,* 2022).

The power of the brand goes beyond its recognition and position in the market in which it operates; whether the brand identity is more emotional or rational is less important than the values and beliefs that the brand communicates to create social influence (Alvarado & Guzmán, 2020). It should speak of how the promise of value is fulfilled or not and how the client develops feelings and emotions towards the brand. Consumer aspirations are an important aspect in the branding process, often linked to issues of self-image and status, so before publishing the brand must decide what kind of relationship they want to have with their customers and build it based on what they expect to see and receive from the brand (Anagnostopoulos *et al.,* 2018).

The construction of the brand in SNS must have a clear beacon that guides the strategies and decisions of the organization, which is why content can be created for several reasons, such as building relationships or promoting values, and this as such, it can reveal aspects of the organization's strategy and at the same time of the corporate identity (Devereux *et al.,* 2017), which will lead to a relationship with its consumers that will grow over time through mutual interactions and not only in moments of consumption of the product or service.

Within the brand identity are the aspects that define it and that make it stand out in the market and that remain in the mind of the consumer, branding speaks of the brand in general and reaches the aspects that are not perceived by the consumer at first glance but that make the brand what it is.

According to the above, the following study seeks to explore the construction of organizational identity in social networks, in this case Instagram, since we believe that these digital tools that communicate through subjective elements are one of those that most create emotional connections and interactions today between brands and consumers, which draws attention to be explored and seeks to be understood from a theoretical perspective that generates new sources of knowledge and discussions in the research field.

3. METHODOLOGY

3.1. Netnography

The analysis of the construction of the identity through images was achieved through a nonparticipative, netnographic study (Kozinets, 2009). While netnographic studies could be used in various sectors, researchers stress the great opportunity of netnography in the fashion sector (Parrott *et al.,* 2015). Netnography, an area of ethnography is a qualitative research meth-

od based on precise techniques and applied approaches used for online communities which helps to understand the actions, conduct and participant's relation in the community (Vannini, 2019)

This study sought to investigate the behavior of brands and consumers in SNS and how technology has assisted the evolution of communication between them. Netnography is a special kind of qualitative social media research, that applies ethnographic techniques to comprehend social interaction in settings of modern digital communications (Bansal *et al.,* 2024). This research technique uses the information that is publicly available in online communities to identify and understand the needs of its members (Divakaran, 2017). It was mainly used to observe and understand the interactions and attitudes between some brands and their consumers, collecting a significant amount of data that gives way to a clearer understanding of the symbolic construction that human beings live in the digital world. In conclusion, netnography is writing about people's interactions in social networks (Kozinets, 2015).

Netnography helps researchers reach the data faster and easier without interaction with actual individuals (Vo Thanh and Kirova, 2018) and as a research method, within its qualitative nature, it allows us to understand the social behavior in which people use power technologies to share stories, play identities and influence perceptions and narratives (Lund *et al.,* 2017). It is based on a set of guidelines combined with flexible procedures that emphasize researcher engagement, ethical considerations, and contextualization (Kozinets & Gretzel, 2024). It also serves to understand the behavior of brands and their identities in the digital space within the communities to be investigated, in the case of this research, Instagram. The netnographic research tradition in marketing and consumer research emphasizes understanding connections rather than geographic location (Hine, 2000), and explores how social constructions such as language, consciousness, and shared meanings represent consumers' lived experiences (Myers, 2013).

Netnography embraces holistic digital contexts and as such, it can offer a window into the evolving digital ecosystem where human and machine voices coalesce and intermingle in a complex and dynamic technocultural milieu (Kozinets & Gretzel, 2024). Now that they are collected and a state of data saturation is reached, Kozinets proposes to look at categories, codes, abstractions, conceptions, and constructs in a general way. Once this is done, he proposes to try to use the imagination and then remember a new hermeneutical interpretation. He thinks about the holonic sphere and its relation to social interaction and experience, and how human social and interactive experiences are designed and connected through technology (Kozinets, 2015), and it is at this point that the propositional moment of the method occurs.

It is important to highlight that visual and textual analysis is starting to incorporate digital images on the SNS image-sharing platform Instagram as research data (Drenten *et al.,* 2019) and through a netnographic process of hermeneutic analysis where reading and rereading, interpreting and reinterpreting what has already been reinterpreted leads to the construction of information that makes sense and is seen from the digital context as understandable and true. Netnography is closely aligned with the idea of investigating human experience so that social reality is seen as an iterative process in constant change (Reid & Duffy, 2018).

3.2. Sample design and data collection method

For this study, 10 Colombian swimwear brands with a high number of followers on Instagram were selected. While sample sizes might be a cause for concern for positivists, in an interpretivist paradigm the size of a qualitative sample is relevant only in respect to the project's nature (MacCarthy, 2022). These accounts were chosen at the convenience of the researchers, and the information was collected over four months. Netnography encompasses a diverse range of online content such as images, drawings, photography, sound files, and audiovisual presentations (Jeacle, 2020). The data for this study included the photos and videos posted, the number of likes, the descriptions accompanying the posts, and comments from followers. For each of the brands, a file was generated, in which the data from those four months was stored, and later codified using MAXQDA software.

The SNS selected was Instagram, first because it is one of the most popular social networks in the world, particularly among young people (Marquez, *et al.,* 2022), and on the other hand it is used not only for interactions with other people but also for purchases (Dos Santos & Tateo, 2024). It has a significant impact on decisions related to consumption (Dumas *et al.,* 2020; Sherlock & Wagstaff, 2019; Yurdagül *et al.,* 2021).

The purpose of collecting the photos and videos together with the descriptions was to identify how the text that accompanies the photo influences the creation of the organizational identity based on the image or if it was just another form of communication that the SNS provided to the brand.

Through the use of emojis and hashtags, the brands could establish patterns that would mark their behavior within the SNS in a unique way. At the time this information was collected, we searched within each of the web pages of the analyzed brands for their statement of who they are or their mission, to later compare how what they expressed through text was reflected through images within their SNS or if their identity was different through these two types of communication.

As outlined in the methodology section, a comprehensive analysis was conducted on 10 Colombian swimwear brands. The study involved gathering data on each brand's presence on Instagram, along with a compilation of the descriptions provided on their respective websites. The collected data provided valuable insights into the online strategies and branding efforts employed by each brand. The following table presents a detailed overview of the SNS and website descriptions for each of the 10 brands, offering a holistic perspective on their digital presence and brand positioning within the swimwear industry in Colombia.

Table 1
Brands Description

Brand Number	Web Site	Number of Followers	Verified Account	Description
1	www.aguabendita.com	654.000	Yes	Catalina Álvarez and Mariana Hinestroza, two Colombian women who are passionate about design, decided to create unique and exclusive swimwear to tell the world their story, by mixing details, contemporary design, and crafts.
2	www.maajiswimwear.com	563.000	Yes	The portfolio of this brand includes swimwear, sportswear, cover-ups, children, bags, and accessories. All its lines have a unique combination of colors, shapes, avant-garde silhouettes, textures, and the ubiquitous presence of details that define the brand's philosophy. Its commitment is to always surprise with products of excellent quality, design, and innovative technology.
3	www.palorosabeachwear.com	383.000	No	Palo Rosa is an eccentric, unconventional, and modern brand, dedicated to satisfying avant-garde women who are passionate about attracting attention by always wearing exclusive garments. This Colombian brand of swimwear aims to satisfy today's woman and highlight her femininity with high-tech materials and hand-made to result in a unique product that makes a difference.
4	www.ondademar.com	240.000	Yes	Onda de Mar products are known for their style, originality and superior quality. The company ensures an exclusive and unique look required by fashion and resort lifestyle lovers. His clothes are meticulously designed, inspired by a relaxed and sophisticated lifestyle. Its product lines range from casual to sophisticated and refined, always maintaining luxury as its main characteristic.
5	www.ancoraswimwear.com	173.000	No	From the beginning, Ancora has been characterized as a conceptual, pioneering brand totally focused on conceptualizing the same elegant and innovative lifestyle for men and women. The slogan "Dressed to Swim" or "Dress to swim" calls for the use of urban trends in swimwear for both men and women.
6	www.malaiswimwear.com	127.000	No	Contemporary passionate women who not only seek to be at the forefront but also want a responsible product with a soul. Women who when they wear a Malai garment remember who made it. A woman who feels the power of energy and everything around her. A woman who wants to take with her the best moment of her life "vacation at sea". They say they exist for the woman who is looking for a high-end product that makes her feel happy.
7	www.granadinabm.com	132.000	No	Every swimsuit is an adventure. The print on each garment is unique and as a general rule, each of these garments must be comfortable, versatile, and tell a story. Each Granadina swimsuit is unique and represents the essence of the group of friends. But there is more. It is not only about bathing suits, but about the lifestyle of real women who like to be comfortable, of course, but without stopping showing off on their vacations, in their moments of sunshine.
8	www.towerswimwear.com	98.900	No	Towers Swimwear It was born as an initiative of entrepreneurship and love for summer, the beach, and the sea, since then each of its designs has been characterized by its uniqueness, authenticity, and irreverence, in addition to the quality of its garments made by women head of family from the city of Medellin and 100% Colombian supplies.
9	www.cositalinda.com	79.900	No	Their garments are created as part of a unique collection, specially developed with a style that mixes shapes, fabrics, bases, embroidery, and graphic elements that refer to a widely explored concept to generate trends. Products are designed and produced by an interdisciplinary work team, people concerned about the best quality and giving the user an excellent experience of elegance that reflects the best of beauty, style, and luxury.
10	www.palmarosa.com	34.200	No	The brand is heavily influenced by the beautiful country of Colombia; its colors, culture, and diversity have helped create a very unexpected mix of patterns and textures that have characterized Palmarosa since its inception. All textile patterns and designs are created by Palmarosa, giving them a bohemian and sophisticated feeling with a romantic mix, with a subtle Latin style and always maintaining high-quality standards.

Source (s): Authors and brands Web sites.

4. DATA ANALYSIS

Qualitative data analysis is the classification and interpretation of linguistic (or visual) material to make statements about implicit and explicit dimensions and structures of meaning-making in the material and what is represented in it. Meaning-making can refer to subjective or social meanings (Mezmir, 2020).By combining a methodology such as Netnography for data collection and following the sequential steps described by Silverman (2006, p. 159) for content analysis, along with a manual review of the sample material, it was sought to analyze not only the explicit meaning conveyed through words, but also to gain a deeper understanding of the representations conveyed by images and videos in the creation of brand identity through Instagram. It should also be noted that netnography questions the binary separation between participation and passive observation, considering it a continuum that includes various degrees and nuances (Wu, 2022).

In the first place, it should be considered that these brands were followed up on their profiles created on Instagram for 4 months, where not only the image was collected, but also the text that accompanied it, as well as the comments left by the people within each of the publications. In this case, it is not exclusively about followers because as they are open pages it is not necessary to follow these brands on Instagram to comment, like or simply observe.

Qualitative coding protocols are necessary to break down, extract, and assign meaningful labels within the data set. Coding entails the work of scrutinizing, pondering, and organizing collected observations and relating them to theoretically relevant abstract features and possible relationships (Locke *et al.,* 2022). Once this coding process is completed and verified as robust (Anderson, 2017), second-order or analytical codes and patterns may be identified and evaluated (Discetti *et al.,* 2023). The coding that was given to each one of the images was based on the idea of making textual what could be observed in the images, all this in a descriptive way, such as describing the colors that are observed in the image, the places, if there is a product or not, if there is a presence of models, foods, or phrases, to name a few. Qualitative descriptive research generates data that describes the "who, what, and where of events or experiences" from a subjective perspective (Kim *et al.,* 2017). Following this, the text that accompanies the image published by each of the brands was also coded, looking for the relationship between what they showed visually and what they wanted to communicate as a brand, giving greater importance to the use of emojis and hashtags, these two elements that have emerged from the evolution of communication through SNS. The first allows for a better demonstration of what is being expressed; emojis establish a framework for categorizing the set of signals used by consumers online, where emojis are classified as a form of visual textual paralanguage that can influence brand perceptions, consumer experience, and the brand-consumer relationship (Luangrath *et al.,* 2017). The second was initially created to generate trends but is also used to improve search patterns by users of the SNS.

From a general perspective, it could be inferred that when talking about swimwear brands, images of the sea, beaches, and sunny days will come to consumers' minds. That is to say, a mental relationship is formed regarding the use that would be given to the garments offered by these brands. In this sense, when analyzing these brands, it is found that, although these obvious places for the human mind do have space within the publications of the brands, they do not generate a pattern of visual identification of these. That is to say, the brands go further, and it could be said that the vast majority of them not only present the obvious but also seek to show the entire lifestyle, understanding that the term "lifestyle" refers to a way of life or the way in which an individual chooses to live, characterized by a patterned system of life structure and activities (Dayun & Eunju, 2021). In this case all of that surrounds the garments that when we use is when we reveal the most of our bodies.

When beginning to observe the collected data, it is evident how the brands are interested in showing their consumers tips to lead a desirable lifestyle to wear the garments designed by them in the best way. Food images, recommendations of places to visit, hydration or tanning advice, complete looks that accompany the garments, and in general the search for physical care are topics that are beginning to be discussed and evidenced within the contents of these brands. All of this is because fashion brands contribute to the development of commercial activities, relationships among people, fields such as art, music, literature, culture, beauty, and many more (Noris *et al.,* 2020).

For brands it is clear that to sell their garments, they must present to their consumers how they will accompany the non-verbal expression of their personal styles. In other words, a woman who wears a brand like brand one, which is full of details, colors, and textures, is not the same as one who wears, a brand that hopes to be recognized for the simplicity and sophistication of its garments. All of these brand expresses their styles very well, which speak to two different women who by wearing any of their clothes, will let the world see more of their personality. As stated by Kalbaska *et al.,* (2019), it is also a matter of communication: from a more personal level fashion helps people communicate their own identity, who they are and also who they would like to be, and from a wider level, it gathers together many communication and marketing experts, coming from different fields and having different backgrounds.

Like consumers, brands recognize that an image is worth more than a thousand words; each of the people who access SNS seeks identification, a sense of belonging, and, as previously discussed within the theoretical framework, emotional connections. When talking about fashion clothing it is important to recognize that these are not simple objects that one uses to cover or adorn one´s body. There is much more involved in the simple act of putting on clothes, since "nothing is only one thing" (Tateo & Marsico, 2019, p. 135)

By having the brands selected and as a first approach, each of their web pages was explored, especially the part in which they talk about who they are, and what their missions are, what they want to express, but through text so that once audiovisual data could be compared, it could be determinated if they are consistent with what they express textually within their websites and what they present within their SNS profiles.

Within the analysis of the data, some relationships became evident, and others raised doubts about the intention of the publication. The vast majority of these brands allude to the impor-

tance of being Colombian, that they are made in the country, and that in general, they recognize their Latin roots, but in contrast to this it is found that a small part of these make use of Colombian landscapes to show their products. Most of these brands in the texts that accompany the images address their consumers in English. Certainly, given the discourse within each brand, this can be attributed to their international strategic approach upon which they are placing their wagers.

Likewise, each one speaks of its importance of being unique, innovative, and exclusive, which also allows us to conclude that there is a clear understanding that consumers today are greatly affected by aspects such as being unique and feeling that although they are not personalized garments, using any of these brands will give a touch of exclusivity to their look.

Compared to what they express within their websites, there is one more aspect that should be mentioned: the vast majority speak only of being feminine brands, only some of them, such as brand 5, express that women's swimsuits complement men's shorts. But when analyzing their publications, they refer to the fact that they are practically family brands, where there is a swimsuit for the different members of the family in the case of children and in others, being able to wear outfits that combine with your partner is one of the greatest benefits offered by these brands.

