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## Sustainable business models of e-marketplaces: An analysis from the consumer perspective

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### ABSTRACT

This study analyzes the preferences and perceptions of consumers in e-marketplaces to design and guide sustainable business models based on economic, social, environmental, and technological dimensions. The results are based on a sample of 387 respondents to analyze the main reasons and benefits for using e-marketplaces, the preferences, and perceptions of consumers regarding sustainability dimensions in e-marketplaces, and the assessment of technological features of digital platforms. Using descriptive statistics and structural equation modeling (SEM), this study highlights the importance of e-marketplace business models and their customer-centric value propositions in effectively communicating and ensuring high levels of usability and stability in the digital platform. The findings underscore the importance of informing consumers about the benefits of participating in digital platforms, with particular emphasis on the technological and environmental dimensions, which emerged as the most influential factors in the development of a sustainable business model for e-marketplaces. However, the study also emphasizes the need not to overlook the economic and social dimensions, as they are crucial for maintaining a sustainable business model in the long run. In conclusion, this research provides valuable insights to guide e-marketplace business models towards sustainability based on the perspectives and contributions of consumers.

### 1. Introduction

In recent years, the significance of electronic commerce and e-marketplaces has surged, playing a pivotal role in the advancement, expansion, and triumph of businesses. The outbreak of the Covid-19 pandemic has further underscored the indispensable role that the digital economy assumes. Notably, e-commerce sales have witnessed substantial growth, witnessing a remarkable 19% surge in 2020 and a subsequent 22% escalation in 2021. These impressive figures surpass the projected growth rates of 9% and 12% for the respective time frames, demonstrating the resilience and potential of electronic commerce, particularly during periods of adversity (International Trade Administration, 2023). Moreover, the Covid-19 pandemic has accentuated the importance of electronic commerce and e-marketplaces as indispensable

tools and solutions for consumers. They have emerged as dedicated platforms, offering solid support to small businesses, fostering internal growth, enabling international trade, and elevating the competitiveness of economies (WTO, 2020).

An e-marketplace functions as a virtual marketplace, connecting numerous sellers and buyers to facilitate the exchange of goods, services, and information through a commercial system, commonly presented as an application or a website (Alazab et al., 2020). Within e-marketplace platforms, transactions and business activities take place, serving as online marketplaces where sellers offer products or services to consumers (Malak et al., 2021). Notably, platform providers do not assume ownership of the transacted products and services (Croitor et al., 2021). Three primary types of e-marketplaces prevail: Business to Consumer (B2C), Business to Business (B2B), and Consumer to Consumer (C2C).

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These platforms act as impartial intermediaries, facilitating interactions between two parties (Cano et al., 2022). Consequently, an e-marketplace is characterized as a digital mediator crafted to establish connections between buyers and sellers, streamlining transactions between them (Sfenrianto et al., 2018). This platform effectively accommodates to the requirements of both consumers and suppliers, offering goods and services via a transactional network that harnesses procurement information systems (Standing and Standing, 2015). These online platforms empower consumers to make purchases from the comfort of their homes or workplaces, while sellers can manage their businesses without the overhead costs associated with brick-and-mortar stores (Fuadah et al., 2022).

Prominent e-marketplace solutions with substantial visitation rates include Amazon, eBay, Rakuten, Mercado Libre, Zalando, Shopee, Aliexpress, Walmart.com, Etsy, Taobao, Newegg, and more. These platforms collectively strive to bridge the gap between buyers and sellers, streamlining the process for buyers to access information regarding seller pricing and product offerings (Bakos, 1997). An essential principle that e-marketplaces must fulfill revolves around enabling effective communication and fostering trust between sellers and buyers, thereby cultivating and sustaining customer-seller relationships (Tran, 2021). The establishment of trust and brand loyalty assumes paramount significance, safeguarding the interests of both buyers and sellers, and positioning e-marketplaces as the preeminent choice for locating specific products from trusted vendors (Martins et al., 2020).

In Colombia, the e-marketplace landscape has witnessed a rise in market share and consolidation, with various players emerging as key participants. Prominent e-marketplaces in the country include Mercado Libre (multicategory), Linio (multicategory), Dafiti (fashion), Falabella (multicategory), Agaval (multicategory), Flamingo (multicategory), Pepe Ganga (multicategory), Éxito (supermarket), Locatel (health and personal care), Home Center, OLX, Jumbo, Amazon, Aliexpress, among others. These platforms have gained traction and popularity among consumers, contributing to the growth of the e-marketplace sector. One significant factor that has driven the increased usage of e-marketplaces in Colombia is the implementation of VAT (value-added tax) free days. These initiatives were introduced by the government for a three-day period each year between 2020 and 2022, aimed at stimulating the economy that was adversely impacted by the Covid-19 pandemic. As a result, some e-marketplaces operating in Colombia experienced remarkable sales surges, with increases of over 1000% reported during these VAT-free days (La República, 2020).

The growth of e-commerce in Colombia is evident through statistical data, indicating an increasing number of individuals engaging in online purchases. In 2020, 13% of individuals aged 18 and above made online purchases, with 50.6% being men and 49.4% women. By 2021, this percentage rose to 16.4%, with 49.49% being men and 50.51% women (CCCE, 2023). Furthermore, the monetary value of online sales in 2022 reached USD 13 billion, demonstrating substantial growth compared to previous years. This represented a 38.4% increase compared to 2021 and a remarkable 94.1% growth compared to 2020. Notably, these figures reflect an average month-over-month growth rate of 2.6% (CCCE, 2023). It is particularly significant to note that these statistics are even more remarkable considering that the year 2022 witnessed economic and social activities taking place in Colombia without mobility restrictions or confinements.

Hence, the analysis of buyers within e-marketplaces assumes paramount importance, given their role as both consumers and pivotal participants on these platforms. It becomes imperative to serve to their interests and viewpoints to craft value-oriented solutions (Nagy et al., 2018). In the scope of digital marketplaces, buyers and sellers are interlinked, yet their financial objectives often diverge. Buyers prioritize lower prices and extended payment terms, while sellers strive for price premiums and immediate payment (Jiang, 2002; Lahkani et al., 2020). Intermediaries and platform administrators employ diverse mechanisms to foster trust among buyers and sellers (Kangning Wei et al., 2019),

underscoring the significance of comprehending and addressing the distinct needs of both parties. Within this study, the emphasis lies on buyers, who constitute the consumer base using e-marketplaces.

Consumers have evolved beyond passive buyers and have become integral to product development, actively participating as contributors and co-creators in shaping business models through research, development, and innovation. This shift facilitates open innovation, enabling the capture of consumer value and fostering interactive communication (Cavallo et al., 2022; Faridian, 2023; Gascó, 2017; Yun and Liu, 2019). Consumer-centric business models offer a distinct focus, preventing e-marketplaces from being all-encompassing without a defined value proposition (Duan et al., 2010). Perceived value emerges as a pivotal factor driving behavioral intentions among buyers in both B2C and C2C e-marketplaces (Chang et al., 2020), particularly when online purchases lack the personal interaction between buyers and sellers. Navigating e-marketplaces under conditions of uncertainty can influence users' perception of ease of use and, consequently, their purchase intentions (Malak et al., 2021). Trust assumes significance as a precursor to buyers' intent to purchase, as buyers place their trust in sellers and other stakeholders within the e-marketplace when engaging in transactions (Albats et al., 2020; Chang et al., 2020). Buyers' role as key stakeholders in e-marketplace business models is further underscored by the rising adoption of social media for word-of-mouth marketing, primarily driven by buyer reviews and social referral mechanisms (Malak et al., 2021). Overall review ratings can impact both rational and emotional consumers (B. Li et al., 2016), making buyers convincing promoters who can amplify sales within an e-marketplace. Additionally, suppliers' performance is influenced by buyers through comprehensive vendor ratings (Kumar et al., 2020).

E-marketplaces play a significant role in promoting sustainable consumption by reducing travel costs, minimizing customers' environmental impact, offering online products at all times, and ensuring secure payment systems (Cano et al., 2022). This relationship between sustainability and e-marketplaces spans economic, environmental, social, technological, and systemic dimensions (Alt, 2020), and can be addressed through open innovation, which involves companies interacting with external stakeholders, particularly customers (Felin and Zenger, 2014; Shaikh and Randhawa, 2022; Tsai et al., 2022). This collaborative interaction inspires stakeholder engagement within e-marketplaces (Bigliardi and Filippelli, 2022; Yun, Zhao, Wu et al., 2020), influencing the evolution of business models. Open innovation is essential to increase competitive advantage and satisfy the demand for market orientation (Cano et al., 2022; X. Zhang et al., 2023). It facilitates the emergence of sustainable innovations that impact organizational sustainability and democratizes best practices, optimizing resource utilization (Costa and Matias, 2020; Lippolis and Ruggieri, 2023; Lopes et al., 2017). As a result, open innovation processes contribute to the formulation of sustainable business models that yield profitability for e-marketplaces while benefiting society and the environment (Abhari and Mcguckin, 2023; Allal-ch et al., 2023; Cano et al., 2022).

The existing literature has extensively explored various factors that impact transaction intentions in e-marketplaces, encompassing both buyers and sellers in C2C e-commerce contexts (Kangninga Wei et al., 2014). Additionally, studies have delved into the influence of social capital and virtual community dynamics on buyers' sustained engagement in B2B e-marketplaces (Yen and Tseng, 2014). The role of seller reputation on buyers' behavior has also been studied (Dráb et al., 2015), along with the identification of factors that contribute to buyer satisfaction (Sfenrianto et al., 2018). Furthermore, researchers have proposed economic models towards optimizing buyer satisfaction by aligning their requirements with sellers' offerings (Le et al., 2018), and comparing the relative impact of trust and risk on transaction intentions within C2C e-marketplaces for both buyers and sellers (Kangning Wei et al., 2019). Other research have also analyzed consumers' perceptual and psychological responses to co-designed packaging in e-marketplaces (Ammar et al., 2018). Notably, classification frameworks for

e-marketplaces have been developed, demonstrating how the design process of these platforms can revitalize conventional industries (Martins et al., 2020). Moreover, studies have ventured into understanding customers' preferences regarding diverse shopping strategies (Maltese, Le Pira et al., 2021).

Recent research has shown the importance of better understanding sustainable e-marketplaces. This involves finding ways to combine the traditional aspects of sustainability with technology in business models (Alt, 2020; Sun et al., 2021), and understanding how e-commerce platforms influence consumers' value perceptions and future behavior (Mileros et al., 2019). Then, a sustainable business model needs to consider economic, social, environmental, and technological dimensions (Wang et al., 2021; Xue et al., 2022). The literature suggests that future studies on e-marketplaces should focus on these sustainability aspects and look at how these dimensions impact the environment, society, and the economy as a whole. It's also important to involve different stakeholders and gather feedback from e-marketplace users to improve business models (Cano, Londoño-Pineda, Castro et al., 2022). Some existing research has looked at sustainability in e-marketplace business models from different angles. For example, Daniel et al. (2004) introduced a framework that explains the sustainability of e-marketplaces considering factors at the macroeconomic and regulatory level, the industry level, and the individual firm levels. However, this approach doesn't cover the triple bottom line theory, which addresses sustainability in terms of economic, social, and environmental factors.

Other studies in the literature have focused on the sustainability of e-marketplaces from the economic and social dimensions, leaving a significant gap in addressing eco-efficiency from the environmental perspective. For instance, Zhao et al. (2009) examined B2B e-marketplaces, investigating ownership structures and market competition's impact on sustainability. They analyzed different costs related to the economic dimension and social welfare effects within the social dimension. Ghonaim et al. (2013) delved into market dynamics, strategic rules, and smart exchanges for generalized second-price auctions in e-marketplaces. Their aim was to enhance access to inventory and information (economic dimension), as well as to promote transparency, self-sufficiency, and social efficiency (social dimension). Another example is the work by Quaranta and Salvia (2017). They conceptualized an e-marketplace to ease small enterprises' access to larger distribution channels through direct sales (economic dimension). Additionally, their approach aimed to connect and unite key stakeholders and all value chain participants (social dimension), ensuring sustainable rural development. Likewise, Hongsuchon et al. (2022) employed Structural Equation Modeling (SEM) to study how customer trust and commitment impact sustainable customer purchases within an e-marketplace. Their analysis involved evaluating reliability, validity, and proposed hypotheses, and incorporate latent variables like customer purchase value (economic dimension) and customer learning value (social dimension). Similarly, Dewi et al. (2022) used SEM to investigate how an e-marketplace for rural tourism affects dynamic sustainability. They considered exogenous variables such as product factors, price factors, and time-saving factors (economic dimension) that influence dynamic sustainability outcomes.

However, the existing literature lacks studies that comprehensively examine sustainable e-marketplace business models, taking into account all dimensions: economic, social, environmental, and technological. Furthermore, no studies have focused on incorporating the perspectives of crucial stakeholders, such as consumers. As a result, this study aims to bridge this gap by analyzing the preferences and perceptions of key stakeholders, namely consumers in e-marketplaces. The goal is to develop and direct sustainable business models that create additional value across economic, social, environmental, and technological dimensions. The remainder of this article is as follows: Section 2 presents a framework for the main dimensions of sustainability related to consumers in e-marketplaces. Section 3 presents the methodology based on a survey to obtain the perceptions and preferences of consumers in e-

marketplaces. Section 4 discusses the main results, and the most relevant conclusions are presented in Section 5.

## 2. Consumer-driven sustainability in e-marketplaces

In the current era of digitalization, e-marketplaces have led to novel business models and effective avenues for engaging with customers (Aladalah et al., 2014). These platforms have significantly heightened convenience, allowing customers to effortlessly purchase a wide range of goods at any time (W. Song et al., 2020). Within e-marketplace business models, the competitive advantage hinges upon a compelling value proposition that delivers benefits to consumers and other stakeholders (Alt, 2020). In this regard, consumers occupy a central role as key stakeholders in e-marketplaces. They now possess an increasing ability to influence various aspects of e-commerce services, spanning time, price, quality, sustainability, and fairness (Buldeo et al., 2021). Furthermore, customers contribute to shaping a fresh value proposition, introducing novel ideas into the existing business ecosystem (Yun et al., 2020). Their engagement entails formulating a business model designed to generate and deliver value (Joseph et al., 2019).

By integrating customers into the design and evolution of business models, companies can enhance their collaborative potential with customers and embrace a sustainability-oriented approach (Micheline et al., 2019). Additionally, digital communication and online payment systems offered by e-marketplaces provide substantial convenience, time and cost savings, and sustainability benefits (Nuseir, 2018). Through a commitment to sustainability, businesses can enhance their operational efficiency and strategic expansion, attain a durable competitive edge, provide sustainable value to society at large, minimize environmental impacts, and elevate customer service while optimizing costs (Mangiaracina et al., 2015, 2019). As a result, it is imperative for e-marketplaces to holistically address sustainability concerns, encompassing the economic, social, environmental, and technological dimensions.

### 2.1. The economic dimension of e-marketplaces

From the consumer perspective, the economic dimension of sustainability in e-marketplaces encompasses various aspects that contribute to cost savings and enhanced shopping experiences. These factors include discounted prices, cost-effective purchasing opportunities, time efficiencies in sourcing and buying, access to a wider set of sellers, and the ability to compare prices and products across multiple vendors (Loro and Mangiaracina, 2022; Tran, 2021). E-marketplaces also afford the convenience of shopping from any location, with goods conveniently delivered to customers' homes, thereby reducing travel time, and enabling shopping anytime (Oláh et al., 2019; Sfenrianto et al., 2018). Moreover, as urban congestion-related costs lead to time loss and prolonged travel periods (Villa and Monzón, 2021), the efficient delivery speed, timing, and location offered by e-marketplaces can significantly impact waiting times for buyers and influence sustainable online consumer behavior (Buldeo et al., 2021). In addition, digital platforms facilitate effective online interactions for streamlined business operations, which in turn contribute to reduced costs (Malak et al., 2021).

The concept of timesaving holds significant importance as it can positively influence consumers' motivation to engage with e-marketplaces (Jiang, 2002). Therefore, digital platforms prioritize the efficient and prompt purchase of products to offer cost savings and convenience with minimal effort for consumers (Joo et al., 2012). E-marketplaces also play a role in fostering sustainable consumption practices by minimizing travel costs (Leary et al., 2017) and reducing expenses related to information gathering and purchasing prices (Tzong-Ru and Jan-Mou, 2006). Furthermore, e-marketplaces effectively discourage buyers from visiting traditional brick-and-mortar stores, enabling them to purchase the same products at lower prices online. This is possible

because online shoppers can avoid the costs associated with physical infrastructure and the obligation to pay substantial rent fees and state or local sales taxes (He et al., 2016; Loro and Mangiaracina, 2022; Tung, 2018). In practice, certain e-marketplaces have adopted strategies to align their online retail prices with in-store prices for the same items. However, some multi-channel retailers opt not to match prices and offer more favorable costs through digital platforms (J. Wei and Chang, 2022). This approach acknowledges that customers tend to prioritize more budget-friendly options, especially those with low-income levels (W. Song et al., 2020).

Likewise, e-marketplaces play a significant role in reducing buyer search costs, leading to lower prices and enhanced competition among suppliers (Standing et al., 2010). This reduction diminishes the ability of sellers to generate monopolistic profits, while concurrently increasing the market's capability to allocate resources more efficiently (Bakos, 1997). Furthermore, digital platforms facilitate effective online interactions, optimizing business processes while maintaining lower operational costs (Loro and Mangiaracina, 2022). E-marketplace platforms aim to attract and retain sellers by diversifying their product offerings, thereby ensuring the platform's sustained viability and success (Croitor et al., 2021). This approach involves expanding the range of available products across various categories, consequently boosting online shopping traffic. As a result, more consumers are drawn to make online purchases due to the availability of a broad selection of competitively priced items (Robina-Ramírez et al., 2020). The survival of e-marketplaces is based on active participation from both buyers and sellers, generating consistent earnings through ongoing engagement and interaction with consumers (Standing and Standing, 2015; Kangninga Wei et al., 2014). By offering an extensive array of suppliers and products, e-marketplaces can provide enhanced value for buyers and users of electronic platforms (Tung, 2018).