Online experiences challenge brands since emotions and sensations must be produced through images or videos, taking advantage of the fact that social networks offer consumers and businesses valuable opportunities to establish positive connections and enhance their advertising efforts (Salem & Alanadoly, 2021). Each of the evaluated brands showed a different evolution that, in general, stems from a clearer and broader understanding of their consumers. Words such as exclusive, unique, and innovative can be seen in each of the brands, but the important thing is to understand what the consumers of each of the brands understand by exclusive, unique, and innovative, which will allow them to generate not only garments but also content with which to identify each other and thus generate long-term relationships.

In summary, and as indicated above, the methods applied followed the recommended procedures concerning netnography (Kozinets, 2015, 2020) and content analysis (Silverman, 2006) to ensure a high level of reliability in the research conducted.

5. FINDINGS

In this study, the most significant data obtained from the observation of the 10 swimwear brands will be used and will be located within the Corporate Brand Identity Matrix proposed by Urde (2013), which is composed of nine elements within an organizational identity framework described from the textual. Additionally, we believe that, as mentioned previously, this framework adapts very well to the construction of identity that can be achieved through social media based on images. As a result of this study, these elements will be further described for audiovisual identity construction, which is the main objective of this study. This approach allows us to examine how these brands utilize visual content on social media to shape their identity, considering the unique aspects of image-based communication in the digital landscape. By integrating the Corporate Brand Identity Matrix with the visual strategies observed, we aim to provide a comprehensive understanding of how swimwear brands establish and reinforce their identity in the online space, focusing specifically on the visual elements that resonate with their target audience.

Corporate Brand Identity Matrix

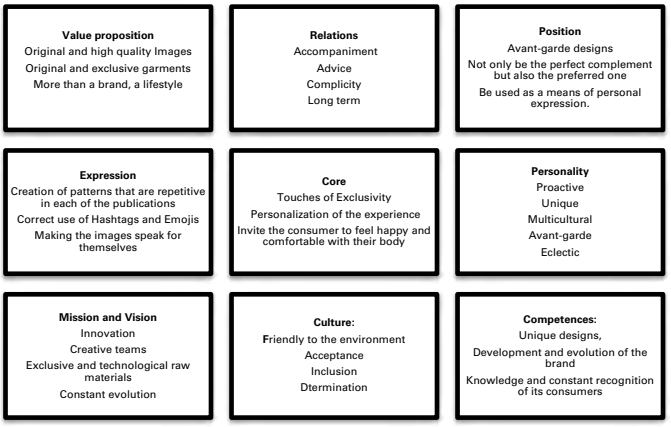

Figure 2
Corporate Identity Matrix
Source: Authors from Urde (2013, p. 75).

As nowadays many consumers prefer simpler but richer shopping experiences by using the Internet and new shopping technologies, retailers need to create the necessary conditions for providing the right experience (Silva *et al.*, 2020). The swimwear brands evaluated in most of the data reflected a clear focus on the creation of lifestyles, that is, they do not want to be the garment that accompanies only a moment but are seen as a way of living life. They not only want to be a company, but they also want to be a guide for their consumers.

In the first link of the corporate identity matrix proposed by Urde are the value proposition, relationships, and position. These three, as external factors, occur when the brands have already carried out an initial recognition process and have created guidelines for the development of what they want to reflect externally. From the visual part, original and high-quality images must be created through which the brand's designs can be shown pleasantly and creatively. Moreover, relationships are no longer just the general knowledge of the consumers, but they should be long term, where the accompaniment and the complicity of giving advice make the relationships feel more like friendship than a commercial transaction.

Regarding the position, it is clear that earning a place in the market is led by earning a place in the minds and hearts of consumers, which is why it must be a form of expression to reach a place where they are not only consumed but also preferred over other brands that can offer the same but do not go beyond being simple clothing producers. In other words, consumers no longer see swimwear only as clothes for the beach, but by following brands and communicating with them through social network sites they are making an even broader statement of their tastes and preferences.

The second link of the corporate identity matrix proposed by Urde tells us about the elements that can be seen both internally and externally. Expression plays a fundamental role in the creation of organizational identity through images, since it makes an obvious allusion to what is being sought and involves knowing how to correctly express everything that the brand has to communicate to its consumers visually.

Creating images and videos that when seen are immediately connected with the brand should be the goal. Whether it is the backgrounds of the photos or the music in the videos, it should be determined what the visual and/or auditory pattern is with which they want to be associated. Likewise, as this SNS (Instagram) allows for text to accompany the audiovisual content, the supporting elements that can be used are especially hashtags and emojis. The first is to create their own and thus generate search patterns where the brand is the first to be found, and the second is to find those that express the thoughts and ideas that the brand wants to communicate.

In terms of personality, this is one of the elements with which greater closeness with consumers can be achieved, since this is a way in which the brand is described humanly. This will allow consumers to feel closer to it and to be able to determine in a clear way in which they are similar or if the brand can take on a more aspirational role in the life of the consumer.

In the third link of the corporate identity matrix proposed by Urde, there are internal factors of the brands, these must be recognized initially and from this, guidelines for the development of what they want to reflect externally should be created. The mission and vision tell us who we are and who we want to become but considering that the world of fashion is changing and constantly evolving, these brands must keep in mind that the consumer and the market change; nothing stays the same. While brands evolve, they must remain relevant and true to who they are because if trends are made just to satisfy momentary changes, they can jeopardize the relationships that have been built for a long time with their consumers. That is to say, these two elements must be raised, but constantly evaluated and somehow redirected.

The culture will always be represented through clear and concrete actions, which is to say that through this it will be verified that everything that has been said and exposed is fulfilled. Marketing allows these brands to achieve social expressions that are coupled to each culture. The need to cover ourselves is the same, what makes it different in how we do it is culture, and this in turn is dynamic and changing.

Therefore, through these audiovisual contents, it becomes easier to express oneself in different ways to reach more markets that in turn include different cultures with which each brand seeks to be identified. Finally, within this link is the competition, which within the visual part must seek to show that the brand is in constant evolution and the reasons why it must be first on the preference scale of its consumers.

It is essential to make use of visual content to show significant changes experienced by the brand, remembering that today's consumers have changing tastes and that they will always be on the lookout for brands that surprise them and offer them something new.

The core of the brand is part of the second link, but in some way, it involves all the elements, so it should be referred to as a set of all the elements named above. At this point, it is the promise that is made to consumers, and this has a role of significant importance in the construction of identity since it is where this the trust that exists between brands and consumers is formed and gains strength. This element has a prominent level of subjectivity since this is where the secret of why it is unique lies and the reason for truly wanting to offer not only products but also original experiences for its consumers.

This last element holds Whitin itself the reason why consumers will recognize brands as different and purposeful. The components of this element must be clear and understood by company collaborators, but indecipherable by their competitors, with the sole purpose of fostering a heart-to-heart relationship between brands and consumers. It's not about what other brands do, it's about what makes each brand stand out from the rest.

The nine elements of the Corporate Brand Identity Matrix proposed by Urde are clearly evident in their applicability to Colombian swimwear fashion brands. Through the analysis of these brands on Instagram, it is apparent how each element of the matrix, from mission and vision to values and brand personality, is reflected in the visual communication strategies employed. This approach not only provides a deep understanding of how these brands construct and maintain their organizational identity but also highlights the importance of tailoring these strategies to a specific market. The integration of Urde's matrix with the observations made offers valuable guidance for brands seeking to strengthen their presence and resonance in the competitive digital fashion market.

6. CONCLUSIONS

In terms of the principal conclusions, first, the essence, the soul, and the heart are by nature intangible and imaginary in some way, but by bringing them together and giving them meaning and value they make not only human beings but also brands stand out from each other. It is important to keep in mind that personal expression is based on communicating what you feel and think verbally and nonverbally. The personality of brands is built from these two forms; the verbal form is what you can show tangibly, either through words, designs or styles and the nonverbal form is when it goes beyond what the consumer expects it to be and makes its way into the consumer's habits not only of purchase but also begins to become part of their digital world.

At this point, subjectivity plays a fundamental role since everything lies in the perspective of the core of the brand and how it expects to be represented in the outside world. Subjectivity itself refers to a way of thinking and feeling for oneself, which is why subjective characteristics are a determining factor in the construction of digital content since differentiators will emerge from these that will allow brands to be unique. Thus, they can decide how they want to be seen and how not, as proposed by Roca *et al.* (2017). Unlike more objective or universal approaches, subjectivity in fashion recognizes that decisions about what is beautiful, what is appropriate or what is trendy are deeply influenced by individual and cultural factors. In the specific case of this study, it is also being influenced by the relationship between brands and their consumers, whereby building brands together they end up identifying themselves through the preferences of both.

Taking a tour of the digital world of swimwear brands, you could immediately say that you only see more of the same; pretty women in swimsuits, with spectacular bodies enjoying paradisiacal beaches. However, but deep down, you begin to find that first, brands have ceased to be aspirational in order to make their consumers feel closer to the brand, either by publishing images sent by their users or by sharing images where having a sculptural body does not prevail but rather the sensation of tranquility, comfort and a total acceptance of who they are. Brands have understood that through social networks, it is about making consumers feel closer to them, since the sole purpose of social networks is not a commercial transaction, consumers first consolidate longer and more lasting relationships, where they feel they are taken into account as part of the brands.

Second, the products move to another plane. Although brands want to be profitable, they have understood that their consumers not only want brands that sell to them but also brands with which they can have two-way communication. SNS represents a new challenge for brands and consumer researchers, as they present a new form of the consumer-brand relationship (Davis *et al.*, 2014). Showing ideas of places to meet, beauty products, ideas for personal care, and motivational phrases are some of the content that demonstrates a clear association with the correct lifestyle that should be led to better enjoy the products of the brand. This seems to be one of the most important points revealed by this research, which indicates that building relationships with their consumers not only based on the sale and purchase of products helps to share and promote brand organizational values. Being able to co-create and have two-way relationships with their consumers supports the process of creating not only products but in this case especially identity in SNS based on images.

This point highlights that brands within SNS in terms of content control, still have the power to decide how to display their identity through these media. In this sense, brand literature tends to conceptualize brand identity as an internal construct that emanates unilaterally from the organization (So *et al.*, 2017). As human beings what makes us different from each other, apart from our appearance, is the personality forged and formed by our roots, lifestyles and culture. The same happens with brands; their personality is born from the roots that their creator imprints on Them. It is intended to be used in certain moments of life and the culture to which it belongs marks the path of the needs that it will satisfy.

Mobile and web-based technologies create interactive platforms for individuals and communities to share, co-create, discuss, and modify user-generated content (Kietzmann *et al.*, 2011). These technologies have revolutionized the way people relate to content created by brands, allowing real-time interactions. Organizations can now take advantage of these digital spaces to create and project their identity in a more dynamic and interactive way. This real-time interaction allows organizations to continually evolve their identity based on the opinions and contributions of their community, allowing for a more fluid and responsive approach. As a result, the integration of mobile technologies and image-based social networks is not only improving connectivity, but also transforming the fundamental ways in which identity is constructed and perceived in the digital age. The constant increase in connectivity that these platforms allow has also given rise to the formulation of new ways of constructing organizational identity.

7. THEORICAL CONTRIBUTION

The research reveals how visual content strategies and social media interactions contribute significantly to the formation of brand identity, aligning with the approaches of Urde (2013) in his Corporate Identity Matrix. This model suggests that brand identity is built through a combination of internal and external factors, such as mission and vision, organizational culture, and competencies, as well as value proposition, relationships and market position. In the digital context, these elements materialize in the posts and visual content that brands share on platforms such as Instagram. Furthermore, the research corroborates McFarland and Ployhart's (2015) theories on the rapid evolution of social networks and their ability to transform communication between brands and consumers. Social network interactions allow consumers to influence brand messages and meanings, which aligns with Farzin *et al.*'s (2020) findings on consumers' active participation in creating and modifying branded content online. This bidirectionality in communication is fundamental to building a coherent and resonant brand identity.

8. PRACTICAL IMPLICATIONS

Human communications are being shaped by new technologies, so this research for practice could be of great use since SNS today are gaining more and more strength as a marketing and advertising tool within organizations.

In the case of the swimwear brands analyzed, there was an initial perception that it was only necessary to publish pretty women in swimwear and that's it. However, after conducting the research, the brands have evolved and must continue in constant evolution to build lasting relationships with their consumers through SNS.

It is not only about looking for women with bodies that are almost unattainable for their consumers, but it is also about showing a real brand, that adapts to anybody a brand that does not want to be seen in an aspirational way but in a real way. Not only through their communication but also in building relationships that feel real, true and lasting.

That is why, by building their identity on SNS based on images, this research will serve as a source of support for brands to understand that they not only sell products through their photos but that their consumers look for brands that reflect lifestyles, and that speak to real women, making value propositions that the consumer can perceive.

Finally, this study contributes to understanding how brands can leverage image-based platforms to differentiate themselves and create a strong and consistent identity that resonates with consumers.

9. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study is not free of empirical, methodological and conceptual limitations. At an empirical level, the case study period is

limited, but according to the direction offered by netnography, it is extensive enough to provide an in-depth account of the aspects that contribute to the creation of organizational identity in social networks based on images, in the case of this study, Instagram.

This research has some limitations. Firstly, it focuses only on netnographic research on chosen brands, considering that Internet research can be broader, since it can use other approaches. The web provides researchers with various opportunities that can be considered. in future research. Furthermore, it is clear that this research cannot be generalized to the entire fashion population, since it is exploratory. Therefore, for future research a greater number of brands or brands that are part of markets other than the Colombian one could be selected.

As a continuation of the present study, a future line will be to identify if the comments that accompany the photos or videos, written by the brand, generate some type of influence on the comments that are given by the users of the SNS, such as the use of the same emojis. By validating whether this happens or not, it will be possible to demonstrate in a better way that the relationship that exists between brands and consumers through the SNS, has not only remained a like but has also evolved to the point of influencing how comments on these photos or videos are made. The understanding and validation of this will also serve as a source of reference to give a broader explanation of the aforementioned if the brand wants to identify itself with its consumers or if it wants its consumers to identify with it.

In the same way, this type of research could be replicated in other sectors in which a high use of SNS based on images is shown, to understand how identity is built through these, which would allow in the future consideration of how the construction of identity through images occurs as well as how organizational identity is built through text in a general way.

Additionally, this research could be applied to other social media platforms like TikTok, Snapchat, and YouTube Shorts, where strategies for constructing organizational identity based on visual content can be explored and adapted. These platforms, known for their emphasis on visual content, offer new opportunities for brands to connect with their consumers in creative and dynamic ways. Extending the analysis to these social network sites allows an investigation into how brands can maintain their organizational identity while leveraging the unique features of each platform to maximize their reach and impact.