E-marketplaces offer buyers a convenient way to compare prices and find the most competitive market rates, facilitated by the wide range of products available (Aladalah et al., 2014; Oláh et al., 2019). The availability of numerous similar products offered by multiple sellers within e-marketplace platforms prompts buyers to become more selective, seeking out items at competitive prices while also considering various seller-related criteria (Arif et al., 2020). Moreover, online buyers tend to gravitate toward platforms that offer a diverse range of purchasing options. This diversity prompts consumers to engage in browsing activities driven by hedonic motives, including enjoyment and diversion. This variety also serves as an effective risk mitigation strategy, moderating perceived risks associated with online purchases. Additionally, the presence of comparable items enhances the process of making informed product choices, facilitated by extensive online browsing (Joo et al., 2012).

Buyers in e-marketplaces enjoy several advantages, including enhanced seller credibility, the ability to compare prices and offerings from multiple suppliers, and access to feedback from previous customers, all of which contribute to an informed purchasing process (Martins et al., 2020). Notably, elements like product reviews (both in terms of quantity and ratings), customer feedback, addressed questions, and discounts play a pivotal role in facilitating efficient purchasing decisions (Christian and Utama, 2021; B. Li et al., 2016). These factors serve to validate the seller's performance across various dimensions, such as product pricing, successful sales volume, and geographical proximity to the buyer (Arif et al., 2020). Given that e-marketplaces involve complementary goods as well, platform providers must offer economic incentives to consumers through discounts to substitute and complementary products, thereby increasing market share and the customer base (Oláh et al., 2019). As such, considerations like impulse buying behaviors and fluctuating moods can play a role in shaping consumers' online shopping decisions (Jaller and Pahwa, 2020; Joo et al., 2012).

Likewise, the provision of supplementary services by e-marketplaces and the perceived value from customers have a notable impact on

repurchase intentions by molding the purchasing experience, a critical aspect of online shopping (Mourtzis et al., 2020). Achieving this involves offering discounts on products, enhancing product quality, and minimizing non-monetary expenses tied to product acquisition and utilization. Similarly, the intention to repurchase in the context of online shopping can be mediated by ease of access, efficient search processes, robust evaluation methods, smooth transactions, and seamless post-purchase convenience (Pham et al., 2018).

## 2.2. The social dimension of e-marketplaces

The social dimension of sustainability within e-marketplaces becomes evident through its impact on societal welfare, addressing concerns like congestion, traffic-related externalities, and the overall quality of life (Pourrahmani and Jaller, 2021). This dimension also encompasses products linked to ethical labor practices, benefits for producers, and fostering relationships between buyers and sellers. The remarkable surge in e-commerce activities has contributed to an influx of delivery trucks into cities, resulting in detrimental outcomes such as increased congestion and pollution (Jaller and Pahwa, 2020). Congestion cost can be understood as the time lost by individuals due to additional vehicles slowing down the overall traffic flow, thus increasing travel times (Villa and Monzón, 2021). Consequently, congestion directly contributes to escalated air pollution, heightened energy consumption, and subsequently, the deterioration of urban residents' health, manifesting as illnesses including cancer, respiratory disorders, and cardiovascular diseases (Nürnberg, 2019). Furthermore, congestion and traffic congestion negatively impact the quality of life for urban dwellers, giving rise to noise pollution, emissions, and an increased likelihood of accidents, carrying both material and immaterial costs (Villa and Monzón, 2021).

Urban mobility serves as a means for both passengers and freight to access various locations, but it gives rise to external costs like congestion, pollution, landscape degradation, diminished public spaces, and safety concerns. In this context, the emergence of e-marketplaces and e-commerce offers a potential solution to avoid or minimize the need for physical trips, thereby enhancing citizen well-being, city accessibility, and overall quality of life (Maltese, Gatta et al., 2021). Additionally, the adoption of online applications can contribute to an improved quality of life for citizens (Schaffers et al., 2011), and the use of social media can empower local residents to market and sell their produce through e-commerce platforms, thereby supporting livelihoods and reducing poverty levels (Oláh et al., 2019). Consequently, e-marketplaces present opportunities to provide new markets and sustainable products to maintain competitiveness (Lillehagen and Petersen, 2015). For instance, these platforms can highlight eco-labels on products, providing customers with better insight into sustainable offerings and aiding them in making environmentally conscious purchases (W. Song et al., 2020). As consumer awareness about environmental concerns increases, there is a growing willingness to pay more for environmentally friendly products (D. Yang et al., 2019), while sustainable business models can offer marketing advantages for sustainable products, even if they are associated with higher prices (Prause, 2015).

E-marketplaces are built on the fundamental principle of mediating interactions between sellers and buyers. Their role involves streamlining transactions, aligning supply with demand, and enhancing overall market efficiency (Croitor et al., 2021). By nurturing buyer-seller relationships, these platforms establish channels for effective communication and seamless transactions (Sfenrianto et al., 2018; Tran, 2021), positioning themselves as the primary option for consumers seeking products from reliable sellers (Martins et al., 2020). In B2B interactions, e-marketplaces have the potential to connect previously disparate firms and effectively replace direct connections between buyers and sellers (Zhao et al., 2009). However, addressing information asymmetry issues becomes essential, particularly in the context of cross-border e-commerce (M. Zhang et al., 2020).

### 2.3. The environmental dimension of e-marketplaces

The environmental dimension of sustainability in e-marketplaces yields positive ecological impacts by addressing the ecological footprint and externalities tied to city congestion and traffic. These platforms facilitate the exploration of fair trade-based products and endorse less environmentally detrimental business models compared to physical stores. E-marketplaces foster sustainable consumer behaviors by reducing the carbon footprint of commercial activities (Leary et al., 2017), particularly when consumers are situated in city centers, as it reduces travel distances between the store and their residence. Furthermore, digital platforms exhibit sustainability benefits in the pre-sale and sale phases of the purchasing process, along with efficient last-mile delivery transportation (Mangiaracina et al., 2016). Online purchases typically generate a lower carbon footprint than traditional in-store transactions due to enhanced logistical efficiency, excluding immediate deliveries (fast delivery) which may require specialized last-mile routes for swift delivery. Among the various processes within e-commerce and e-marketplaces, the consumer's location holds the most substantial environmental impact. Numerous factors contribute to the carbon footprint in these channels, including transportation (fuel consumption of vehicles used for last-mile delivery), energy consumption (energy sources employed across the supply chain), and information flow (electricity for transmitting data, emissions from printed labels for product tracing) (Prasertwit and Kanchanasuntorn, 2021).

The rapid growth of e-commerce has been accompanied by an increased distribution of parcels within urban areas, leading to significant externalities such as traffic congestion and emissions (Arnold et al., 2018). Consequently, a trade-off emerges between the reduction in travel required for offline store visits and the surge in traffic generated by delivery trucks and vans from various companies, highlighting the fact that online shopping does not eliminate the need for physical shopping trips (Van Loon et al., 2015). Considering this challenge, e-marketplaces hold the potential to alleviate traffic congestion and its associated environmental impacts, such as smog and pollution (M. Song et al., 2019; R. Xie et al., 2019). One approach to achieving this goal is the implementation of sustainable urban mobility plans aimed at reducing traffic volumes, the frequency and duration of motorized journeys, noise and air pollutants, as well as time wastage (Maltese, Gatta et al., 2021). Moreover, e-marketplaces can play a constructive role in promoting an interest in environmental preservation among both buyers and sellers. They can achieve this by advocating for fair trade practices grounded in mutual trust, environmental safeguards, and the availability of environmentally friendly products (Robina-Ramírez et al., 2020).

The environmental impact caused by last-mile logistics can be reduced by using urban distribution route optimization algorithms, adoption of energy-efficient vehicles and processes, and resolving conflicting interests among stakeholders. Sustainable business models adopted by e-marketplaces can significantly contribute to reducing travel time, distances covered, vehicle usage, waiting periods, energy consumption, and CO<sub>2</sub> emissions associated with these logistics processes. To this end, the integration of technologies and operational methods, including cargo bikes, electric vehicles, parcel lockers, crowdshipping logistics, and underground transportation offer viable alternatives for diminishing environmental impacts while maintaining the value proposition of e-marketplace business models (Viu-Roig and Alvarez-Palau, 2020). As e-commerce continues to expand, environmental concerns like noise and air pollution will persist within urban areas. This highlights the importance for e-marketplace business models to adhere to safety regulations and seek ways to mitigate delivery times, thereby addressing consumer expectations (Oláh et al., 2019; Villa and Monzón, 2021). Additionally, many consumers hold the perception that online purchases and home deliveries contribute positively to the environment by reducing individual travel needs. Consequently, e-retailers must actively promote the environmental advantages of online

shopping in their business models (Mangiaracina et al., 2016). Demonstrating the effectiveness of these claims is critical and requires practical and measurable achievements in environmental efficiency.

### 2.4. The technological dimension of e-marketplaces

Approaching sustainable operations within e-marketplaces involves a multi-dimensional framework encompassing economic, social, environmental, and technological considerations. These dimensions collectively contribute to commercial opportunities, economic stability, community enhancement, natural resource preservation, and technological innovation. This comprehensive approach highlights the potential for positive impact across various facets of e-marketplace operations (Cano, Londoño-Pineda, and Rodas, 2022). Sustainable e-marketplaces traditionally encompass three established dimensions: economic, social, and environmental. A more comprehensive approach introduces the technological dimension, which encompasses various elements such as innovative product offerings, collaborative innovation, adoption of green information technologies, and the robust functioning of information systems (Alt, 2020; Viu-Roig and Alvarez-Palau, 2020; J. Xie and Wang, 2021). However, the fourth dimension of sustainability in e-marketplaces—the technological dimension—has received relatively limited attention in the existing literature. Among the four dimensions, the environmental aspect has garnered the most frequent consideration, given its immediate impact on ecological well-being. Following closely are the social and economic dimensions, which have also been explored to a notable extent. In contrast, the technological dimension has been less thoroughly analyzed, and its potential contributions to sustainable e-marketplaces have yet to be fully uncovered (Viu-Roig and Alvarez-Palau, 2020).

Features such as webpage quality (design, content, and navigation), ease of use (adequate organization and structuring of online platforms to achieve accessibility and facilitate its use), and visual appeal positively affect purchasing intention in e-marketplaces. Another feature that leads to consumers' purchase intention is trustworthy sources, which, through persuasive online word of mouth, leads shoppers to select online platforms over the offline system (Robina-Ramírez et al., 2020). Likewise, safe transactions, privacy policies, and agreements with financial companies to protect customers against fraudulent actions represent advantages for consumers in e-marketplaces (Martins et al., 2020; Tran, 2021). Therefore, digital platforms should deliver security, privacy, and order to inspire trust since both perceptions of platform quality and platform brand influence consumers more than sellers in transaction intentions (Malak et al., 2021). Then, a more holistic understanding of e-marketplace sustainability can be achieved by exploring and understanding the ways in which technology can enhance sustainable practices.

### 2.5. Relationship between sustainability dimensions and the e-marketplace business model

The concept of a business model encompasses a range of activities undertaken by a company, including value proposition, creation, delivery, and value capture. This process involves collaborating and engaging with external stakeholders such as suppliers, customers, partners, government authorities, and social organizations (H. Li et al., 2022; Nosratabadi et al., 2019). Hence, there is an ongoing need for research to address gaps, contingencies, and outcomes in business models (Mileros et al., 2019). One area of concern is the lack of progress in business model innovation, particularly in addressing the social and environmental consequences brought about or facilitated by various industries. This includes a concerning lack of advancement towards achieving the United Nations Sustainable Development Goals (SDGs), all while maintaining productivity and profitability (Bocken and Short, 2021; Schaltegger et al., 2016). E-marketplace business models cannot afford to ignore this reality. They must be designed with careful

consideration to ensure their viability over the medium and long term. Achieving this involves reshaping value propositions to align with user and customer preferences and desires. Furthermore, to ensure sustainability and minimize negative external impacts, businesses must incorporate functions that account for consumer preferences. This approach enables improved interaction with consumers and collaborative identification of value propositions that fulfill economic, social, environmental, and technological objectives. This is particularly pertinent considering the growth of e-commerce and e-marketplaces, which have been found to contribute significantly to CO2 emissions, pollution, and escalating traffic congestion (Sun et al., 2021).

As a result, the significance of sustainable business models lies in their ability to foster value creation through innovative governance structures, thus transcending conventional frameworks that encompass economic, social, environmental, and technological perspectives (Alt, 2020; Schaltegger et al., 2016). Unsustainable business models based on short-term shareholder value—not stakeholder value—can be overcome through a focus on society and the environment, inclusive value creation, and the maximization of material and energy efficiency (Bocken and Short, 2021). Consequently, the notion of a sustainable business model emerges as a framework describing how organizations produce, deliver, and capture value in a sustainable manner, encompassing economic, social, environmental, and other contexts. It offers market-oriented solutions that lead to win-win outcomes for diverse stakeholders (Nosratabadi et al., 2019). Similarly, a sustainable business model serves as a tool to describe, analyze, manage, and communicate the ways a company captures economic value while also nurturing or replenishing natural, social, and economic assets beyond its organizational boundaries (Schaltegger et al., 2016). Furthermore, it underscores the importance of maintaining robust digital technology to enhance ecological network value for stakeholders in technologically-enabled businesses (H. Li et al., 2022).

In the context of e-marketplaces, sustainable business models need to carefully balance objectives across economic, social, environmental, and technological dimensions. They aim to ensure efficient commercial operations and transactions, minimize environmental impact, improve interactions with stakeholders—especially consumers—and ensure user-friendly and stable digital platforms. The core idea of business model value propositions often revolves around consumers. These consumers are no longer passive buyers; they actively participate in product development and play roles as contributors and co-creators in shaping business model innovations. Therefore, a successful e-commerce business model depends not only on its structure and marketing strategies but also on the blend of consumer-focused approaches (Ballestar et al., 2018), considering that buyers represent some of the most relevant customers in e-commerce platforms (Mileros et al., 2019). As a result, forming strategic partnerships and collaborations with stakeholders, particularly consumers, serves as a rich source of knowledge and business structures that facilitate continuous transformation and iterative enhancements in business models (H. Li et al., 2022). Such efforts yield numerous benefits, including reduced resource consumption, streamlined product and service creation resulting in lower costs and pollution (Sun et al., 2021), as well as fostering new product development activities and boosting the sustainability of business models (Kortmann and Piller, 2016).

When considering the integration of business model sustainability with the economic dimension, it brings consumers various benefits. These advantages encompass reducing travel time, enabling redirection of time towards productive activities, cutting travel expenses, offering lower overall costs compared to physical markets, enabling comparison of offerings from multiple sellers, facilitating searches for various products to fulfill purchasing needs, and providing supplementary services and value in the purchase price. All these factors directly influence the sustainability of e-marketplace business models. Therefore, the following hypothesis is proposed:

**Hypothesis 1.** The economic dimension significantly impacts the sustainability of e-marketplace business models for consumers.

Similarly, when examining the connection between business model sustainability and the social dimension, this dimension offers consumers benefits such as enhancing urban mobility, contributing to well-being by reducing stress and increasing leisure time, simplifying the identification of products associated with fair practices, and facilitating connections between buyers and sellers. All these elements directly contribute to the sustainability of e-marketplace business models. Consequently, the following hypothesis is suggested:

**Hypothesis 2.** The social dimension significantly influences the sustainability of e-marketplace business models for consumers.

Regarding the relationship between business model sustainability and the environmental dimension, it encompasses aspects for consumers such as reducing users' environmental impact by saving on fuel consumption for travel, simplifying searches for environmentally friendly products, and endorsing low-emission business models. All these factors have a direct impact on the sustainability of e-marketplace business models. Thus, the following hypothesis is put forth:

**Hypothesis 3.** The environmental dimension significantly affects the sustainability of e-marketplace business models for consumers.

Concerning the technological dimension's correlation with business model sustainability, it offers consumers elements like service quality reliability of the platform, access to transactional and historical information, user-technology interaction (usability), platform stability, consistent numbers of sellers and buyers, real-time feedback on commercial information, and product suggestions for purchase. All these aspects directly influence the sustainability of e-marketplace business models. Hence, the following hypothesis is presented:

**Hypothesis 4.** The technological dimension significantly impacts the sustainability of e-marketplace business models for consumers.

### 3. Methods

As this study aims to analyze the preferences and perceptions of consumers to support the sustainability of e-marketplaces, an online questionnaire-based survey was designed. As shown in Table 1, the research instrument that served as a guide for creating the form distributed to the respondents is divided into several sections dedicated to the respondents' demographic profile, history of e-marketplace usage, economic, social, and environmental dimensions of sustainability, prioritization of sustainability dimensions, and technological and systemic aspects of e-marketplaces. For the section on sustainability dimensions, respondents were asked to rate their agreement with the statement that buying goods and services in e-marketplaces could contribute to economic, social, and environmental benefits, using a five-point Likert Scale (1: strongly disagree; 2: somewhat disagree; 3: neither agree nor disagree; 4: somewhat agree; 5: strongly agree). For the technological and systemic aspects section, respondents were asked to rate, according to their preferences and perception, the importance of some aspects that an e-marketplace could provide, using a five-point importance Likert scale (1: not important; 2: slightly important; 3: moderately important; 4: important; 5: very important).