10. REFERENCES

Alvarado-Karste, D. & Guzmán, F. (2020). The effect of brand identity-cognitive style fit and social influence on consumer-based brand equity. *Journal of Product & Brand Management*, *29*(7), 971-984. https://doi.org/10.1108/JPBM-06-2019-2419

Anagnostopoulos, C., Parganas, P., Chadwick, S., & Fenton, A. (2018). Branding in pictures: using Instagram as a brand management tool in professional team sport organisations. *European Sport Management Quarterly* , 413-438. https://doi.org/10.1080/16184742.2017.1410202

Anderson V. (2017). Criteria for evaluating qualitative research. *Human Resource Development Quarterly*, *28*(2), 125–133. https://doi.org/10.1002/hrdq.21282

Bansal, R., Martinho, C., Pruthi, N., & Aggarwal, D. (2024). From virtual observations to business insights: A bibliometric review of netnography in business research. *Heliyon*, 10(1). https://doi.org/10.1016/j.heliyon.2023.e22853

Belk, R. W. (2013). Extended Self in a Digital World. *Journal of Consumer Research, Inc. 40*(3), 477-500. https://doi.org/10.1086/671052

Boyd, D. M., & Ellison, N. B. (2008). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, 210-230. https://doi.org10.1111/j.1083-6101.2007.00393.x

Cheung, M. F., & To, W. (2016). Service co-creation in social media: An extension of the theory of planned behavior. *Computers in Human Behavior, 65*, 260-266 https://doi.org 10.1016/j.chb.2016.08.031

Davis, R., Piven, I., & Breazeale, M. (2014). Conceptualizing the brand in social media community: The five sources model. *Journal of Retailing and consumer services*, 21(4), 468-481.https://doi.org10.1016/j.jretconser.2014.03.006

Dayun Jeong & Eunju Ko (2021). The influence of consumers' self-concept and perceived value on sustainable fashion. Journal of Global Scholars of Marketing Science, https://doi.org 10.1080/21639159.2021.1885303

D. Buhalis (Ed.) (2022), Encyclopedia of tourism marketing and management, Edward Elgar Publishing, Northampton, MA. https://doi.org10.4337/9781800377486

Devereux, L., Melewar, T., & Foroudi, P. (2017). Corporate Identity and Social Media: Existence and Extension of the Organization. *International Studies of Management and Organization*, 110-134. https://doi.org10.1080/00208825.2017.1256161

Discetti, R., & Anderson, V. (2023). The Value of Netnography for Research in HRD. *Human Resource Development Review*, *22*(1), 59-83. https://doi.org10.1177/15344843221137506

Divakaran, P. K. (2017). The netnographic method as early warning: Linking antecedents of prerelease behavior of technology-enabled community to future market trends. *Technological Forecasting & Social Change*, 245-257. https://doi.org10.1016/j.techfore.2017.08.003

Dos Santos César, J. L., & Tateo, L. (2024). The use of branded clothing in identity development and social relations between adolescents. *Culture & Psychology*, 0(0). https://doi.org10.1177/1354067X241236721

Drenten, J., Gurrieri, L. and Tyler, M. (2019). Sexualized labor in digital culture: Instagram influencers, porn chic and the monetization of attention. *Gender, Work and Organization*, *27*(1), 41-66. https://doi.org10.1111/gwao.12354

Dumas T. M., Maxwell-Smith M. A., Tremblay P. F., Litt D. M., Ellis W. (2020). Gaining likes, but at what cost? Longitudinal relations between young adults' deceptive like-seeking onsicanalím, peer belonging and self-esteem. *Computers in Human Behavior*. https://doi.org10.1016/j.chb.2020.106467

Dutta, A., & Sharma, A. (2023). Netnography and Instagram community: An empirical study. *Business Information Review*, *40*(1), 33-37. https://doi.org/10.1177/02663821231157

Farzin M., Vazifehdust H., & Hamdi K. (2020). Projective techniques for understanding cyber-market mavenism in social network sites. *Revista Brasileira de Gestão de Negócios*, *22*(3), 729–749. https://doi.org/10.7819/rbgn.v22i3.4074

Farzin, M., Sadeghi, M., Fattahi, M., & Eghbal, M. R. (2022). Effect of Social Media Marketing and eWOM on Willingness to Pay in the Etailing: Mediating Role of Brand Equity and Brand Identity. *Business Perspectives and Research*, *10*(3), 327-343. https://doi.org/10.1177/22785337211024926

Hankinson, G. (2004). Relational network brands: Towards a conceptual model of place brands. Journal of Vacation Marketing, 10(2), 109-121. https://doi.org/10.1177/135676670401000202

Hanna, R., Rohm, A., & Crittenden, V. L. (2011). We're all connected: The power of the social media ecosystem. *Business horizons*, 54(3), 265-273. https://doi.org/10.1016/j.bushor.2011.01.007

Hine, C. (2000). *Virtual Ethnography*. Sage Publications UK, London. https://doi.org/10.4135/9780857020277

Hollebeek, L. D., Glynn, M., & Brodie, R. (2014). Consumer Brand Engagement in Social Media: Conceptualization, Scale 2 Development and Validation. *Journal of Interactive Marketing, 28*, 149–165. https://doi.org/10.1016/j.intmar.2013.12.002

Huang-Horowitz, N., & Freberg, K. (2016). Bridging organizational identity and reputation messages online: A conceptual model. *Corporate Communications: An International Journal, 21* (2), 195-212. ISSN: 1356-3289

Hu, X., Hu, D., Zheng, S., Li, W., Chen, F., Shu, Z., y otros. (2017). How people share digital images in social networks: a questionnaire-based study of privacy decisions and access control. *Multimedia Tools and Applications*, 18163-18185. https://doi.org/10.1007/s11042-017-4402-x

Jeacle, I. (2020). Navigating netnography: A guide for the accounting researcher. *Financial Accountability & Management*, 37(1), 88-101. https://doi.org/10.1111/faam.12237

Kalbaska, N., Sádaba, T., & Cantoni, L. (2019). Editorial: Fashion communication: Between tradition and digital transformation. https://doi.org/24434/J.SCOMS.2018.02.005

Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business horizons,* 54(3), 241-251. https://doi.org/10.1016/j.bushor.2011.01.005.

Kim, E., & Drumwright, M. (2016). Engaging consumers and building relationships in social media: How social relatedness influences intrinsic vs. extrinsic consumer motivation. *Computers in Human Behavior*, 63, 970-979. https://doi.org/10.1016/j.chb.2016.06.025.

Kim H, Sefcik JS & Bradway C. (2017) Characteristics of qualitative descriptive studies: A systematic review. *Research in Nursing & Health*, *40*, 23–42. https://doi.org/10.1002/nur.21768.

Kozinets, R.V. (2009). *Netnography: Doing Ethnographic Research Online*. Sage, London. ISBN: 1848606451

Kozinets, R. V. (2015). *Netnography Redefined.* London: SAGE Publications Ltd. ISBN: 9781446285756

Kozinets, R. V. (2020). *Netnography. The Essential Guide to Qualitative Social Media Research*. London: SAGE Publications Ltd. ISBN: 978-1526444707

Kozinets, R. V., & Gretzel, U. (2024). Netnography evolved: new contexts, scope, procedures, and sensibilities. *Annals of Tourism Research*, 104, 103693. https://doi.org/10.1016/j.annals.2023.103693

Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2019). Digital entrepreneurship: A research agenda on new business models for the twenty-first century. *International Journal of Entrepreneurial Behavior & Research*, *25* (2), 353-375. https://doi.org/10.1108/IJEBR-06-2018-0425

Lam, S.K., Ahearne, M., Mullins, R. *et al.* Exploring the dynamics of antecedents to consumer–brand identification with a new brand. *J. of the Acad. Mark. Sci.* 41, 234-252 (2013). https://doi.org/10.1007/s11747-012-0301-x

Lasswell, H. D. (1960). The structure and function of communication in society. *The communication of ideas*, *37*(1), 136-139.

Locke, K., Feldman, M., & Golden-Biddle, K. (2022). Coding Practices and Iterativity: Beyond Templates for Analyzing Qualitative Data. *Organizational Research Methods*, *25*(2), 262-284. https://doi.org/10.1177/1094428120948600

Luangrath, A. W., Peck, J., & Barger, V. A. (2017). Textual paralanguage and its implications for marketing communications. *Journal of Consumer Psychology*, *27*(1), 98–107. https://doi.org/10.1016/j.jcps.2016.05.002

Lund, N. F., Cohen, S., & Scarles, C. (2017). The power of social media storytelling in destination branding. *Journal of Destination Marketing & Management*, 271-280. https://doi.org/10.1016/j.jdmm.2017.05.003

Márquez I., Lanzeni D., Masanet M. J. (2022). Teenagers as curators: Digitally mediated curation of the self on Instagram. *Journal of Youth Studies*, *26*(7), 907-924. https://doi.org/10.1080/13676261.2022.2053670

MacCarthy, M. (2022). Nethnography, complementing Netnography: a defensible praxis for the online researcher. *Current Issues in Tourism*, *26*(23), 3782-3793. https://doi.org/1080/13683500.2022.2120384

McFarland, L. A., & Ployhart, R. E. (2015). Social Media: A Contextual Framework to Guide Research and Practice. *Journal of Applied Psychology, 100* (6), 1653-1677.https://doi.org/10.1037/a0039244

Mezmir, E. A. (2020). Qualitative data analysis: An overview of data reduction, data display, and interpretation. *Research on humanities and social sciences*, *10*(21), 15-27. https://doi.org/10.7176/RHSS/10-21-02

Moreno, S. (24 of July de of 2018). El secreto que lanza al éxito los bikinis colombianos. Así transforman el cuerpo. *El nuevo herald*. https://www.elnuevoherald.com/noticias/acceso-miami/negocios/article215384800.html.

Myers, M.D. (2013). *Qualitative Research in Business and Management*. Sage Publications (2nd ed), Los Angeles. ISBN 0857029746, 9780857029744

Nisar, T. M., & Whitehead, C. (2016). Brand interactions and social media: Enhancing user loyalty through social networking sites. *Computers in Human Behavior, 62*, 743-753. https://doi.org/10.1016/j.chb.2016.04.042

Noris, A., Nobile, T. H., Kalbaska, N., & Cantoni, L. (2020). Digital Fashion: A systematic literature review. A perspective on marketing and communication. *Journal of Global Fashion Marketing*, *12*(1), 32-46. https://doi.org/10.1080/20932685.2020.1835522

Oliva, E. J., & Carvajal Prieto, L. (2015). La identidad organizacional y su influencia en la imagen: una reflexión teórica. *Suma de Negocios*, 114-123. https://doi.org/10.1016/j.sumneg.2015.08.011

Parrott, G., Danbury, A. and Kanthavanich, P. (2015). Online behaviour of luxury fashion brand advocates. *Journal of Fashion Marketing and Management*, *19*(4), 360-383. https://doi.org/10.1108/JFMM-09-2014-0069

Prado-Gascó, V., Calabuig Moreno, F., Añó Sanz, V., Núñez-Pomar, J., & Crespo Hervás, J. (2017). To post or not to post: social media sharing and sporting event performance. *Psychology and Marketing*, 995-1003. https://doi.org/10.1002/mar.21038

Purchase, S., Silva Rosa, R., & Schepis, D. (2015). Identity construction through role and network position. *Industrial Marketing Management*, 154-163. https://doi.org/10.1016/j.indmarman.2015.07.004

Raji, R.A., Rashid, S. and Ishak, S. (2019). The mediating effect of brand image on the relationships between social media advertising content, sales promotion content and behaviuoral intention. *Journal of Research in Interactive Marketing*, *13*(3), 302-330. https://doi.org/10.1108/JRIM-01-2018-0004

Reid, E., & Duffy, K. (2018). A netnographic sensibility: developing the netnographic/social listening boundaries. *Journal of Marketing Management*, 263-286. https://doi.org/10.1080/0267257X.2018.1450282

Roca, D., Wilson, B., Barrios, A., & Muñoz-Sánchez, O. (2017). Creativity identity in Colombia: the advertising creatives' perspective. *International Journal of Advertising*, 831-851. https://doi.org/10.1080/02650487.2017.1374318

Rodrigues, C., & Schmidt, H. J. (2021). How the Creative Class Co-creates a City's Brand Identity: A Qualitative Study. *Journal of Creating Value*, 7(1), 19-43. https://doi.org/10.1177/23949643211010594

Salem, S.F., & Alanadoly, A.B. (2021). Personality traits and social media as drivers of word-of-mouth towards sustainable fashion. *Journal of Fashion Marketing and Management*, *25*(1), 24-44. https://doi.org/10.1108/JFMM-08-2019-0162

Schembri, S., & Lorien , L. (2015). Online brand communities: constructing and coconstructing brand culture. *Journal of Marketing Management, 32* (7-8), 628-651. https://doi.org/10.1080/0267257X.2015.1117518

Scheinbaum, A. C. (2016). Digital engagement: opportunities and risks for sponsors: Consumer-Viewpoint and practical considerations for marketing via mobile and digital platforms. *Journal of Advertising Research*, *56*(4), 341-345. https://doi.org/10.2501/JAR-2016-040

Sherlock M., Wagstaff D. L. (2019). Exploring the relationship between frequency of Instagram use, exposure to idealized images, and psychological well-being in women. *Psychology of Popular Media Culture*, *8*(4), 482-490. https://doi.org/10.1037/ppm0000182

Silva, S.C., Duarte, P. and Sundetova, A. (2020). Multichannel versus omnichannel: a price-segmented comparison from the fashion industry. *International Journal of Retail & Distribution Management*, *48*(4), 417-430. https://doi.org/10.1108/IJRDM-07-2019-0232

Silverman, D. (2006). *Interpreting Qualitative Data*. SAGE Publications, London (3rd ed.). ISBN: 9781446259962

So, K. K. F., King, C., Hudson, S., & Meng, F. (2017). The missing link in building customer brand identification: The role of brand attractiveness. *Tourism Management*, *59*, 640-651. https://doi.org/10.1016/j.tourman.2016.09.013

Sreejesh, S., Paul, J., Strong, C., & Pius, J. (2020). Consumer response towards social media advertising: Effect of media interactivity, its conditions and the underlying mechanism. International Journal of Information Management, *54*, 102155. https://doi.org/10.1016/j.ijinfomgt.2020.102155

Tateo, L. & Marsico, G. (2019). Framing a Theory of Ordinary and Extraordinary in Cultural Psychology. In G. Marsico & L. Tateo (Eds), *Ordinary Things and their Extraordinary Meanings*. *Annals of Cultural Psychology*, *3*, 11-29. ISBN 978-1-64113-682-2

Tiggemann, M., & Barbato, I. (2018). "You look great!": The effect of viewing appearance-related Instagram comments on women's body image. *Body Image*, 61-66. https://doi.org/10.1016/j.bodyim.2018.08.009

Urde, M. (2013). The Corporate Brand Identity Matrix. *Journal of Brand Management , 20*, 742–761. https://doi.org/10.1057/bm.2013.12

Vannini P (2019) How to create and disseminate ethnographic and qualitative research to wide audiences. In: Doing Public Ethnography, 1st edition. Routledge, p. 166. ISBN: 9781138086432

Velicia-Martin, F., Folgado-Fernández, J. A., Palos-Sánchez, P. R., & López-Catalán, B. (2022). mWOM Business Strategies: Factors Affecting Recommendations. *Journal of Computer Information Systems*, *63*(1), 176-189. https://doi.org/1080/08874417.2022.2041504

Vo Thanh T., & Kirova V. (2018). Wine tourism experience: A netnography study. *Journal of Business Research*, *83*, 30-37. https://doi.org/10.1016/j.jbusres.2017.10.008

Voorveld, H. A., Van Noort, G., Muntinga, D. G., & Bronner, F. (2018). Engagement with social media and social media advertising: The differentiating role of platform type. *Journal of advertising*, *47*(1), 38-54. https://doi.org/10.1080/00913367.2017.1405754.