The questionnaire was based on the topics covered in Section 2 of this study, which presents the main impacts related to the economic, social, and environmental dimensions of sustainability in e-marketplaces, as well as the technological and systemic elements of these digital platforms. The online questionnaires were developed using the Google Forms platform and distributed to respondents through email and WhatsApp. The respondents were informed of the survey's objective, which was to gather information from potential and current e-marketplace users about their preferences and perceptions of these platforms. Additionally, a basic definition of e-marketplaces was

**Table 1**  
Research tool for the survey of buyers in e-marketplaces.

Respondents' demographic profile	
Gender	What is the gender with which you best identify?
Age	What is your age range?
Education level	Please indicate the last academic degree you have completed.
Historical use of e-marketplaces	
User experience on e-marketplace platforms	Have you been a user of any E-marketplace? If you answered 'No,' please provide the reasons for not using e-marketplaces. If you answered 'Yes,' please indicate the main reasons for buying or browsing in an e-marketplace.
Incentives to buy products	In your opinion, what is the main incentive or benefit for purchasing products/services in an e-marketplace?
Sustainability dimensions	
Economic dimension	Reduction of travel time to a store to dedicate it to other productive activities (Buldeo et al., 2021; Malak et al., 2021; Oláh et al., 2019; Sfenrianto et al., 2018; Villa and Monzón, 2021). Travel cost reductions (Bakos, 1997; He et al., 2016; Jiang, 2002; Joo et al., 2012; Leary et al., 2017; Loro and Mangiaracina, 2022; W.Song et al., 2020; Standing et al., 2010; Tung, 2018; Tzong-Ru and Jan-Mou, 2006; J.Wei and Chang, 2022). Lower costs than buying products in brick-and-mortar markets (Fuadah et al., 2022; He et al., 2016; Loro and Mangiaracina, 2022; Tung, 2018). Comparison of offers from multiple sellers for the same product/service (Aladalah et al., 2014; Arif et al., 2020; Christian and Utama, 2021; Joo et al., 2012; B.Li et al., 2016; Martins et al., 2020; Oláh et al., 2019). Search for several products/services to satisfy a purchase need (Croitor et al., 2021; Joo et al., 2012; Robina-Ramírez et al., 2020; Tung, 2018; Kangninga Wei et al., 2014). Additional services and added values are included in the purchase price (Mourtzis et al., 2020; Pham et al., 2018). Reduction of travel time to a store to dedicate it to other productive activities (Croitor et al., 2021; Jaller and Pahwa, 2020; Joo et al., 2012; Oláh et al., 2019). Improvement of mobility in the city (Arnold et al., 2018; Jaller and Pahwa, 2020; Nürnberg, 2019; Villa and Monzón, 2021). Improvement of the quality of life by reducing stress due to traffic congestion on the roads and increasing free time for other activities (Maltese, Gatta et al., 2021; Oláh et al., 2019; Schaffers et al., 2011). Search for products associated with good labor practices, social benefits for producers, etc. (Barska and Wojciechowska-Solis, 2020; Lillehagen and Petersen, 2015; Prause, 2015; W.Song et al., 2020; D. Yang et al., 2019). Contact between buyers and sellers (Croitor et al., 2021; Martins et al., 2020; Sfenrianto et al., 2018; Tran, 2021; M.Zhang et al., 2020; Zhao et al., 2009).
Social dimension	Reducing the ecological footprint of users (consumers) by saving on fuel consumption and energy sources used in travel and transport (Arnold et al., 2018; Leary et al., 2017; Maltese, Gatta et al., 2021; Mangiaracina et al., 2016; Prasertwit and Kanchanasuntorn, 2021; M.Song et al., 2019; Van Loon et al., 2015; R.Xie et al., 2019). Facilitating the search for environmentally friendly products (Robina-Ramírez et al., 2020). Encouraging business models and marketing channels that generate less ecological footprint compared to conventional commerce models (Mangiaracina et al., 2016; Oláh et al., 2019; Villa and Monzón, 2021; Viu-Roig and Alvarez-Palau, 2020).
Environmental dimension	Usability Reliability of the e-marketplace platform's service
Technological dimension	

**Table 1 (continued)**

Respondents' demographic profile	
	quality (Tran, 2021). Long-term access to transaction, registration, and historical information. (Alt, 2020). Interaction between the user and the technology (platform usability) (Robina-Ramírez et al., 2020). <i>Stability</i> Stability of the platform/market (Robina-Ramírez et al., 2020). Stability of sellers and buyers on the platform (Alt, 2020). Real-time feedback on offers, discounts, trends, and new products. (Alt, 2020). Product recommendations (Alt, 2020).
Dimension prioritization	The importance of the economic, social, environmental, and technological dimensions of sustainability (Alt, 2020; Rosenberg et al., 2021; Viu-Roig and Alvarez-Palau, 2020; Wang et al., 2021; Xue et al., 2022).

provided, with examples of digital platforms such as Amazon, eBay, Mercado Libre, and Aliexpress.

To explore the preferences and perceptions of consumers regarding the sustainability of e-marketplaces, this study obtained responses from 392 participants in Medellín, Colombia. The sample size was determined based on a simple random sampling technique, ensuring a confidence level of 95% and a margin of error of 5%. From the collected data, it was found that five respondents did not provide complete information on all aspects analyzed in this research, resulting in a final sample size of 387 respondents, which still adheres to the requirements of simple random sampling. The data gathered through the questionnaire designed for this study was subjected to descriptive statistical analysis. This analysis aimed to identify the user experience, factors influencing purchasing decisions on e-marketplace platforms, as well as the perceptions and evaluations of consumers in Colombia regarding the economic, social, environmental benefits, and technological and systemic components. These findings serve as a valuable guide for the development of sustainable business models in the context of e-marketplaces.

Additionally, Structural Equation Modeling (SEM) is utilized to validate the relationships between variables and constructs depicted in Table 2. The purpose is to establish the most significant connections between sustainability dimensions and a sustainable business model for e-marketplaces, as perceived by consumers. SEM enables the examination of these relationships, providing valuable insights into the interplay of variables and constructs within the context of the study. In this regard, SEM encompasses various related procedures, including covariance structure analysis, covariance structure modeling, and analysis of covariance structures. SEM serves as a causal inference method that incorporates qualitative causal hypotheses based on theory, queries about causal relationships among variables of interest, and data from experimental or quasi-experimental designs. It generates valuable outputs such as numerical estimates of model parameters for hypothesized effects, logical implications of the model, and an assessment of the degree to which the data supports the testable implications of the model. By specifying a model that reflects predictions derived from a theory, SEM examines the theory through the relationships among plausible constructs measured by appropriate observed variables. The fitting of the model to the data is crucial, as an inadequate fit can provide valuable insights by challenging or debunking existing theories. Therefore, SEM contributes significantly to addressing substantive theoretical issues, regardless of whether the model is ultimately retained or not (Kline, 2016).

As depicted in Fig. 1, the model presented in this study involves first-order latent variables, symbolizing the four dimensions under investigation. Additionally, it incorporates a second-order latent variable, representing the sustainable business model. Second-order latent variables are formed through the combination of two or more first-order

**Table 2**  
Structural equation model constructs and observed variables.

Constructs / Latent Variables	Observed variables	Abbreviation
Economic Dimension	Reduce travel time to spend it on productive activities	1. RTT
	Reduction of travel costs	2. RTC
	Lower total cost than in brick-and-mortar markets	3. LTC
	Comparison of offers from multiple sellers	4. COS
	Search for multiple products to satisfy a purchase need	5. SMP
	Additional services and added value in the purchase price	6. ASV
	Encourage the purchase of related products	7. PRP
Social Dimension	Improve mobility in the city	8. IMC
	Improve wellbeing by reducing stress and increasing free time	9. WSF
	Facilitate the search for products associated with fair practices	10. PFP
	Facilitate and contact between buyers and seller	11. CBS
Environmental Dimension	Reduce user pollution by saving on fuel consumption for travel	12. RUP
	Facilitate the search for environmentally friendly products	13. SEP
Technological Dimension	Promote low-pollution business models	14. LBM
	Reliability in the quality of service of the platform	15. RQS
	Access to transaction and historical information	16. ATI
	Interaction between user and technology (usability)	17. IUT
	Stability of platform	18. SOP
	Stability in the number of sellers and buyers	19. SSB
	Real-time feedback on commercial information	20. RTF
Sustainable Business Model	Suggestions of products to buy	21. SPB
	Economic Dimension Importance	22. ECI
	Social Dimension Importance	23. SOI
	Environmental Dimension Importance	24. ENI
	Technological Dimension Importance	25. TEI

latent variables. These second-order variables enable the representation of complex connections between observable and latent variables, facilitating the capture of underlying constructs that cannot be directly measured. The proposed model is also designed to illustrate reflective measurement, wherein latent variables are presumed to influence observed variables which are known as effect or reflective indicators.

The proposed conceptual model was conducted using SmartPLS 4 software because the PLS method can be applied to complex SEM with a large number of constructs, does not require normally distributed input data, can handle both reflective and formative constructs, and can handle first- and second-order variables together (Vranjanac et al., 2023). The software also allowed the inclusion of latent variables, their corresponding observed variables, and the relationships between these variables. With SmartPLS 4, it was able to specify the measurement model by defining the indicators for each latent variable and the structural model by specifying the relationships between the latent variables.

#### 4. Results

The survey results indicate that out of 392 respondents, 54.6% were female and 45.4% were male. Most respondents (46.2%) were between 25 and 34 years old, followed by 27.3% in the 18–24 age range, 14.3% in the 35–44 age range, and 12.2% in the under 18 or over 45 age ranges. Table 3 shows that 59.2% of respondents have a bachelor's degree, 24.0% have a high school degree, and 16.9% have an associate,

master's, or doctoral degree.

The survey shows that 72.2% of respondents confirm having used e-marketplace platforms at some point, while 27.8% say they have not used or accessed them. According to Fig. 2(a), there is evidence of greater use of e-marketplaces by respondents with higher academic degrees (Doctoral, Master's, Bachelor), where more than 78% of respondents claim to have used these digital platforms, while at most 59% of people with high school or associate degrees have used e-marketplaces. Similarly, Fig. 2(b) shows that respondents between the ages of 18 and 44 have participated more in e-marketplaces than those under 18 or over 45. It is important to note that 79% of people between the ages of 18–24 years have used these platforms, while 54% of respondents aged 55–64 have not used them, nor have 80% of people over 64. This information indicates that a higher education level may imply a greater awareness and approach to information systems and digital platforms related to e-commerce, and young adults, who are usually in active working life, are more likely to use e-marketplace platforms.

Of the respondents who have not used e-marketplaces, Fig. 3 shows that the main reason is the lack of knowledge about digital platforms for electronic markets (52.3%), followed by a preference for in-person/physical shopping (offline shopping) (16.5%) and distrust of e-commerce (13.8%). Of these respondents, 7.3% commented that they were not clear about the benefits of making purchases in an e-marketplace, while other respondents cited reasons such as a lack of understanding of how e-marketplaces operate, a lack of proficiency with technology, and a lack of clarity regarding guarantee and return policies. These results support the idea of strengthening basic and higher education to increase awareness and training in e-commerce modalities, promoting the benefits of making purchases in e-marketplaces through advertising campaigns, and highlighting existing data protection policies and security measures for financial transactions through e-commerce.

On the other hand, Fig. 4 highlights that the main reasons for respondents to have been users of e-marketplaces are to consult products and prices to make a better purchase (56.2%), save time in the purchase process (47.0%), buy only the product/service that they require (37.1%), save money on the purchase (33.2%), buy the product/service they want and other complementary products/services (26.5%). Other less frequent reasons motivating purchases in e-marketplaces include understanding how digital platforms work (19.8%) and taking advantage of the purchasing impulse generated by online advertising (16.3%). These results show the strengths that e-marketplace business models should promote in their value offers and marketing campaigns to expand their buyer base (Standing and Standing, 2015). Thus, the sustainability of e-marketplaces can be ensured by increasing the buyer (Tung, 2018; Kangninga Wei et al., 2014) by providing customers with features to compare prices and products, compare online and offline purchasing times and costs, and suggest products related to those previously consulted or added to the shopping cart.

According to Fig. 5, respondents perceive that the main benefits of buying products/services in an e-marketplace are related to achieving more attractive prices than in brick-and-mortar stores (54.3%), reducing shopping time (46.7%), and finding a greater variety of products/services for a specific requirement (39.8%). In order of secondary importance, the respondents consider finding new suppliers and brands not available in offline stores (27.3%), the variety of suppliers for the same product/service (26.3%), and the speed of delivery of the purchased product (21.7%) as incentives to make purchases in e-marketplaces.

##### 4.1. Dimensions of sustainability in e-marketplaces

Of the economic advantages that electronic marketplaces can offer to consumers, respondents valued to a greater degree (3.86 on a scale of 1–5) that e-marketplaces can contribute to the reduction of travel time, and the saved time can be invested in other productive activities (see Fig. 6). Likewise, the benefit of comparing suppliers' offers for the same product, facilitating the search for multiple products to satisfy a



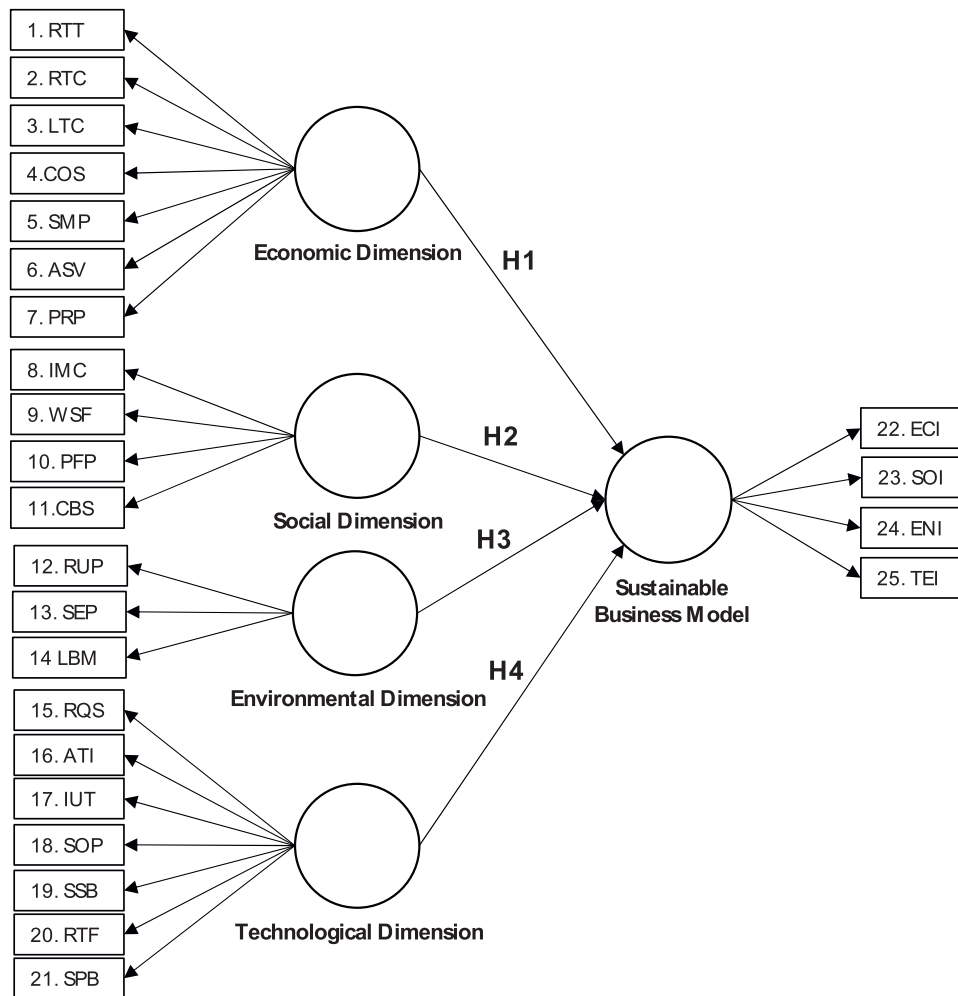


Fig. 1. A conceptual model for sustainable e-marketplace business models.

Table 3  
Respondent demographic profile.

Demographic aspect	Answer options	Responses	Percentage
Gender	Female	214	54.6%
	Male	178	45.4%
Age	Under 18 years	9	2.3%
	18–24 years	107	27.3%
	25–34 years	181	46.2%
	35–44 years	56	14.3%
	45–54 years	21	5.4%
	55–64 years	13	3.3%
Academic degree	Older than 64 years	5	1.3%
	High school degree	94	24.0%
	Associate degree	30	7.7%
	Bachelor's degree	232	59.2%
	Master's degree	29	7.4%
	Doctoral degree	7	1.8%

purchase requirement, and reducing travel costs (related to fuel, tickets, transportation fees, and parking, among others) are highly appreciated by respondents (values between 3.76 and 3.78). Therefore, as with Fig. 5, these results show that consumers in e-marketplaces value more aspects related to the time and cost of the purchase process and the variety of products/services offered by these platforms. These assessments could be considered to improve the value offering and satisfaction of e-marketplace users.

Regarding the social benefits, Fig. 6 shows that respondents valued to a greater extent the potential for buying products in e-marketplaces to

improve their quality of life by reducing stress due to congestion and increasing free time for other personal activities, assigning an average value of 3.66. The benefit of contributing to the search for products associated with good labor practices and social benefits for producers, among others, received an average value of 3.64. Respondents assigned a score of 3.61 to the potential for e-marketplaces to facilitate and accelerate contact between customers and suppliers, while the benefit of improving mobility in the city received a score of 3.57. Thus, the benefits that received the highest ratings are related to improving the quality of life for consumers and the opportunity to support products related to fair business practices. Based on Fig. 6, the respondents believe that the most significant environmental advantage of purchasing products in e-marketplaces is promoting business models and sales channels that produce lower pollution levels, which they rated at 3.64. Contributing to the search for environmentally friendly products received a value of 3.57, and the potential for reducing user pollution by saving on fuel consumption for trips received a score of 3.56.

In addition to the traditional dimensions of sustainability, this study provides insights into the technological factor of e-marketplaces, which can be considered an additional sustainability dimension (Viu-Roig and Alvarez-Palau, 2020). Fig. 6 demonstrates that e-marketplace consumers value platform reliability, stability, and usability, with ratings above 4.2 on a scale of 0–5. Other technological aspects are equally important, with values above 4.0, surpassing the factors evaluated in the traditional sustainability dimensions. Therefore, e-marketplace platforms must ensure long-term access to transaction information, provide real-time feedback on offers, discounts, trends, and new products, suggest

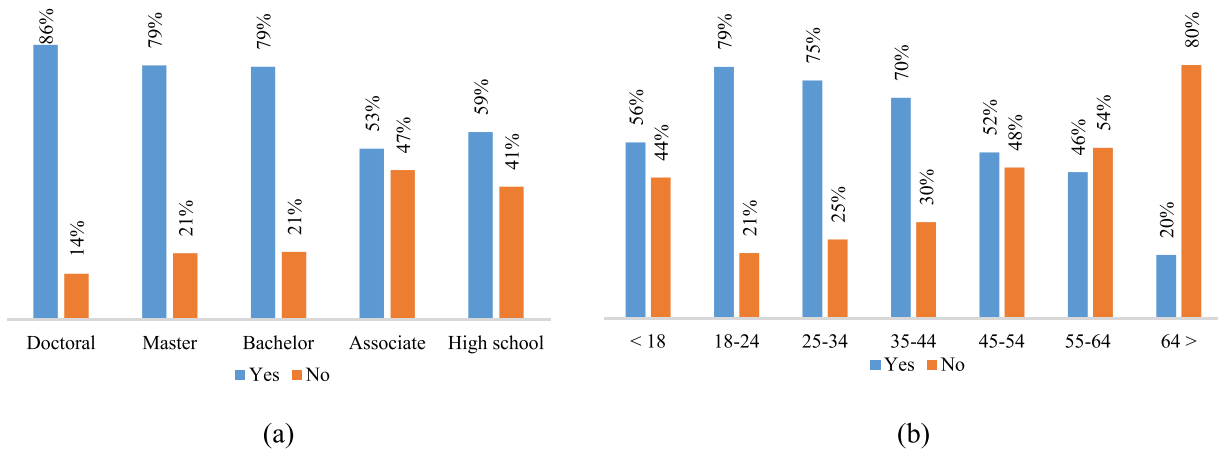


Fig. 2. Use of e-marketplaces by (a) academic degree and (b) age.