Ward, E., Yang, S., Romaniuk, J. *et al.,* (2020) Building a unique brand identity: measuring the relative ownership potential of brand identity element types. *J. Brand Manag*, 27, 393-407. https://doi.org/1057/s41262-020-00187-6

Wu D. (2022). More than a solo method: Netnography's capacity to enhance offline research methods. *Area*, *54*(1), 88–95. https://doi.org/10.1111/area.12750

Xie-Carson, L., Benckendorff, P., & Hughes, K. (2023). Keep it Unreal: Exploring Instagram Users' Engagement With Virtual Influencers in Tourism Contexts. *Journal of Hospitality & Tourism Research*, *0*(0). https://doi.org/10.1177/10963480231180940

Xu, Q., & Sundar, S. (2016). Interactivity and memory: Information processing of interactive versus non-interactive content. *Computers in Human Behavior , 63*, 620-629. DOI: 10.1016/j.chb.2016.05.046

Yurdagül C., Kircaburun K., Emirtekin E., Wang P., Griffiths M. D. (2021). Psychopathological consequences related to problematic Instagram use among adolescents: The mediating role of body image dissatisfaction and moderating role of gender. *International Journal of Mental Health and Addiction*, *19*(5), 1385-1397. https://doi.org/10.1007/s11469-019-00071-8

Zamparini, A., & Lurati, F. (2017). Being different and being the same: Multimodal image projection strategies for a legitimate distinctive identity. *Strategic Organization, 15* (1), 6-39. https://doi.org/10.1177/1476127016638811

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Uncovering the receiver's traits that moderate the effect of e-WOM valence on the purchase intentions of healthy food products

Descubriendo los rasgos del receptor que moderan el efecto de la valencia del e-WOM en las intenciones de compra de productos alimenticios saludables

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ABSTRACT

This study applies the information integration theory (IIT) to explore how individuals simultaneously combine several stimuli —electronic word-of-mouth (e-WOM) valence, information source, and brand expectations— depending on four traits —consumption product frequency, social media use frequency, health consciousness and susceptibility to social influence— to form intentions toward health food brands products commented in social media. A 2×2×2 experiment was designed, and 200 Mexican consumers recruited online were randomly assigned to a high or null brand expectation condition before being exposed to a combination of positive or negative e-WOM published by a digital consumer or an influencer. According to the IIT, a multiplicative algebraic model describes how the receiver's health consciousness, product category consumption frequency, and social media use moderate the relationship between e-WOM valence and consumers' purchasing intention. The moderator effect of two experimental factors, the information source and the brand expectations, plus the moderator effect of the consumer social susceptibility were not empirically supported; however, brand expectations directly influenced the purchase intention. This study contributes to the online consumer behavior and e-WOM literature by examining the nonconscious or semiconscious processing of e-WOM valence when combined with other stimuli and how the effect of e-WOM valence changes depending on individual behaviors and traits.

Keywords: e-WOM, social media, purchase intention, online consumer behavior, healthy food products.

R E S U M E N

Este estudio aplica la teoría de integración de la información (IIT) para explorar cómo los individuos combinan simultáneamente varios estímulos —la valencia del boca a boca electrónico (e-WOM), la fuente de información y las expectativas de marca— dependiendo de cuatro características —la frecuencia de consumo de la categoría de productos, la frecuencia de uso de medios sociales, la conciencia sobre la salud y la susceptibilidad hacia la influencia social— para formar intenciones de compra hacia un alimentos de marcas saludables comentados en redes sociales. Se diseñó un experimento 2×2×2 y 200 consumidores mexicanos reclutados en línea fueron asignados aleatoriamente a un nivel de expectativa de marca alto o nulo antes de exponerlos a una combinación de e-WOM positivo o negativo publicada por un consumidor digital o un *influencer*. De acuerdo con la IIT, un modelo algebraico multiplicativo describe cómo la conciencia sobre la salud, la frecuencia de consumo de la categoría de producto y la frecuencia del uso de las redes sociales moderan la relación entre la valencia de e-WOM y las intenciones de compra de los consumidores. El efecto moderador de dos de los factores experimentales, la fuente de información y las expectativas de marca, además del efecto moderador de la susceptibilidad a la influencia social no se apoyaron empíricamente, sin embargo, las expectativas de marca tuvieron un efecto directo significante sobre las intenciones de compra. Este estudio contribuye a la literatura del comportamiento en línea del consumidor y del e-WOM al examinar el procesamiento no-consciente o semiconsciente de la valencia de e-WOM cuando ésta se combina con otros estímulos y cómo el efecto de la valencia de e-WOM cambia dependiendo de los comportamientos y rasgos de los individuos.

Palabras clave: e-WOM, redes sociales, intención de compra, comportamiento en línea del consumidor, productos alimenticios saludables.

1. INTRODUCTION

Currently, 59.4% of consumers worldwide spend more time on social media (e.g., Facebook, Instagram, and Twitter) than they did in the past (Statista, 2023). As consumers become overloaded by the large volume of online information, they have become more skeptical about traditional advertising and tend to use social media platforms to make informed purchasing decisions based on the comments of other consumers, trustworthy social networks, and experts (Verma & Yadav, 2021). This widespread use of social media has enhanced the role of electronic word-of-mouth (e-WOM) as one important informal source of information regarding products and services. According to Nielsen (2022), Internet users mainly trust the recommendations of people they know above any advertising while the opinions of digital consumers, particularly those who have experienced the product/service or are like-minded, are judged the second most reliable source of information. Previous research (Chevalier & Mayzlin, 2006; Sénécal & Nantel, 2004) also demonstrates how online product recommendations influence consumers' product choices.

e-WOM is "any positive or negative statement made by potential, actual, or former consumers about a product or company, which is made available to a multitude of people and institutions via the Internet" (Hennig-Thurau *et al.*, 2004, p. 39). Consumers create e-WOM in a variety of ways, such as online product reviews, personal e-mails, social media posts, discussion boards, and online communities (Babić Rosario *et al.*, 2020; Chu & Kim, 2018). e-WOM is considered the electronic version of the traditional WOM; however, e-WOM can be more easily obtained and spread primarily to other digital consumers at a remarkably higher speed than regular WOM (Huete-Alcocer, 2017). Therefore, e-WOM represents an unprecedented opportunity for marketers because it has the potential to significantly influence consumers' attitudes, perceptions toward brands, and purchase decisions (Sen & Lerman, 2007; Shabbir-Husain & Varshney, 2022).

Even though studies on e-WOM have substantially increased in the past two decades (Babić Rosario *et al.*, 2020) the effect of its valence (positive versus negative) on consumer behavior and decision-making is inconsistent. Some studies (Barcelos *et al.*, 2018; Lee & Ro, 2016) concluded that negative e-WOM has the strongest influence on consumer responses, whereas others (e.g., Manganari & Dimara, 2017) posit that positive e-WOM has the greatest effect. Therefore, the extant literature calls for further studies to increase the understanding of the variables that reinforce or hinder the effect of e-WOM on key consumers' responses (Jeong & Koo, 2015; Verma *et al.*, 2023). To address this need, this study aims to test the moderator effect that brand expectations and the receiver's traits have on the relationship between the e-WOM valence and consumer's purchase intentions for healthy food products. The receiver's traits studied include two psychographic traits (susceptibility to social influence and health consciousness), and two behaviors (frequency of product usage and frequency of use of social media). To the best of the authors' knowledge, some of these variables have been scarcely studied in the e-WOM literature, particularly brand expectations, frequency of product usage, health consciousness, and frequency of use of social media. Additionally, previous studies have not simultaneously examined the moderating effect of this set of variables that seem important in the context of healthy food products.

We chose a healthy food product category as many consumers have made eating healthily a higher priority in their lifestyles after the pandemic of COVID 19. According to the 2023 Data Bridge Market Research Report, the size of the global health and wellness food market size was USD 878.84 billion in 2023 and is projected to increase its value to USD 1,816.44 billion by 2031, with a compound annual growth rate of 9.50% from 2024 to 2031. The online survey performed by McKinsey (Grimmelt *et al.*, 2022) reports different age cohorts are interested in consuming healthy and sustainable food but they are confused about what manufactured products contribute to their goals of adopting healthier lifestyles. Countries like Mexico have introduced front labels in the packaging of food and beverages that provide a general idea of how healthy a manufactured-packed product is. However, although Mexican consumers support the implementation of front-of-package warning labels (e.g. if it has a large amount of sugar), their introduction has not increased their consumption (Ayuzo del Valle *et al.*, 2022). Other actions beyond classifying food as "good" or "bad", such as providing nutritional education, improving taste, and promoting positive e-WOM for healthy food products seem more promising.

The literature review on e-WOM performed by Akdim (2021) in the travel sector showed that the message valence, relevance, understandability, and visual cues are the most important antecedents of the consumer's behavioral intentions; source credibility is the sender characteristic that most affect the consumer's behavioral intentions, and susceptibility to interpersonal influence is the receiver characteristic that most influence attitudes and behavioral intentions. This study contributes to the online consumer behavior and e-WOM literature by providing empirical evidence about other receiver's traits (health consciousness, frequency of consumption of the product category, and frequency of social media use) that moderate the relationship between e-WOM valence and purchase intentions for the case of healthy food products. In addition, the information integration theory (IIT) (Anderson, 1981, 2014), a scarcely used theoretical approach (Babić Rosario *et al.*, 2020) is used to explore the effect of e-WOM valence on consumers' responses, by proposing how consumers unconsciously or semiconsciously process information to form attitudes and intentions (Anderson, 1981; Carlson & White, 2008).

The IIT proposes that the information is organized by individuals using a goal-direct method of processing through three sequential operations: valuation, integration, and response. The valuation process transforms observable stimuli into subjective representations or psychological values. The integration process transforms subjective representations into an internal judgment. The action process transforms this judgment into an observable response (Anderson, 1981, 2014). Accordingly, the e-WOM valence is an external stimulus that the individual receives, weighs, and integrates to produce a response. A consumer exposed to positive/negative e-WOM may process the post regarding the product of a healthy brand depending on the source that gives the message, their expectations regarding the brand, and their personal traits.

We discuss the research framework, describe key constructs, and state hypotheses in the section following this introduction. Next, we present data collection, measure validation, analytical procedures, and results. Finally, we discuss the implications, limitations, and future research directions.

2. THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESES

2.1. e-WOM valence and source of information

Valence is defined as the positive, negative, or neutral characteristics of the statements in a message (Tirunillai & Tellis, 2014). A positive statement is associated with satisfying consumer experiences, while a negative statement is associated with consumer complaints (Tsao, 2014). The content's valence provides readers with positive or negative guidance, while a neutral review offers descriptive information without any evaluative direction (Manganari & Dimara, 2017).

The literature on WOM valence has focused on assessing what type of content valence people prefer to share (Mishra & Maheswarappa, 2019) and what drives individuals to share positive or negative content (Amatulli *et al.*, 2019). Additional literature has explored the effect of content valence on consumers' attitudes and behavior (Lee & Ro, 2016; Manganari & Dimara, 2017; Roy *et al.*, 2019) and which type of content (positive or negative) has the most impact (Lee & Ro, 2016; Park & Nicolau, 2015; Sen & Lerman, 2007; Shabbir-Husain & Varshney, 2022; Tsao, 2014).

In terms of the influence of content valence, the literature suggests that consumers consider negative reviews to be more significant or helpful (Barcelos *et al.*, 2018; Lee & Ro, 2016; Park & Nicolau, 2015; Shabbir-Husain & Varshney, 2022). Sen and Lerman (2007) suggested that people are more likely to attend and read negative reviews of commodity products than positive ones. However, Tsao (2014) found that the influence of valence depends on how the information is used. For example, negative reviews have a greater impact on movie selection than positive ones, while positive reviews have a greater impact on movie evaluation than negative ones. Roy *et al.* (2019) found that reviews that contain both positive and negative justifications simultaneously have a more positive impact on online purchase intention than those that only contain positive or negative reviews.

This study follows the stream of research that claims negative e-WOM has the greatest effect on consumer behavior but also acknowledges that the influence of e-WOM on purchase intention depends on the homophily, trustworthiness, expertise, and informative scope of the source of information. This second essential element of e-WOM communication that affects consumers' responses has two main categories: regular digital consumers or well-known individuals perceived as reliable sources acknowledged as influencers. The extant literature has focused on evaluating what type of e-WOM source has the greatest effect (Chen *et al.*, 2016; De Veirman, Cauberghe, & Hudders, 2017) and what source's characteristics (e.g., credibility) are more desirable (Gross & Wangenheim, 2018; Lou & Yuan, 2019) and influential (Manchanda, Arora, & Sethi, 2022; O'Reilly *et al.*, 2016; Zainal, Harun, & Lily, 2017).

Studies on the e-WOM source suggest that the information spread by influencers is more credible and likely to reach a wider audience (De Veirman *et al.*, 2017) because influencers have desirable characteristics and qualities that increase their impact over others (Gross & Wangenheim, 2018; Lou & Yuan, 2019) and, as a result, have many followers. Lou and Yuan (2019) analyzed the effect of social media influencers on consumers in the context of marketing and discovered that credibility, attractiveness, and the sense of identity felt by followers have a positive impact on consumer behavior and purchase intentions. According to Audrezet *et al.* (2020), influencers positively affect consumer-based brand value. Folkvord *et al.* (2020) compared the effectiveness of promoting healthy food in digital media by a real versus a fictitious influencer and concluded that parasocial interaction mediates the effect of the type of influencer on consumers' attitudes and purchase intention regarding healthy food products. Real social influencers who establish a strong connection (fit) with their followers deliver more effective messages than those with weaker connections. According to Sánchez-Fernández and Jiménez-Castillo (2021), followers' emotional attachment to the influencer and the value they place on the information they share impact WOM and purchase intentions.

As stated in the IIT, the information source and valence are external stimuli received and integrated by the individual to produce a response. We propose that individuals process posts concerning healthy food brands as stimuli depending on their content (if negative or positive) and the source's characteristics (credibility, expertise, immediacy, or attractiveness). Thus, individuals may integrate quantitative judgments into the same post differently depending on how the stimulus is combined during the valuation process. Therefore, we propose the first research hypothesis:

H1: *Negative e-WOM has a greater (negative) effect on purchase intention than the (positive) effect of positive e-WOM, but these effects are strengthened when the source of information is an influencer.*

2.2. Brand expectations as moderator of the e-WOM valance on purchase intentions

Although social media research claims that consumers have pre-existing brand expectations, how they influence online consumer behavior has been barely examined (Krishnamurthy & Kumar, 2018). According to IIT, specific expectations are shaped when a consumer receives information from a brand (López & Sicilia, 2014), which depend on factors such as the brand's communication and marketing efforts (Karanges *et al.*, 2018). Consumers embrace a stronger interest and passion for an object when they have higher expectations about it (Zaichkowsky, 1985). Moreover, consumers with high brand expectations are less likely to change their impressions of the brand regardless of its negative aspects (Oflaç, Sullivan, & Baltacioğlu, 2012).

Tsao (2014) explored the influence of expectation and online reviews of moviegoers on movie selection and evaluation and concluded that expectations moderate the effect of review valence on movie selections and subsequent evaluations. Mov-

iegoers with low expectations were more receptive to e-WOM from other viewers and the ratings of film critics. Therefore, based on this limited existing literature and the first research hypothesis, we expect brand expectations influence how consumers perceive and interpret e-WOM valence. If a brand has set high expectations and consistently meets them, positive e-WOM will reinforce these expectations, potentially leading to purchase intentions. Conversely, if the e-WOM is negative, consumers with high brand expectations may perceive it as less credible or relevant, thereby moderating its impact on purchase intentions, but the moderating effect will be stronger. In the context of healthy food, brand expectations can play an even more crucial role. Consumers often rely on brand expectations as a heuristic to gauge product healthiness and quality, given the complexity of nutritional information. Therefore, we formulate the next research hypothesis.