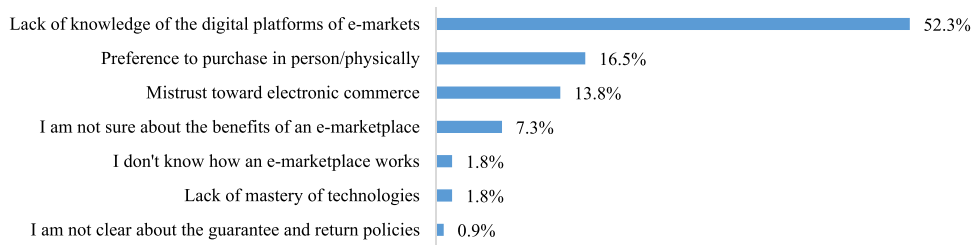


Fig. 3. Main reasons for the non-use of e-marketplaces.

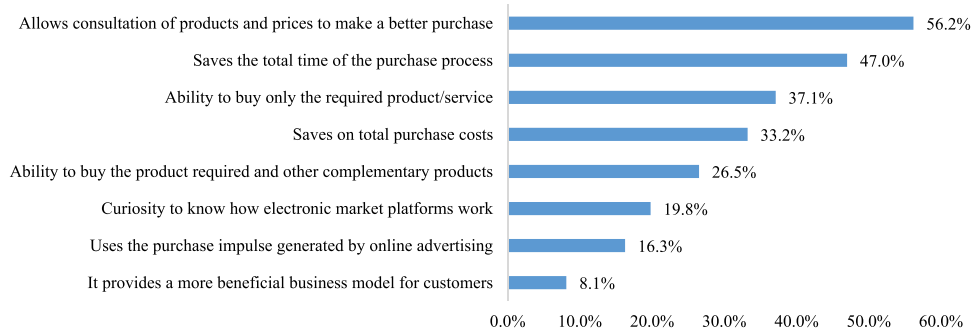


Fig. 4. The main reasons for the use of e-marketplaces.

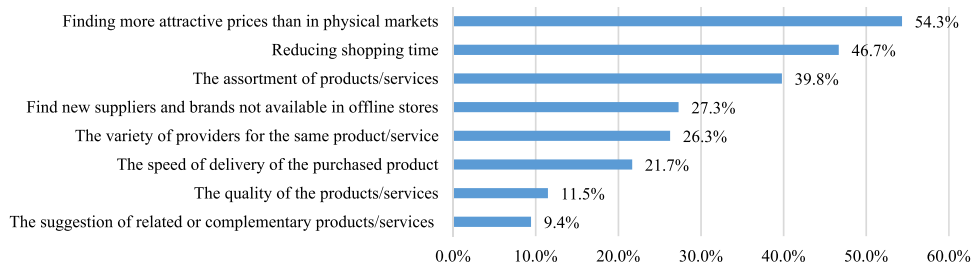


Fig. 5. Benefits of buying products from e-marketplaces.

purchases based on user preferences, and maintain stability in the number of buyers and sellers on the platform to satisfy consumers' technological needs.

Fig. 7 illustrates the preferences and relative importance of sustainability dimensions in e-marketplaces as determined by the respondents. The ratings provided by the respondents indicate that the economic and

environmental dimensions hold similar levels of importance, with ratings of 3.99 and 3.98, respectively. The social dimension, on the other hand, received a rating of 3.83. Notably, the technological dimension received the highest level of importance, with a rating of 4.26. This finding suggests that e-marketplace business models should prioritize the usability and stability of the technological platform to ensure

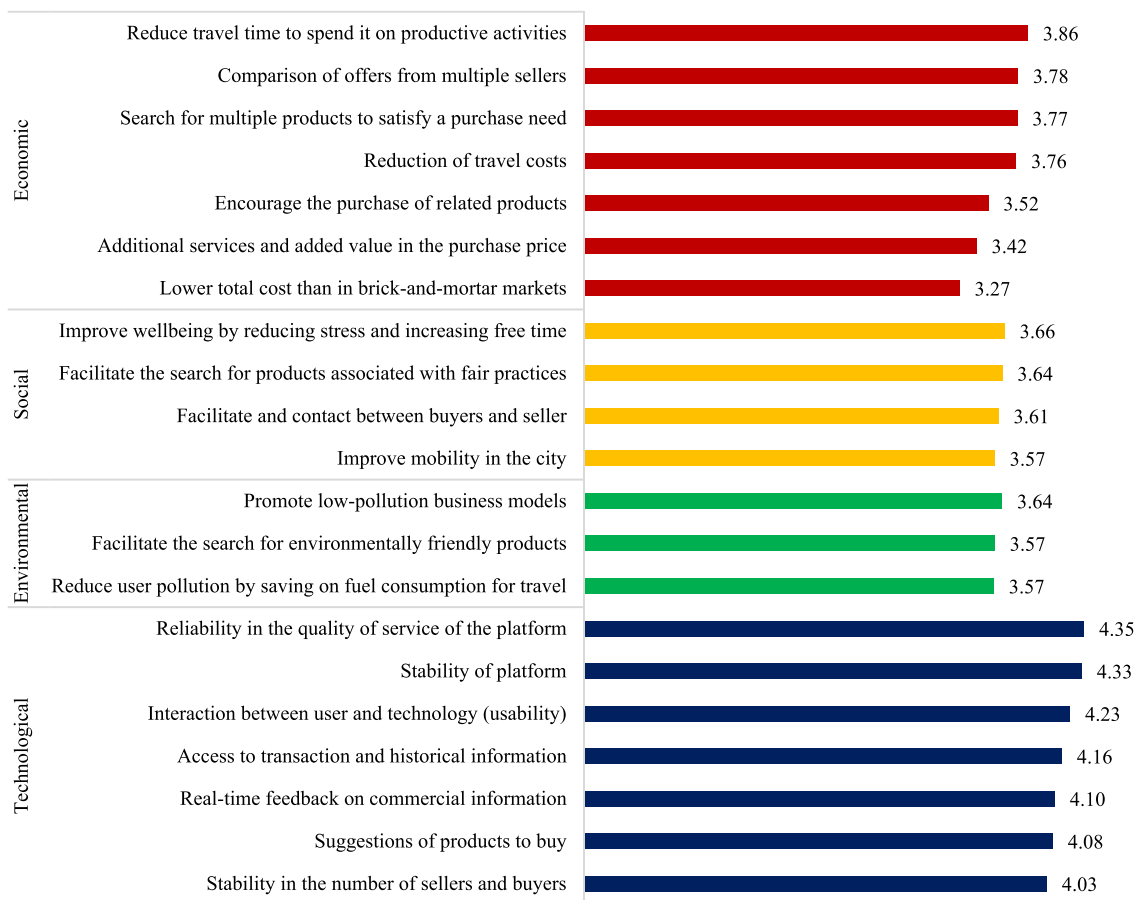


Fig. 6. Assessment of the economic, social, environmental, and technological dimensions.

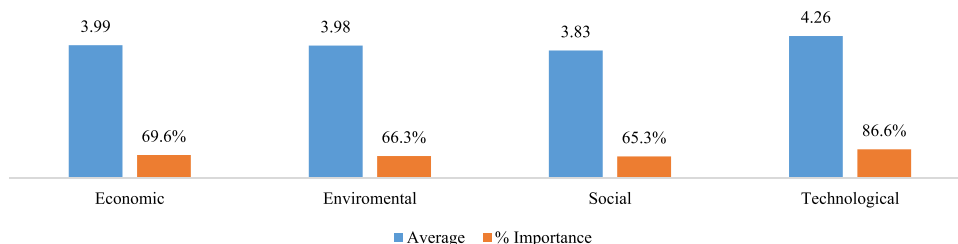


Fig. 7. Prioritization of sustainability dimensions.

seamless operations and transactions, while also delivering economic, environmental, and social benefits to buyers. Furthermore, Fig. 7 reveals that 86.6% of respondents considered the technological dimension to be important or very important in ensuring the sustainability of e-marketplaces. In comparison, 69.1%, 66.3%, and 65.3% of respondents regarded the economic, environmental, and social dimensions, respectively, as important, or very important. These insights can assist in the weighting of sustainability dimensions from the perspective of consumers in models that measure sustainability in e-marketplaces, considering the diverse interests of various stakeholders.