H2: *Brand expectations moderate the effect of e-WOM valence on consumers' intentions to purchase a healthy food brand. Negative e-WOM has a greater negative effect on consumers' purchase intentions than the favorable effect of positive e-WOM when brand expectations are higher.*

2.3. Psychographic and behavioral variables as moderators of the effect of e-WOM valence on purchase intentions

Psychographic variables have been shown to explain consumer responses toward e-WOM (e.g., Lee & Koo, 2012; Lee & Ro, 2016¸ Zou, Yu, & Hao, 2011). For example, Valkenburg and Peter (2013) state that individual differences may moderate the effect of media use on cognition, emotions, attitudes, beliefs, physiology, and behavior. Additional studies suggest that susceptibility to interpersonal influence significantly impacts consumer decision-making (Bearden, Netemeyer, & Teel, 1989; Chu & Kim, 2011; Stöckli & Hofer, 2020; Teo, Leng, & Phua, 2019). Consumer susceptibility to social influence (CSSI) is the tendency to modify one's attitudes or behavior in response to the activities of others (Bearden *et al.*, 1989; Blank, Walther, & Isemann, 2017); in the e-WOM context, it is conceptualized as the tendency to learn about products and services by seeking information from others when making purchase decisions (Park *et al.*, 2011). Individuals who are more susceptible to the impact of information place a higher weight on the message's information, while individuals more susceptible to normative social influence place a higher weight on the transmission and relationship processes (Chu & Kim, 2011). Stöckli and Hofer (2020) showed that susceptibility to normative social influence predicts the extent to which Facebook users comply with the behavior of others (e.g., buying, or visiting what users on other online social networks post).

Zhou and Guo (2017) found that reviewers' susceptibility to social influence from previous reviewers depends on the reviewers' characteristics (connectedness and expertise), characteristics of the review itself (valence and length), and a temporal factor (time distance). De Pelsmacker *et al.* (2018) evaluated the moderating role of review readers' product category involvement and susceptibility to interpersonal influence on the relationship between the text valence of online reviews and readers' WOM intention and concluded that the review text valence effect is more significant for more highly involved and socially susceptible people.

In terms of healthy choices, which is the context in which the present study is developed, health consciousness (HC) is one of the key psychographic factors that impact consumers' decisions (Ali & Ali, 2020). Health-conscious individuals are motivated to improve and maintain good health, seek information regarding nutritious diets, engage in more physical activity, and care about disease prevention (Michaelidou & Hassan, 2008; Nagaraj, 2020; Shin & Mattila, 2019; Wardle & Steptoe, 2003). In addition, health-conscious consumers are more likely to search for health and nutrition information on social media and the Internet (Ahadzadeh, Sharif, & Ong, 2018; Castillo, Carrete, & Arroyo, 2022). According to Nagaraj (2020), HC has a positive impact on consumers' attitudes and, as a result, on the intention to purchase organic food products. Several studies examined the moderating role of HC on consumers' attitudes and behaviors (Sakib, Zolfagharian, & Yazdanparast, 2020; Suttikun, 2021).

Adapting the previous findings to the context of e-WOM for healthy food brands, this study proposes the fourth and fifth research hypotheses:

H3: *The influence of e-WOM valence on the intentions to purchase a healthy food brand is greater when a consumer is highly susceptible to social influence.*

H4: *The influence of e-WOM valence on the intentions to purchase a healthy food brand is greater for more health-conscious consumers.*

Last, previous studies (Lin & Lin, 2007) suggest that consumers with higher product knowledge, which includes awareness of product categories, product beliefs, and previous experience using products, evaluate products based on their perceptions of the product's attributes (e.g., quality) as they are confident in their product knowledge. Product experience can be directly related to the frequency of product consumption, making it a suitable proxy. For example, Kaplan *et al.* (2007) show the frequency of product consumption (FPC) has a (direct or indirect) impact on consumers' decision to purchase a customized product within a base category. Other authors, such as Samson (2010), concluded that the FPC within a particular product category has a significant impact on the number of WOM conversations. Furthermore, the analysis of panel data from five product (including healthy food) trial campaigns shows WOM is less effective among loyal product users (i.e., those who frequently use a particular brand) than it is among non-loyal users. According to Lee and Koo (2012), negative reviews have a significant negative impact on message credibility, which is moderated by the consumer's objective information and subjective knowledge. Thus, further research on the interaction between FPC and WOM is recommended.

There are a limited number of studies on how the frequency of social media usage (FSMU) affects consumer behavior. Most studies on the impact of social media use have focused on the psychological context, for example, when looking at personality traits that result in the increased usage of social networks (Gil de Zúñiga *et al.*, 2017). Other studies have focused on predicting FSMU

based on the number of likes in particular categories and group memberships, privacy settings, and the time since comments are made (Ballings & Van den Poel, 2015; Greenwood, 2013). López and Sicilia (2014) showed a quadratic relationship between a consumer's Internet experience and the effect exerted by e-WOM. Experienced and novice Internet users are more influenced by e-WOM than consumers with medium experience. Novice Internet users seem to experience difficulties in distinguishing the fairness of online opinions and rarely question whether they are based on true evidence. In contrast, expert Internet users check information to discriminate fake from honest online posts, learn where to search for e-WOM, and thus are more likely to follow recommendations. The only study that explored the impact of FSMU (among other variables) on the consumption of conventional foods is the one reported by Sumaedi and Sumardjo (2021). Although the study did not find a direct effect of this variable on conventional food consumption, FSMU may modify consumers' behavior by increasing the effect of e-WOM. Therefore, this study proposes the sixth and seventh research hypotheses:

H5: *The influence of e-WOM valence on the intentions to purchase a healthy food brand is greater if the individual consumes more frequently products within a base category.*

H6: *The influence of e-WOM valence on the intentions to purchase a healthy food brand is greater if the consumer uses social networks frequently compared to those who use them infrequently.*

Figure 1 shows the model that integrates all research hypotheses.

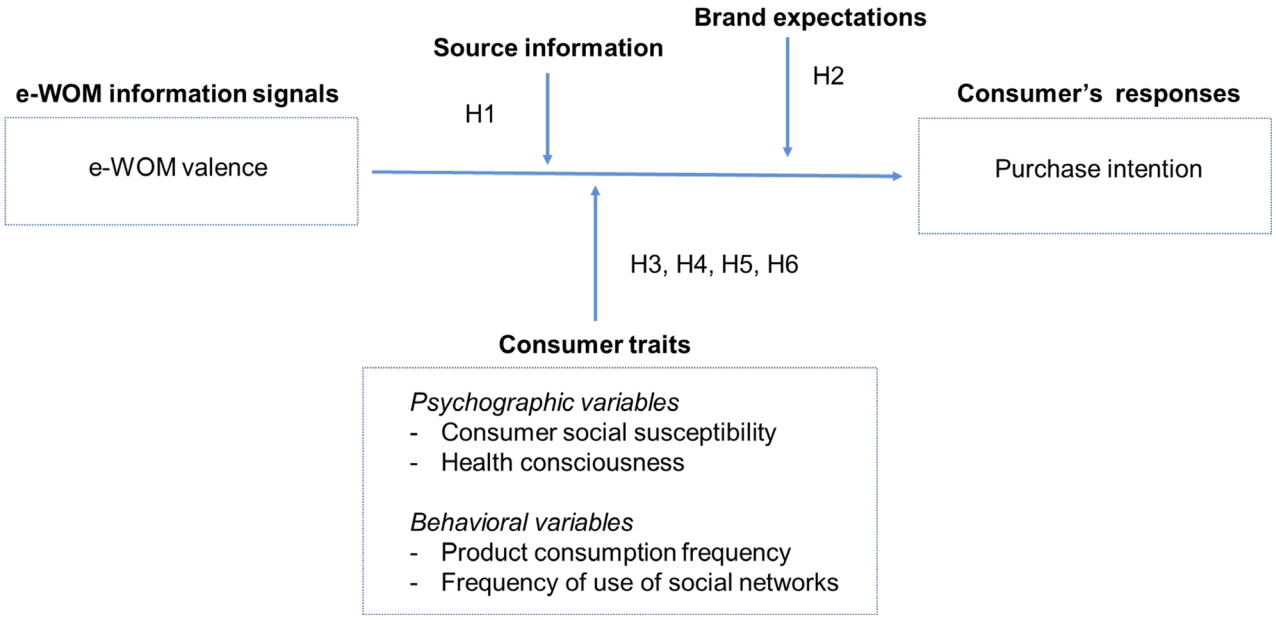


Figure 1
Conceptual Framework
Source: Own elaboration.

3. METHODOLOGY

3.1. Experimental design

A randomized factorial 2×2x2 experiment was conducted to test the research hypotheses H1–H6. Factorial experiments are the basic design for Information Integration Theory (Anderson, 2014) to manipulate variables and infer the cognitive algebraic model individuals utilize to interpret stimuli. The primary method of data presentation in IIT is factorial graphs that display the mean response at various factor combinations.

The first experimental factor is the e-WOM valence (positive versus negative), the second is the source of the e-WOM (a regular digital consumer versus an influencer), and the third is the expectation of a healthy brand (null versus high). e-WOM valence is operationalized by providing positive or negative comments about a fictitious health food product. A fictitious brand rather than an actual brand was used to eliminate any potential effect of other variables, such as the brand's image, on the participants' expectations and reactions toward posts (Rao, Qu, & Ruekert, 1999; Hem, De Chernatony, & Iversen, 2003). The fictitious healthy food product was a fortified ready-to-eat cereal with characteristics of existing brands, such as Special-K, All-Bran, and Nestle Fitness. A cereal was selected because it belongs to a product-based category that includes healthy products (Drewnowski, 2010).

After revising actual comments regarding healthy cereals sold by various brands, 24 comments were collected: 12 negative and 12 positive. The comments were used as a reference to create a distinctively positive and negative e-WOM for the fictitious cereal brand. Then, a total of 144 undergraduate and graduate students enrolled in a university in northern Mexico were recruited to evaluate the valence of the comments. The e-WOM valence was tested as a within-subjects factor, i.e., each participant randomly assessed the assigned positive and negative comments. The participants rated each comment using a bipolar

scale of positive/healthy to negative/unhealthy (1 = not healthy and 5 = very healthy). The ratings assigned to each post were compared with a paired *t*-test ($t = 121.267$, $p = 0.000$). The average for the e-WOM positive valence (average = 4.41, SD = 0.17) was significantly higher than for the e-WOM negative valence (average = 1.50, SD = 0.19).

The source of information was operationalized by creating a fictitious profile for a regular digital consumer, Ricky_201, and for an influencer named Laura's healthy lifestyle. The influencer differed from the regular consumer in that she had many more followers and a considerably larger number of comments, indicative of her "expertise" in healthy food. A brief introduction about her life before she endorsed the new healthy cereal was provided to complete the "influencer" profile (see Appendix 1).

The manipulation check to verify the high versus null expectations was performed by recruiting 150 students; students were randomly assigned to one of two conditions. Participants assigned to the high-expectation condition were informed about the functional and healthy attributes of the cereal, including that it was made from organic wheat. Participants assigned to the null-expectation condition only received information regarding the origin of the brand's name. Then, we assessed whether the information concerning the brand induced high versus null brand expectations by asking participants to rate their brand expectations on a five-point scale, from 1 = very low to 5 = very high. The following statements, adapted from Gupta and Stewart (1996), comprised the brand expectation scale going from 1= low to 5 = high: (1) What health benefit do you expect if you consume Triticum cereal? (2) How much do you think Triticum cereal will help you to maintain a healthy lifestyle? (3) What extra nutritional value do you expect the product to have over other cereals? (4) What do you expect the quality of the product to be? (5) What is your expectation regarding the taste and texture of the cereal? The scores of the two groups were then compared using a two-sample independent *t*-test. Significant differences were found between the two conditions ($t = 14.506$, $p = 0.000$). The high-expectation group had an average score of 4.02 (SD = 0.53) versus 2.86 (SD = 0.46) for the null-expectation group. Therefore, the results confirmed that brand expectations toward the fictitious food were properly operationalized. Samples of students were used in this research only to perform simple manipulation checks while a sample of actual consumers was used to assess the complexity of the moderating relationships among the stimuli and the receiver's traits.

3.2. Experimental subjects

Two hundred individuals were recruited through social media to participate in the experiment following the European Society for Opinion and Marketing Research and Global Research Business Network guidelines for the quality of online samples (ESOMAR & GRBN, 2015). Criteria for inclusion were that participants had to repeatedly eat cereal (at least once per week) and be at least 18 years old (Appendix 2 shows the respondents' profiles). In academic research, recruitment via social media has increased and Fazzino *et al.* (2015) found no significant differences between participants recruited through social media and traditional methods.

The participants were randomly assigned to any of the two conditions (high and null brand expectations) before being randomly assigned to a single stimulus corresponding to a combination of the other two experimental factors (source of information and e-WOM valence). After reviewing the comments, participants responded to a structured questionnaire containing valid scales that operationalize all constructs of the model in Figure 1. HC was measured using a five-item scale from Michaelidou and Hassan (2008), e.g. "I am alert to changes in my health." Susceptibility to social influence (SSI) was measured using a seven-item scale adapted from Tkaczyk (2015), e.g. "I often use information from my friends and family before buying a product." Purchase intention was measured using a two-item scale adapted from Putrevu and Lord (1994), e.g., "I will most likely buy the new cereal brand." The participants specified their level of agreement or disagreement with all statements using a five-point Likert scale, going from 1 = totally disagree to 5 = totally agree.

The frequency of consumption of cereal (portions per week) was measured on an ordinal scale (1 = daily, 2 = three to six times per week, and 3 = once to twice per week), where the participant indicated "How often eat portions of cereal per week." FSMU was measured by asking the respondent, "How often do you use social networks?" (1 = several times a day to 5 = never). Questions regarding the participants' age, gender, and marital status were also included.

4. RESULTS AND DISCUSSION

4.1. Scale validation

The current study ascertains the presence of Common Method Bias (CBM) by employing Harman's one-factor test through Exploratory Factor Analysis (EFA), utilizing a non-rotated method in MINITAB 21. The results indicated that a unique factor accounted for just 36.5% of the variance, a percentage below the suggested threshold of 0.50 by Podsakoff *et al.* (2003) while the three-factor solution accounted for 68%. These results signify the absence of notable bias originating from a single data source.

Then, a confirmatory factor analysis was conducted using the scale-free least squares estimation method in SPSS AMOS. All goodness-of-fit indexes indicate a good fit for the measurement model: the goodness-of-fit index (GFI) was 0.989, the adjusted goodness-of-fit index (AGFI) was 0.986, and the root-mean-square error of approximation (RMSA) was 0.043 (Browne & Cudeck, 1993; Hair *et al.*, 2014). The scales' unidimensionality, reliability, and convergent validity were assessed using the standardized factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). Table 1 shows the results. All standardized factor loadings were near or above 0.7, Cronbach's alphas ranged from 0.894 to 0.949, all CR exceeded 0.89, and AVE values were above the recommended thresholds of 0.7 and 0.5 (Hair *et al.*, 2014); thus, the convergent validity of the scales is supported.

Table 1
Reliability and validity of the measurement model

Construct	# items	Factor loading	α	CR	AVE
Purchase intention	2		0.949	0.949	0.903
	PI1	0.945			
	PI2	0.956			
Health consciousness	5		0.897	0.898	0.639
	HC1	0.736			
	HC2	0.791			
	HC3	0.761			
	HC4	0.849			
	HC5	0.854			
Susceptibility to social influence	7		0.894	0.896	0.553
	SSI1	0.766			
	SSI 2	0.668			
	SSI 3	0.805			
	SSI 4	0.778			
	SSI 5	0.755			
	SSI 6	0.719			
	SSI 7	0.706			

Note: α = Cronbach's alpha; CR = Composite reliability; AVE = Average Variance Extracted

Source: Own elaboration based on the measurement model results.

Discriminant validity was evaluated by comparing the intercorrelation among PI, SSI, and HC against the square root of the AVE of the factor in question. The AVE's square root is higher than the other correlations thus supporting the discriminant scale according to the Fornell–Larcker (1981) criterion (see Table 2). Because the Fornell-Larcker criterion may be overly conservative, the Heterotrait-Monotrait (HTMT) criterion was also applied. HTMT values below 0.85 are considered acceptable levels of discriminant validity. All HTMT values between constructs are below 0.6, indicating good discriminant validity among the three multi-item constructs.

Table 2
Intercorrelation matrix

	Purchase intention	Health consciousness	Susceptibility to social influence
Purchase intention	0.9035[a]		
Health consciousness	0.0174	0.639[a]	
Susceptibility to social influence	0.0010	0.1109	0.553[a]

Note: (a) Entries on the diagonal are the square roots of AVE.

Source: Own elaboration.

4.2. Data analysis

The general linear model routine of Minitab 21 was used to empirically test the conceptual model (Figure 1) (Perpetuini *et al.*, 2019). The psychographic variables (HC and SSI) and the two behavioral variables (FPC and FSMU) were set as covariates in the model because they were not manipulated but registered as individual characteristics. The demographic variables (age and sex) were also included as control variables. The full factorial model was fitted, including the two- and three-letter interactions among the factors (brand expectations, e-WOM valence, and information source) under the standard assumption of no interaction between the factors and covariates (parallel lines), unless moderator effects were anticipated. A hierarchical model was fitted, where all lower-order terms (main effects) contained in the interactions also appear in the model because although direct effects were hypothesized for none of the behavioral and psychographic traits, including main effects in a factorial model is statistically recommended.

Table 3 results confirm purchase intentions significantly change depending on the e-WOM valence, in agreement with the results of previous studies (M = 4.0460 for positive e-WOM and M = 2.2056 for negative e-WOM). Compared to the overall mean of purchase intention (3.1117), positive e-WOM increases purchase intention by 0.929 units while the mean of negative e-WOM is 0.9061 units below the overall mean. The mean difference between these relative changes is non-significant (P = 0.584). Therefore, the magnitude of the effect of positive or negative e-WOM on purchase intention is statistically equal. The source of information (digital regular consumer versus an influencer) does not enhance the effect of negative or positive valence since the information source by e-WOM valence interaction is non-significant, thus H1 is unsupported.

Brand expectations have a direct significant effect on purchase intentions (P = 0.005). Tukey's test indicates a significant difference (P = 0.05) between the mean purchase intentions toward the cereal depending on the brand expectations (Mean-high expectations = 3.332 / Mean-null expectations = 2.968). However, the moderator effect of brand expectations stated in H2 was not empirically supported (all two and three-letter interactions involving brand expectations and e-WOM valence are not significant). The difference between positive and negative e-WOM for high brand expectations is 1.7867 which is not statistically different from the difference of 1.933 for null brand expectations. In other words, the effect of e-WOM valence on purchase intentions is not enhanced for high brand expectations.

The moderating effect of susceptibility to social influence on the relationship between e-WOM valence and purchase intention (i.e., the interaction between susceptibility to social influence and e-WOM valence) is not significant. Therefore H3 is not supported. This finding contradicts previous research in other sectors, which concludes that consumer susceptibility to interpersonal influence is the receiver characteristic that most significantly influences attitudes and behavioral intentions (Akdim, 2021). According to the cross-country study conducted by PYMNTS and Cybersource (2022), Mexican consumers want

and expect online merchants to support in-store navigation apps, delivery and pickup apps, and a multichannel experience that facilitates online purchasing. Unless the friction shopping experiences of consumers in Mexico are eased, the effect of e-WOM among more socially susceptible consumers can be unappreciated, especially in growing niche markets such as the health and wellness market and consumers may prefer to rely on personal recommendations from the members of their close social groups.

Table 3
Analysis of Variance: Response is Purchase Intention

Variable	df	Adj. SS	Adj. MS	F-test	P-value
Age	1	2.532	2.5318	3.33	0.069
Sex	1	1.386	1.3857	1.83	0.178
Educational level	1	0.711	0.7107	0.94	0.335
Frequency of social networks usage (FSMU)	1	0.705	0.7052	0.93	0.336
Frequency of product usage (FPU)	1	1.066	1.0664	1.40	0.238
Susceptibility to social influence (SSI)	1	0.504	0.5042	0.66	0.416
Health consciousness (HC)	1	4.074	4.0740	5.37	*0.022*
Brand expectations	1	6.183	6.1832	8.14	*0.005*
Source of information	1	0.062	0.0621	0.08	0.775
e-WOM valence	1	3.020	3.0203	3.98	*0.048*
SSI*e-WOM valence	1	0.999	0.9990	1.32	0.252
Freq use social networks*e-WOM valence	1	3.673	3.6726	4.84	*0.029*
Freq cereal consumption*e-WOM valence	1	12.499	12.4995	16.46	*0.000*
Health consciousness*e-WOM valence	1	29.026	29.0256	38.23	*0.000*
Brand expectation*Information source	1	0.002	0.0021	0.00	0.960
Brand expectation*e-WOM valence	1	0.000	0.0004	0.00	0.989
Information source*e-WOM valence	1	1.248	1.2482	1.64	0.201
Brand expectation*Inf source* e-WOM valence	1	0.303	0.3031	0.40	0.528
Error	181	137.432	0.7593		
Total	199	366.728			

Source: Own elaboration.

Figures 2, 3, and 4 were built to understand how the other variables comprising the receivers' profile (HC, frequency of cereal consumption, and frequency of social media use) moderate the influence of e-WOM valence on the consumer's purchase intention. According to Figure 2, positive e-WOM increases purchase intention meanwhile negative e-WOM strongly decreases purchase intentions as the health-consciousness of consumers increases, then H4 is supported. Similarly, Figure 3 shows that frequent consumers of cereal (daily consumption) who assess the new product seem to complement the evaluation of the new brand product using their pragmatic subjective and objective knowledge about the category. Therefore, they are less susceptible to negative e-WOM than low–medium (once to six times per week) frequency cereal consumers who are less knowledgeable about the new cereal and respond more negatively to negative comments about the new cereal, providing empirical support to H5 (Park *et al.*, 1994).

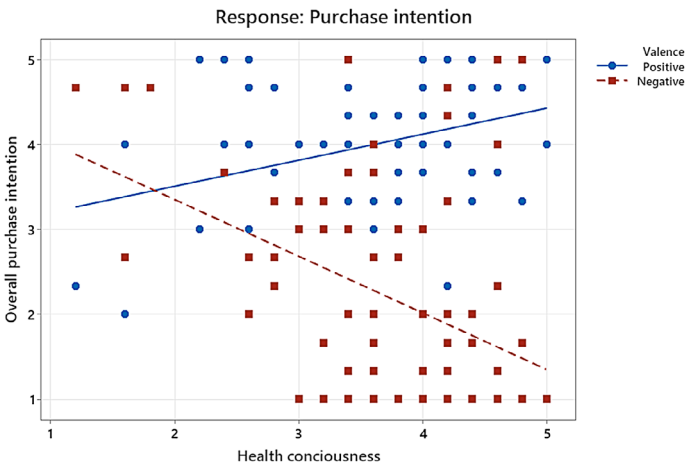


Figure 2
Moderator effect of health consciousness on the effect of e-WOM valence on PI

Source: Own elaboration based on the measurement model results.

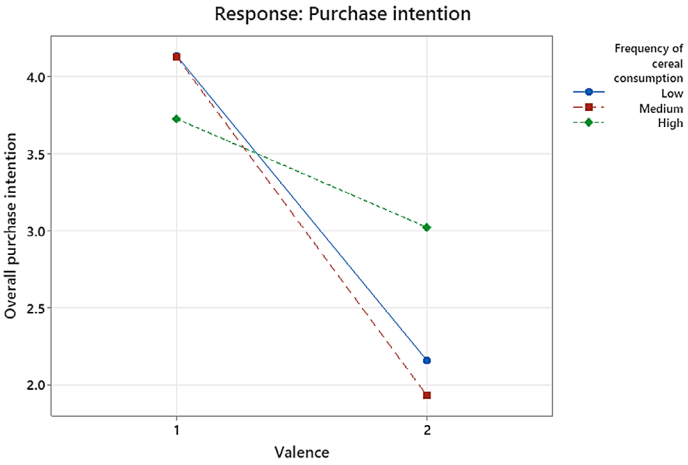


Figure 3
Moderator effect of frequency of cereal consumption on the effect of e-WOM valence on PI
Source: Own elaboration.

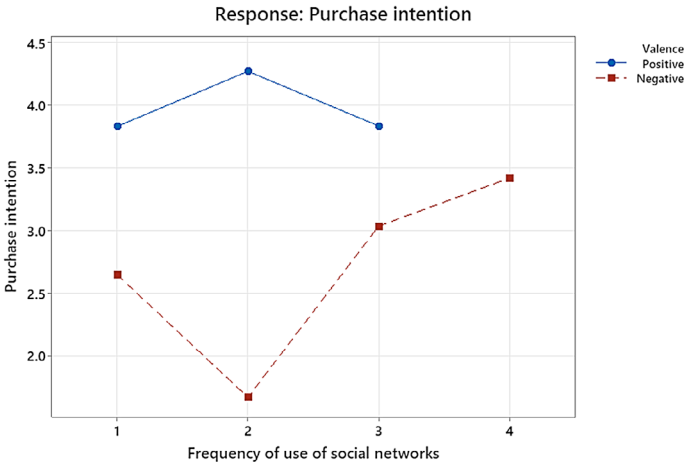


Figure 4
Moderator effect of frequency of use of social networks on the effect of e-WOM valence on PI
Source: Own elaboration.

Finally, FSMU also moderates the effect of e-WOM valence on purchase intention (see Figure 4), then H6 is supported. Negative e-WOM remarkably decreases the intention to purchase the cereal (largest change in purchase intention) among intermediate social media users (code 2 = 5–7 times per week) compared to sporadic (codes 4 = 1–2 times per month and 5 = less than one time per month) and intensive users (code 1 = several times per day). Therefore, our results agree with the results of López and Sicilia (2014) regarding the quadratic relationship between consumers' Internet experience and e-WOM influence. However, this study distinguishes between e-WOM valence and provides an even clearer picture of how the social media experience affects the reception of e-WOM and subsequently the consumer's behavior. Moderate social media users are more prone to notably decrease their purchase intentions for a new healthy product when they receive negative comments (M = 1.6667, SD = 0.8087, Mdn = 1.3333) and increase their intention if they are exposed to positive e-WOM (M = 4.2695, SD = 0.7108, Mdn = 4.3333). Also, consistent with López and Sicilia (2014), frequent social media users seem to know where to search for fair and reliable e-WOM; thus they are less influenceable in their behavior, although as expected they react favorably to positive e-WOM (M = 3.8298, SD = 0.7514, Mdn = 3.6667) and warily to negative e-WOM (M = 2.6458, SD = 1.31694, Mdn = 3.6667). Note that according to the graph of Figure 4, the difference between positive versus negative e-WOM is the largest (2.2762 units) for moderate social media users and the lowest (0.8) for relatively infrequent (1-2 times per month) media users.

Table 4 summarizes the analytical results.

Table 4
Empirical support for the research hypotheses.

Hypotheses	Relationship	Decision
H1	Negative e-WOM has a greater effect on purchase intention than the effect of positive e-WOM if the information source is an influencer	Unsupported
H2	Brand expectations moderate the relationship between e-WOM valence and Consumers' purchase intentions	Unsupported
H3	Consumer susceptibility to social influence moderates the relationship between e-WOM valence and Consumers' purchase intentions	Unsupported
H4	Health consciousness moderates the relationship between e-WOM valence and Consumers' purchase intentions	Strongly supported
H5	Frequency of consumption of the product category moderates the relation between e-WOM valence and Consumers' purchase intentions	Strongly supported
H6	Frequency of social media use moderates the relationship between e-WOM valence and Consumers' purchase intentions	Supported
Post hoc findings		
Brand expectations have a direct effect on consumer's purchase intention		

Source: Own elaboration.

5. CONCLUSIONS

The Internet has become the primary source of information for many consumers and radically influenced their behavior. One of the main changes in modern consumer behavior has been the transition from a passive to an active and informed consumer. Social media customers share their opinions and experiences with goods, services, and brands with online consumers interested in obtaining more information from people and "experts" who have experience with products due to new consumption trends such as healthy eating. Thus, e-WOM has

become an important communication tool a consumer uses to make a purchase decision (Shabbir-Husain & Varshney, 2022), especially if the goods and services are not still positioned in the market as it occurs with new healthy products.

This study aimed to examine how individuals with different profiles (consumption product frequency, social media use frequency, health consciousness, and susceptibility to social influence) simultaneously combine several stimuli —electronic word-of-mouth (e-WOM) valence, information source, and brand expectations— to form intentions toward health food brands products, a category of products that is increasing its value in the food market. The study found negative e-WOM and positive e-WOM have similar effects on the purchase intention of healthy food brands, but obviously in opposite directions. Brand expectations, one of the stimuli evaluated, did not moderate the effect of e-WOM valence on purchase intentions as hypothesized but directly promoted the interest to trail the product, that is purchase intentions are greater for high brand expectations.

5.1. Theoretical implications

The present study makes several important contributions to online consumer behavior and e-WOM literature. This study examined the moderator effect of six variables on the influence of e-WOM valence on the purchase intention of healthy food. To the best of the authors' knowledge, four of these variables have been scarcely studied in the e-WOM literature. These are brand expectations (H2), health consciousness (H4), frequency of product usage (H5), and frequency of use of social media (H6). Our study provides evidence of the significance of three of them: frequency of product usage, health consciousness, and frequency of use of social media. These consumer traits seem to be important, especially in the context of healthy food products, a finding that contributes to increasing the understanding of the variables that reinforce the effect of e-WOM on key consumers' responses, (Jeong & Koo, 2015; Verma *et al.*, 2023).

The analysis of experimental data shows that frequent cereal consumers who assess a new healthy product based on their subjective and objective knowledge are less susceptible to negative e-WOM than low–medium frequency cereal consumers who may be less knowledgeable about the category's healthy options as hypothesized. Negative e-WOM has a larger damaging effect on more health-conscious consumers and intermediate social media users than sporadic and expert users. In other words, a moderate use of social media makes consumers more likely to pay attention to negative reviews about healthy products.

In addition, IIT provides another information processing-related theoretical perspective to explore how various psychological traits and behaviors of the e-WOM receiver moderate the relationship between e-WOM valence and purchase intentions (Liu, H. *et al.*, 2022). The results of this study suggest a simplified algebraic model (Anderson, 1981, 2014) to describe the purchase intention of health-conscious digital consumers with a low-medium frequency of cereal consumption and a moderate use of social media. The model can be written symbolically as follows: Purchase intention: e-WOM valence + brand expectations + e-WOM valence*receiver traits (health consciousness, frequency of cereal consumption, and frequency of social media use). The multiplicative term (*) represents the moderator effect (interaction between variables in statistical terms) of the receiver's profile on the e-WOM influence.

This study may also contribute to the literature on healthy food brands (Anker *et al.*, 2011; Bui *et al.*, 2015; Chrysochou, 2010; Hartmann *et al.*, 2018) by enhancing the understanding of the factors that influence purchase intentions toward healthy products. Academics and food manufacturers are paying more attention to this product category as the market for healthy foods continues growing.

5.2. Practical implications

This study could assist managers of healthy food brands to inform and promote the nutritional value of their brand and products and, at the same time, regulate the influence of e-WOM, which appears to be more convincing for consumers than corporate advertising (Nielsen, 2022; Whitler, 2014).

One of the few tools that companies have to manage the e-WOM environment, especially among health-conscious consumers who are their target segment, is responding to negative comments (Zinko *et al.*, 2021). They should constantly monitor negative comments and must strategically respond to them by honestly stating the actions taken to address the undesirable properties of their products.

To reduce the impact of negative comments on the purchase intentions of infrequent (less knowledgeable) product consumers and intermediate social media users, managers should effectively manage e-WOM valence by promoting positive WOM and carefully managing consumers' expectations (Bughin *et al.*, 2010) about new products as a first step to generate credibility and induce a first trial of their products. In the case of healthy food products, managers may provide information that guarantees the quality and nutritional value of healthy food and conduct product trial campaigns that validate favorable expectations.

5.3. Limitations and future research

This study has some limitations: First, although the experimental design provides strong internal validity, the small sample size and composition may limit the generalizability of the findings to the Mexican consumers of healthy food. Additionally, the demographic profile of the participants (age under 40 years and with university degrees) may not fully capture the behavior of older and less educated digital consumers. This is particularly relevant in the case of heterogeneous populations where a larger sample might reveal other nuanced effects. Second, only one product category, i.e., cereals, was studied. Future studies can include other food categories considered healthy, such as dairy, and compare results with products judged unhealthy, such as salty high-fat snacks. Testing the model with different food categories might be beneficial in increasing the generalizability of the model.

Third, this study uses a fictional digital consumer and influencer. Further studies can examine how actual consumers' and influencers' comments impact the purchase intentions of healthy brands. Current studies have shown that the social relationship between receivers and communicators has a significant impact on e-WOM credibility. Given the simulated portrayals

and brief descriptions of the communicators in our study, any type of connection between participants and the influencer was very limited. The fictional stimulus can explain why the source of information did not enhance the positive (negative) effect of e-WOM as reported in previous research that shows homophily, trustworthiness, and perceived expertise between receivers and communicators significantly influence e-WOM credibility and its dissemination. Fourth, the attachment to the company and its reputation as a manufacturer of healthy products can shield it from the effect of negative e-WOM and enhance the credibility of the messages published to counteract negative posts (Roy *et al.*, 2022). Thus, the use of comments about actual healthy brands in the market is another extension of this research.

Fifth, future studies can examine the mediator effect of brand attitudes on the relationship between e-WOM from different sources and purchase intentions as recent research suggests that brand attitudes significantly mediate the effect of the relationship between the persuasion of digital influencers on purchase intention (Gomes *et al.* 2022; Su *et al.*, 2023). Last, although key psychographic and behavioral variables were included as moderators, according to Roy *et al.* (2022), relatively little attention has been given to other e-WOM receiver characteristics, such as emotions like sympathy or fear, and previous satisfying experiences which can also determine how consumers combine online information to decide the purchase of a product. We expect this study to encourage researchers to use information integration theory (IIT) and statistical experiments to understand how the combination of various communication elements of e-WOM such as the message, the sender characteristics, and the receiver traits influences the behavior of digital consumers (Akdim, 2021).

6. REFERENCES

Ahadzadeh, A. S., Sharif, S. P., & Ong, F. S. (2018). Online health information seeking among women: the moderating role of health consciousness. *Online Information Review*, *42*(1), 58-72. https://doi.org/10.1108/oir-02-2016-0066

Akdim, K. (2021). The influence of eWOM. Analyzing its characteristics and consequences, and future research lines. *Spanish Journal of Marketing - ESIC*, *25*(2), 239-259. ISSN 2444-9695.

Ali, T., & Ali, J. (2020). Factors affecting the consumers' willingness to pay for health and wellness food products. *Journal of Agriculture and Food Research*, *2*, 100076. https://doi.org/10.1016/j.jafr.2020.100076

Amatulli, C., De Angelis, M., & Stoppani, A. (2019). Analyzing online reviews in hospitality: Data-driven opportunities for predicting the sharing of negative emotional content. *Current Issues in Tourism*, *22*(15), 1904-1917. https://doi.org/10.1080/13683500.2019.1594723

Anderson, N. H. (1981). *Foundations of Information Integration Theory*. Academic Press, New York, NY.

Anderson, N. H. (2014). *Contributions to Information Integration Theory. Volume 1: Cognition*. Psychology Press, New York, NY. https://doi.org/10.4324/9781315807324

Anker, T., Sandoe, P., Kamin T., & Kappel, K. (2011). Health branding ethics. *Journal of Business Ethics, 104*(1), 33-45. https://doi.org/10.1007/s10551-011-0887-9

Audrezet, A., de Kerviler, G., & Moulard, J. G. (2020). Authenticity under threat: When social media influencers need to go beyond self-presentation. *Journal of Business Research*, *117*, 557-569. https://doi.org/10.1016/j.jbusres.2018.07.008

Ayuzo del Valle, C., García, F., Musi Gómez, M., *et al.* (2022). Weight stigma in Mexico and front-of-package labeling. A systemic review. *Salud Mental, 45*(2), 81-87. https://doi.org/10.17711/sm.0185-3325.2022.011

Babić Rosario, A., De Valck, K., & Sotgiu, F. (2020). Conceptualizing the electronic word-of-mouth process: What we know and need to know about e-WOM creation, exposure, and evaluation. *Journal of the Academy of Marketing Science*, *48*(3), 422-448. https://doi.org/10.1007/s11747-019-00706-1

Ballings, M., & Van den Poel, D. (2015). CRM in social media: Predicting increases in Facebook usage frequency. *European Journal of Operational Research*, *244*(1), 248-260. https://doi.org/10.1016/j.ejor.2015.01.001

Barcelos, R. H., Dantas, D. C., & Sénécal, S. (2018). Watch your tone: How a brand's tone of voice on social media influences consumer responses. *Journal of Interactive Marketing, 41*, 60-80. https://doi.org/10.1016/j.intmar.2017.10.001

Bearden, W. O., Netemeyer, R. G., & Teel, J. E. (1989). Measurement of consumer susceptibility to interpersonal influence. *Journal of Consumer Research*, *15*(4), 473-481. https://doi.org/10.1086/209186

Blank, H., Walther, E., & Isemann, S. D. (2017). The past is a social construction: susceptibility to social influence in (mis)remembering. In Nash R. A. & Ost J. (Eds.), *False and Distorted Memories* (pp. 55–71). Routledge/Taylor and Francis Group. https://doi.org/10.4324/9781315736242

Browne, M. W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In Bollen K. A. & Long J. S. (Eds.), *Testing Structural Equation Models* (pp. 136-162). Sage, Newbury Park, CA. https://doi.org/10.1177/0049124192021002005

Bughin, J., Doogan, J., & Vetvi, O. J. (2010, April 1). Assessing the impact of word-of-mouth marketing as well as its volume will help companies take better advantage of buzz. *McKinsey Quarterly*. https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/a-new-way-to-measure-word-of-mouth-marketing#/

Bui, M., Kemp, E., & Hamilton, M. (2015). The power of promoting healthy brands: Familiarity in healthy product decision making. *Journal of Promotion Management*, *21*(6), 739-759. https://doi.org/10.1080/10496491.2015.1088920

Carlson, B. D., & White, M. A. (2008). Enhancing stimulus integration in a consumer information processing system: A theoretical foundation. *Marketing Management Journal*, *18*(2), 154-167. ISSN 1534-973X.

Castillo, G., Carrete, L. & Arroyo, P. (2022). Do health-brand fan pages satisfy their consumers' desires? *International Journal of Electronic Marketing and Retailing*, *13*(1), 83–104. https://doi.org/10.1504/ijemr.2022.119252

Chen, J., Teng, L., Yu, Y., & Yu, X. (2016). The effect of online information sources on purchase intentions between consumers with high and low susceptibility to informational influence. *Journal of Business Research*, *69*(2), 467-475. https://doi.org/10.1016/j.jbusres.2015.05.003

Chevailer, J. A. & Mayzlin, D. (2006). The effect of word of mouth on sales: online book reviews. *Journal of Marketing Research*, *43*(3), 345-354. https://doi.org/10.1509/jmkr.43.3.345

Chrysochou, P. (2010). Health food branding: The role of marketing mix elements and public discourse in conveying a healthy brand image. *Journal of Marketing Communications, 16*(1-2), 69-85. https://doi.org/10.1080/13527260903342787

Chu, S. C., & Kim, Y. (2011). Determinants of consumer engagement in electronic word-of-mouth (eWOM) in social networking sites. *International Journal of Advertising*, *30*(1), 47-75. https://doi.org/10.2501/ija-30-1-047-075

Chu, S. C., & Kim, J. (2018). The current state of knowledge on electronic word-of-mouth in advertising research. *International Journal of Advertising*, *37*(1), 1-13. https://doi.org/10.1080/02650487.2017.1407061

Clemente-Ricolfe, J. S., & Atienza-Sancho, P. (2019). Consumer perceptions of influencers' sway over product purchasing. *Comunicación y Sociedad*, *16*, e7296. https://doi.org/10.32870/cys.v2019i0.7296

Data Bridge Market Research (2023). *Global Health and Wellness Food Market – Industry Trends and Forecast to 2031*. https://www.databridgemarketresearch.com/reports/global-health-and-wellness-food-market

De Veirman, M., Cauberghe, V., & Hudders, L. (2017). Marketing through Instagram influencers: the impact of number of followers and product divergence on brand attitude. *International Journal of Advertising*, *36*(5), 798-828. https://doi.org/10.1080/02650487.2017.1348035

De Pelsmacker, P., Dens, N., & Kolomiiets, A. (2018). The impact of text valence, star rating and rated usefulness in online reviews. *International Journal of Advertising*, *37*(3), 340-359. https://doi.org/10.1080/02650487.2018.1424792

Drewnowski, A. (2010). The Nutrient Rich Foods Index helps to identify healthy, affordable foods. *The American Journal of Clinical Nutrition*, *91*(4), 1095S-1101S. https://doi.org/10.3945/ajcn.2010.28450d

ESOMAR & GRBN (2015). ESOMAR/GRBN Guideline for online sample quality. https://www.esomar.org/uploads/public/knowledge-and-standards/codes-and-guidelines/ESOMAR-GRBN_Online-Sample-Quality-Guideline_February-2015.pdf

Fazzino, T. L., Rose, G. L., Pollack, S. M., & Helzer, J. E. (2015). Recruiting U.S. and Canadian college students via social media for participation in a web-based brief intervention study. *Journal of Studies on Alcohol and Drugs, 76*(1), 127–132. https://doi.org/10.15288/jsad.2015.76.127

Folkvord, F., Roes, E., & Bevelander, K. (2020). Promoting healthy foods in the new digital era on Instagram: an experimental study on the effect of a popular real versus fictitious fit influencer on brand attitude and purchase intentions. *BMC Public Health*, *20*(1), 1-8. https://doi.org/10.1186/s12889-020-09779-y

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.2307/3151312

Gil de Zúñiga, H., Diehl, T., Huber, B., & Liu, J. (2017). Personality traits and social media use in 20 countries: How personality relates to frequency of social media use, social media news use, and social media use for social interaction. *Cyberpsychology, Behavior, and Social Networking, 20*(9), 540-552. https://doi.org/10.1089/cyber.2017.0295

Gomes, M. A., Marques, S., & Dias, Á. (2022). The impact of digital influencers' characteristics on purchase intention of fashion products. *Journal of Global Fashion Marketing, 13*(3), 187–204. https://doi.org/10.1080/20932685.2022.2039263

Greenwood, D. N. (2013). Fame, Facebook, and Twitter: How attitudes about fame predict frequency and nature of social media use. *Psychology of Popular Media Culture*, *2*(4), 222. https://doi.org/10.1037/ppm0000013

Grimmelt, A., Moulton, J., Chirag Pandya, C. & Snezhkova, N. (October 5, 2022). Hungry and confused: The winding road to conscious eating, McKinsey, https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/hungry-and-confused-the-winding-road-to-conscious-eating

Gross, J., & Wangenheim, F. V. (2018). The big four of influencer marketing. A typology of influencers. *Marketing Review St. Gallen*, *35*(2), 30-38. ISSN 1865-7516.

Gupta, K., & Stewart, D.W. (1996). Customer satisfaction and customer behavior: the differential role of brand and category expectations. *Marketing Letters*, *7*(3), 249-263. https://doi.org/10.1007/bf00435741

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Pearson Prentice Hall, Upper Saddle River.

Hartmann, C., Hieke, S., Taper, C., & Siegrist, M. (2018). European consumer healthiness evaluation of 'Free-from' labelled food products. *Food Quality and Preference, 68*, 377-388. https://doi.org/10.1016/j.foodqual.2017.12.009

Hem, L. E., De Chernatony, L., & Iversen, N. M. (2003). Factors influencing successful brand extensions. *Journal of Marketing Management*, *19*(7-8), 781-806. https://doi.org/10.1080/0267257x.2003.9728237

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the internet? *Journal of Interactive Marketing*, *18*(1), 38-52. https://doi.org/10.1002/dir.10073

Huete-Alcocer, N. (2017). A literature review of word of mouth and electronic word of mouth: Implications for consumer behavior. *Frontiers in Psychology*, *25*(8), 1256. https://doi.org/10.3389/fpsyg.2017.01256. https://doi.org/10.3389/fpsyg.2017.01256

Liu, H., Shaalan, A., & Jayawardhena, C. (2022). The impact of electronic word-of-mouth (eWOM) on consumer behaviours. In *The SAGE Handbook of Digital Marketing* (pp. 136). SAGE Publications. https://doi.org/10.4135/9781529782509.n9

Jeong, H.-J. & Koo, D.-M. (2015). Combined effects of valence and attributes of e-WOM on consumer judgment for message and product: The moderating effect of brand community type. *Internet Research*, *25*(1), 2-29. https://doi.org/10.1108/intr-09-2013-0199

Kaplan, A. M., Schoder, D., & Haenlein, M. (2007). Factors influencing the adoption of mass customization: The impact of base category consumption frequency and need satisfaction. *Journal of Product Innovation Management, 24*(2), 101-116. https://doi.org/10.1111/j.1540-5885.2007.00237.x

Karanges, E., Johnston, K. A., Lings, I., & Beatson, A. T. (2018). Brand signalling: An antecedent of employee brand understanding. *Journal of Brand Management*, *25*(3), 235-249. https://doi.org/10.1057/s41262-018-0100-x

Krishnamurthy, A., & Kumar, S. R. (2018). Electronic word-of-mouth and the brand image: Exploring the moderating role of involvement through a consumer expectations lens. *Journal of Retailing and Consumer Services*, *43*, 149-156. https://doi.org/10.1016/j.jretconser.2018.03.010

Lee, K. T. & Koo, D. M. (2012). Effects of attribute and valence of e-WOM on message adoption: Moderating roles of subjective knowledge and regulatory focus. *Computers in Human Behavior*, *28*(5), 1974-1984. https://doi.org/10.1016/j.chb.2012.05.018

Lee, S. H., & Ro, H. (2016). The impact of online reviews on attitude changes: The differential effects of review attributes and consumer knowledge. *International Journal of Hospitality Management*, *56*, 1-9. https://doi.org/10.1016/j.ijhm.2016.04.004

Lin, N. H., & Lin, B.S. (2007). The effect of brand image and product knowledge on purchase intention moderated by price discount. *Journal of International Management Studies, 2*(2), 121-132.

López, M., & Sicilia, M. (2014). Determinants of E-WOM influence: the role of consumers' internet experience. *Journal of Theoretical and Applied Electronic Commerce Research*, *9*(1), 28-43. https://doi.org/10.4067/s0718-18762014000100004

Lou, C., & Yuan, S. (2019). Influencer marketing: how message value and credibility affect consumer trust of branded content on social media. *Journal of Interactive Advertising*, *19*(1), 58-73. https://doi.org/10.1080/15252019.2018.1533501

Manchanda, P., Arora, N., & Sethi, V. (2022). Impact of Beauty Vlogger's Credibility and Popularity on eWOM Sharing Intention: The Mediating Role of Parasocial Interaction. *Journal of Promotion Management*, *28*(3), 379-412. https://doi.org/10.1080/10496491.2021.1989542

Manganari, E. E., & Dimara, E. (2017). Enhancing the impact of online hotel reviews through the use of emoticons. *Behaviour and Information Technology*, *36*(7), 674-686. https://doi.org/10.1080/0144929x.2016.1275807

Michaelidou, N., & Hassan, L. M. (2008). The role of health consciousness, food safety concern and ethical identity on attitudes and intentions towards organic food. *International Journal of Consumer Studies*, *32*(2), 163-170. https://doi.org/10.1111/j.1470-6431.2007.00619.x

Mishra, A., & Maheswarappa, S. S. (2019). How content valence and online impression influence goal achievement in social media environment? *Global Business Review*, *20*(5), 267-1281. https://doi.org/10.1177/0972150918793964

Nagaraj, S. (2020). Role of consumer health consciousness, food safety and attitude on organic food purchase in emerging market: A serial mediation model. *Journal of Retailing and Consumer Services*, *59*, 102423. https://doi.org/10.1016/j.jretconser.2020.102423

Nielsen. (2022, mayo). Más cerca: Los influencers ayudan a las marcas a crear vínculos más personales con los consumidores. *Nielsen*. http://www.nielsen.com/us/en/press-room/2012/nielsen-global-consumers-trust-in-earned-advertising-grows.html

Oflaç, B. S., Sullivan, U. Y., & Baltacioğlu, T. (2012). An attribution approach to consumer evaluations in logistics customer service failure situations. *Journal of Supply Chain Management, 48*(4), 51-71. https://doi.org/10.1111/j.1745-493x.2012.03280.x

O'Reilly, K., MacMillan, A., Mumuni, A., & Lancendorfer, K. (2016). Extending our understanding of eWOM impact: The role of source credibility and message relevance. *Journal of Internet Commerce*, *15*(2), 77-96. https://doi.org/10.1080/15332861.2016.1143215

Park, C. W., Mothersbaugh, D. L., & Feick, L. (1994). Consumer knowledge assessment. *Journal of Consumer Research, 21*(1), 71-82. https://doi.org/10.1086/209383

Park, C., Wang, Y., Yao, Y., & Kang, Y. (2011). Factors influencing eWOM effects: Using experience, credibility, and susceptibility. *International Journal of Social Science and Humanity*, *1*(1), 74-79. https://doi.org/10.7763/ijssh.2011.v1.13

Park, S., & Nicolau, J. L. (2015). Asymmetric effects of online consumer reviews. *Annals of Tourism Research*, *50*, 67-83. https://doi.org/10.1016/j.annals.2014.10.007

Perpetuini, D., Cardone, D., Filippini, C., Chiarelli, A. M., & Merla, A. (2019). Modeling impulse response function of functional infrared imaging for general linear model analysis of autonomic activity. *Sensors*, *19*(4), 849. https://doi.org/10.3390/s19040849

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., & Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies." *Journal of Applied Psychology*, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Putrevu, S., & Lord, K. R. (1994). Comparative and noncomparative advertising: Attitudinal effects under cognitive and affective involvement conditions. *Journal of Advertising*, *23*(2), 77-91. https://doi.org/10.1080/00913367.1994.10673443

PYMNTS & Cybersource. (2022). *The 2022 Global Digital Shopping Index*. https://www.cybersource.com/content/dam/documents/campaign/shopping-index/global-digital-shopping-index-2022-mexico-edition-en-us.pdfPYMNTS%20and%20Cybersource

Rao, A. R., Qu, L., & Ruekert, R. W. (1999). Signaling unobservable product quality through a brand ally. *Journal of Marketing Research*, *36*(2), 258-268. https://doi.org/10.1177/002224379903600209

Roy, G., Datta, B., & Mukherjee, S. (2019). Role of electronic word-of-mouth content and valence in influencing online purchase behavior. *Journal of Marketing Communications*, *25*(6), 661-684. https://doi.org/10.1080/13527266.2018.1497681

Roy, G., Datta, B., Mukherjee, S., & Shrivastava, A. K. (2022). Systematic review of eWOM literature in emerging economy using ACI framework. *International Journal of Emerging Markets, 18*(11), 5195-5216. https://doi.org/10.1108/ijoem-08-2021-1313

Sakib, M. N., Zolfagharian, M., & Yazdanparast, A. (2020). Does parasocial interaction with weight loss vloggers affect compliance? The role of vlogger characteristics, consumer readiness, and health consciousness. *Journal of Retailing and Consumer Services*, *52*, 101733. https://doi.org/10.1016/j.jretconser.2019.01.002

Samson, A. (2010). Product usage and firm-generated word of mouth. Some results from FMCG product trials. *International Journal of Market Research*, *52*(4), 459-482. https://doi.org/10.2501/s1470785309201405

Sánchez-Fernández, R., & Jiménez-Castillo, D. (2021). How social media influencers affect behavioural intentions towards recommended brands: the role of emotional attachment and information value. *Journal of Marketing Management*, *37*(11-12), 1123-1147. https://doi.org/10.1080/0267257x.2020.1866648

Sen, S., & Lerman, D. (2007). Why are you telling me this? An examination into negative consumer reviews on the web. *Journal of Interactive Marketing*, *21*(4), 76-94. https://doi.org/10.1002/dir.20090

Sénécal, S., & Nantel, J. (2004). The influence of online product recommendations on consumers' online choices. *Journal of Retailing*, *80*(2), 159-169. https://doi.org/10.1016/j.jretai.2004.04.001

Shabbir-Husain, R. V., & Varshney, S. (2022). Investigating combined effect of WOM and eWOM: role of message valence. *Journal of Consumer Marketing*, *39*(2), 180-190. https://doi.org/10.1108/jcm-08-2020-4047

Shin, J., & Mattila, A. S. (2019). When organic food choices shape subsequent food choices: The interplay of gender and health consciousness. *International Journal of Hospitality Management*, *76*, 94-101. https://doi.org/10.1016/j.ijhm.2018.04.008

Statista. (2023). Social media, statistics, and facts. *Statista*. https://www.statista.com/topics/1164/social-networks/#topicOverview

Stöckli, S., & Hofer, D. (2020). Susceptibility to social influence predicts behavior on Facebook. *PloS one*, *15*(3), e0229337. https://doi.org/10.1371/journal.pone.0229337

Su, B. C., Wu, L. W., Lin, H., & Lin, C. A. (2023). The mediating effect of herd behavior and brand attitude towards the impact of spokesman credibility, source fit, and online word-of-mouth on purchase intention. *Sustainability*, *15*(1), 888.

Sumaedi, S., & Sumardjo (2021). A model of traditional functional food consumption behaviour. *British Food Journal*, *123*(1), 13-30. https://doi.org/10.1108/BFJ-01-2020-0019

Suttikun, C. (2021). "Where should we eat?": How health consciousness moderates the influences driving intentions to purchase healthy food. *Journal of International Food and Agribusiness Marketing*, 1-29. https://doi.org/10.1080/08974438.2021.1980756

Teo, L.X., Leng, H.K., & Phua, Y.X.P. (2019). Marketing on Instagram: Social influence and image quality on perception of quality and purchase intention. *International Journal of Sports Marketing and Sponsorship*, *20*(2), 321-332. https://doi.org/10.1108/ijsms-04-2018-0028

Tirunillai, S., & Tellis, G. J. (2014). Mining marketing meaning from online chatter: Strategic brand analysis of big data using latent Dirichlet allocation. *Journal of Marketing Research*, *51*(4), 463-479. https://doi.org/10.1509/jmr.12.0106

Tkaczyk, J. (2015). Consumer susceptibility to social influence and tendency to generate a positive or negative message in word-of-mouth communication. *Journal of International Conference on Marketing and Business Development*, *1*(1), 21-28. https://www.mbd.ase.ro/?p=83

Tsao, W. C. (2014). Which type of online review is more persuasive? The influence of consumer reviews and critic ratings on moviegoers. *Electronic Commerce Research*, *14*(4), 559-583. https://doi.org/10.1007/s10660-014-9160-5

Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication*, *63*, 221–243. https://doi.org/10.1111/jcom.12024

Verma, S., & Yadav, N. (2021). Past, present, and future of Electronic Word of Mouth (EWOM). *Journal of Interactive Marketing*, *53*(1), 111-128. https://doi.org/10.1016/j.intmar.2020.07.001

Verma, D., Dewani, P. P., Behl, A., & Dwivedi, Y. K. (2023). Understanding the impact of eWOM communication through the lens of information adoption model: A meta-analytic structural equation modeling perspective. *Computers in Human Behavior*, *143*, 107710. https://doi.org/10.1016/j.chb.2023.107710

Wardle, J., & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health*, *57*(6), 440-443. https://doi.org/10.1136/jech.57.6.440

Whitler, K. (July 17, 2014). Why word of mouth marketing is the most important social media. *Forbes*. https://www.forbes.com/sites/kimberlywhitler/2014/07/17/why-word-of-mouth-marketing-is-the-most-important-social-media/?sh=1254d57454a8

Zaichkowsky, J. L. (1985). Familiarity: product use, involvement or expertise? In Elizabeth C. Hirschman and Moris B. Holbrook (Eds.), *NA - Advances in Consumer Research Vol. 12* (pp. 296-299). Provo UT: Association for Consumer Research.

Zainal, N. T. A., Harun, A., & Lily, J. (2017). Examining the mediating effect of attitude towards electronic words-of mouth (eWOM) on the relation between the trust in eWOM source and intention to follow eWOM among Malaysian travellers. *Asia Pacific Management Review*, *22*(1), 35-44. https://doi.org/10.1016/j.apmrv.2016.10.004

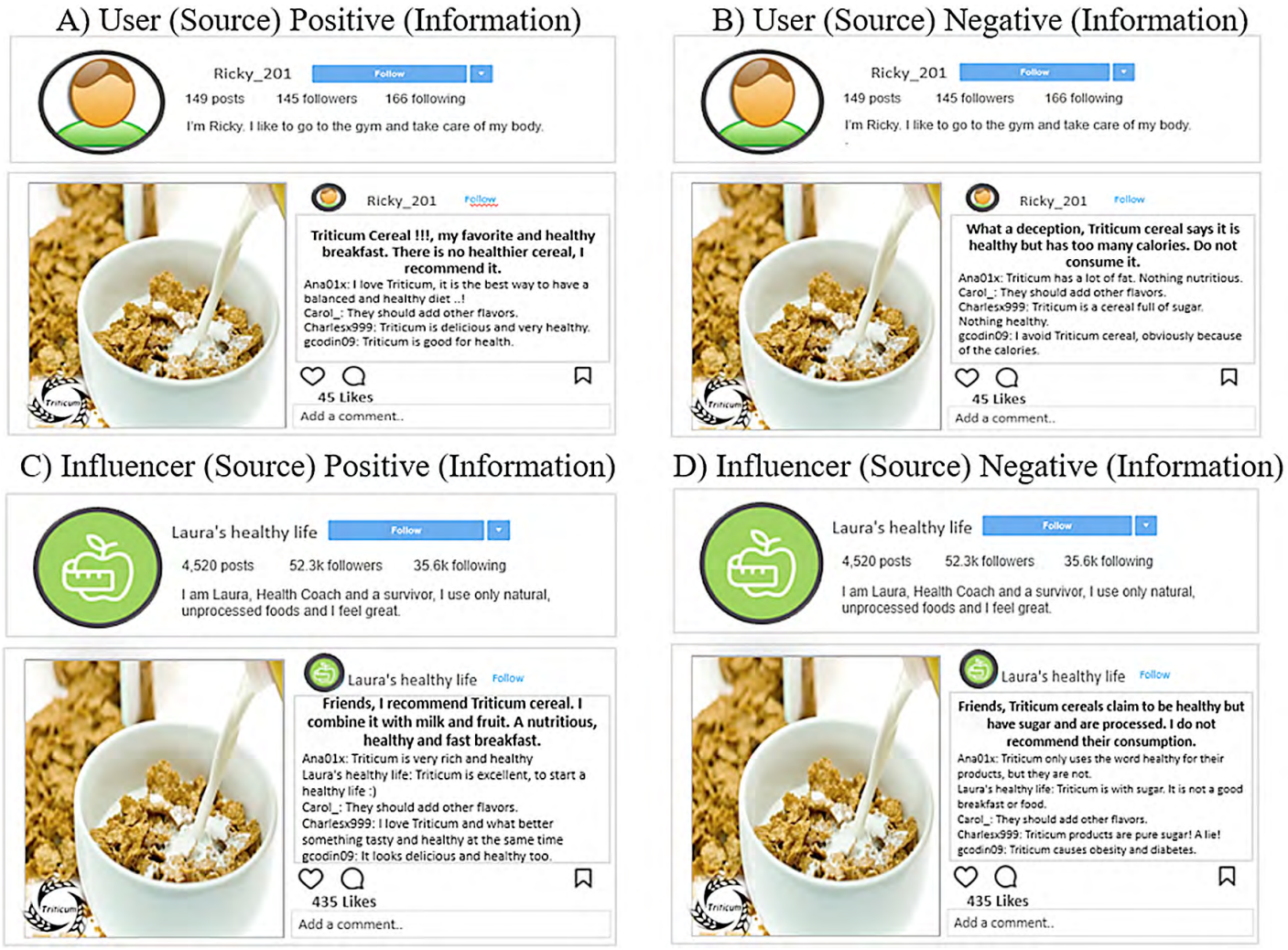
Zhou, S., & Guo, B. (2017). The order effect on online review helpfulness: A social influence perspective. *Decision Support Systems*, *93*, 77-87. https://doi.org/10.1016/j.dss.2016.09.016

Zinko, R., Patrick, A., Furner, C. P., Gaines, S., Kim, M. D., Negri, M., & Villarreal, C. (2021). Responding to negative electronic word of mouth to improve purchase intention. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(6), 1945-1959. https://doi.org/10.3390/jtaer16060109

Zou, P., Yu, B., & Hao, Y. (2011). Does the valence of online consumer reviews matter for consumer decision making? The moderating role of consumer expertise. *Journal of Computers*, *6*(3), 484-488. https://doi.org/10.4304/jcp.6.3.484-488

APPENDIX 1

Visual support for valence and source of information in the experimental study and Influencer's information



Source: Own elaboration.

Only under the influencer conditions did the participants read the following: "First, we would like you to know some facts about Laura's healthy life. Laura has more than 50,000 followers on multiple social media platforms, including Facebook and Instagram, and her followers believe she is an expert in healthy living, including health food brands. People who care about leading a healthy life follow Laura. Her story began when she had a severe illness, so she changed her lifestyle, mainly through improved nutrition. Laura created a blog with hundreds of healthy recipes using healthy foods and brands to promote health. Her food philosophy is more natural, less processed foods."

APPENDIX 2

Respondents' profile (N = 200)

Demographics and Characteristics		%
Gender	Male	50
	Female	50
Age (years):	18–20	9
	21–25	22
	26–30	30.5
	31–35	25
	36–40	7.5
	>40	6
Scholarship:	Elementary	1
	High school	27
	College	60
	Postgraduate	11.5
	Other	0.5
Marital status:	Single	62
	Married	24.5
	Separated	6.5
	Divorced	6.5
	Widower	0.5

Source: Own elaboration.

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