Concluding the preferences and perceptions of e-marketplace consumers, they highly value various aspects of e-marketplaces that contribute to convenience and enhanced quality of life. They appreciate the convenience of reduced travel time, the ability to compare suppliers' offers, search for multiple products, and lower travel costs. Moreover, consumers prioritize the potential of e-marketplaces to alleviate stress caused by congestion and provide more leisure time for personal activities. Additionally, consumers recognize the environmental benefits

of e-marketplaces, particularly in terms of promoting business models and sales channels with reduced pollution levels. Emphasizing usability and stability in the technological platform for seamless operations and transactions is also a key consideration for consumers. Notably, a significant majority of respondents underscore the importance of the technological dimension in ensuring e-marketplace sustainability. These insights gathered from consumers' preferences and perceptions can play a pivotal role in guiding the development and optimization of sustainable business models for e-marketplaces, addressing diverse stakeholder interests.

#### 4.2. Relationships between sustainability dimensions and a sustainable business model

SEM is a valuable tool for exploratory research and testing comprehensive theories and concepts (Hair et al., 2014; Ramirez et al., 2014). In this study, SEM models were employed to examine the relationships between various variables related to the dimensions of sustainability

and sustainable business models of e-marketplaces. Table 2 displays five latent variables, each comprising several observed variables or indicators. The theoretical model posits that the economic, social, environmental, and technological dimensions influence the sustainable business model. Using the SmartPLS 4 software, the structural model was defined, and the software facilitated the estimation of model parameters and the assessment of the significance of relationships between variables.

Fig. 8 illustrates the structure and results of the model implemented in SmartPLS 4. The first step involved assessing the reliability of the observed variables (indicators) in relation to their respective constructs. It is noteworthy that all indicators of the five latent variables meet the criterion of  $\lambda \geq 0.707$  (Ramírez et al., 2014), indicating that all indicators exhibit satisfactory reliability in relation to their respective constructs. Therefore, the findings from the statistical analysis align with the patterns and trends observed in the assessment of the economic,

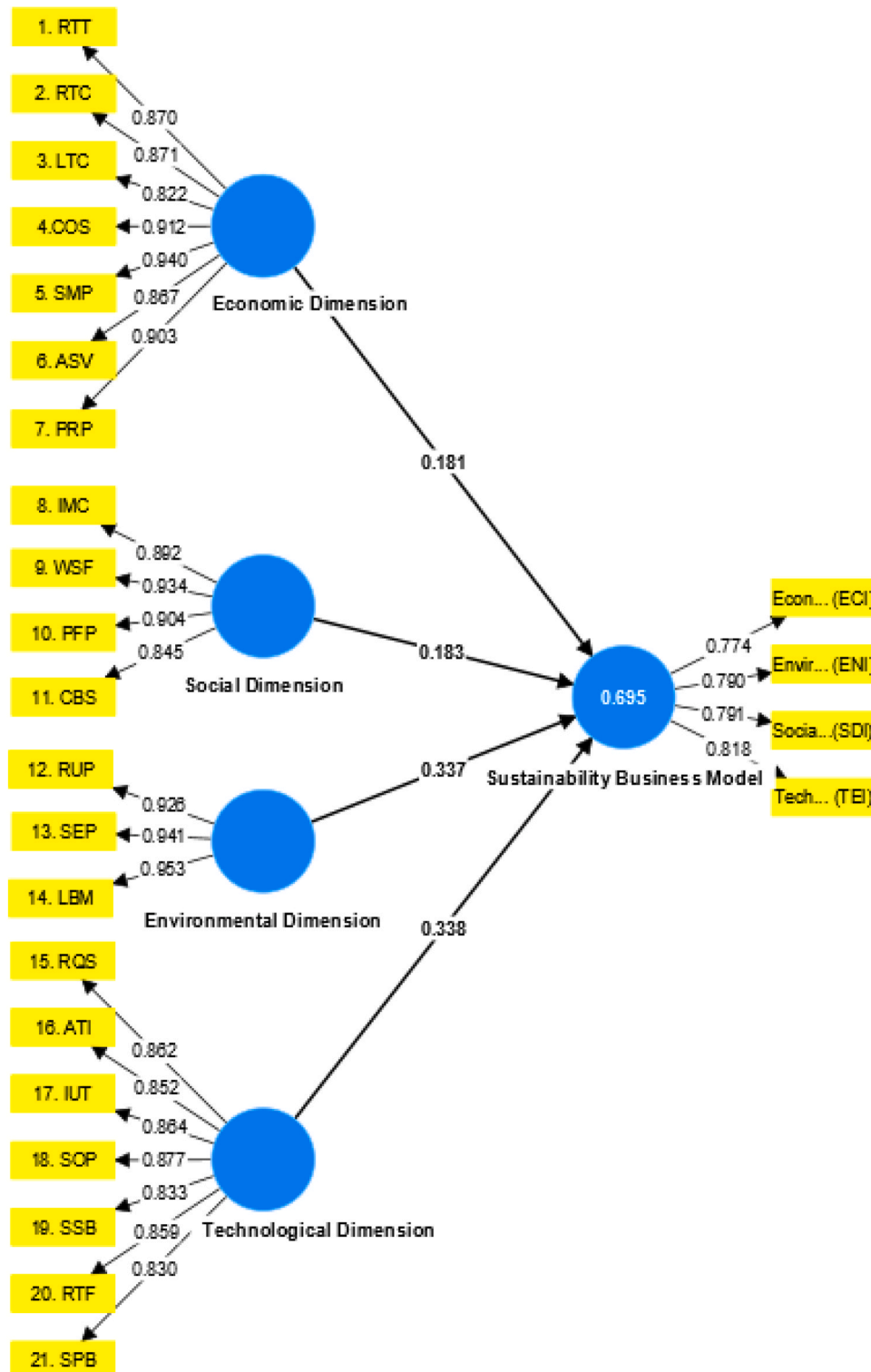


Fig. 8. Structural model for sustainable business model in e-marketplaces.

social, environmental, and technological dimensions, as well as the prioritization and importance assigned to the sustainability dimensions by the respondents. Thus, the statistical validation of the SEM reinforces the credibility and robustness of the descriptive analysis presented in Figs. 5 and 6, confirming that the observed relationships and importance ratings are not merely coincidental but have a solid empirical foundation.

Then, the reliability of the constructs and the internal consistency of the SEM were evaluated using the statistics from Table 4 to assess the robustness of the measurement model. Construct reliability is commonly assessed using measures such as Cronbach’s alpha and Composite Reliability (CR) (Malkewitz et al., 2023). In this study, both Cronbach’s alpha and CR analysis were conducted to evaluate the reliability of the constructs. The results indicate that all constructs in the model exhibit satisfactory reliability. The values of Cronbach’s alpha and composite reliability for each construct exceed the recommended threshold of 0.7, indicating that the constructs are reliable and internally consistent. In addition to construct reliability, the average variance extracted (AVE) is also evaluated to assess the convergent validity and consistency of the model. The AVE values for all constructs in this study are above the threshold of 0.5, indicating that a substantial amount of variance is captured by the constructs themselves, rather than measurement error. This suggests that the model is consistent, and the constructs effectively measure the underlying concepts.

When assessing the validity of the structural model, one commonly used measure is the coefficient of determination ( $R^2$ ). The  $R^2$  value represents the proportion of variance in the dependent variable that is explained by the independent variables in the model. In this study, the  $R^2$  value obtained is 0.695, which indicates that approximately 69.5% of the variance in the sustainability business model can be explained by the four dimensions of sustainability included in the model. Since the  $R^2$  value exceeds the threshold of 0.1, it suggests that the model has structural validity, as a significant amount of the variance in the dependent variable is accounted for by the independent variables. To assess the significance of the predictors and their contribution to the explained variance of the dependent variable, path coefficients are examined. In this study, a criterion of  $\beta \geq 0.2$  is used to determine the significance of the path coefficients (Becker and Ringle, 2022).

The assessment of discriminant validity for the structural model, which measures the extent of differences among the intersecting variables, is presented in Table 5 using the Heterotrait-Monotrait (HTMT) ratio of correlations. This ratio demonstrates heightened sensitivity and specificity in identifying concerns related to discriminant validity, including the detection of collinearity issues between latent variables (multicollinearity) (Vranjanac et al., 2023). Discriminant validity pertains to the capacity of these latent variables to remain distinct from one another and not overly correlated. An acceptable range of HTMT values lies below 0.85 (Hamid et al., 2017). Consequently, it can be deduced that the model demonstrates acceptable discriminant validity, thereby reinforcing the distinctiveness between the latent variables. Furthermore, no indications of multicollinearity problems are observed within the structural relationships of any of the latent variables.

Based on Fig. 8, it can be observed that the path coefficients for the technological and environmental dimensions are the most significant in relation to the sustainable business model. A significant and positive path coefficient indicates that an increase in the predictor variable leads

to an increase in the dependent variable. The fact that these path coefficients are significant suggests that the technological and environmental dimensions have a substantial impact on the development of a sustainable business model in e-marketplaces according to the perceptions of consumers.

### 5. Discussions

As a significant contribution, this study highlights that the technological dimension holds greater importance for respondents, indicating its crucial role in the development of a sustainable business model in e-marketplaces. Moreover, statistical analysis reveals that both the technological and environmental dimensions exhibit significant influence on the sustainable business model according to the perceptions of consumers. Consequently, e-marketplace business models should prioritize showcasing and effectively communicating the usability, stability, and environmental benefits of participating in digital platforms, while also considering economic and social contributions, as depicted in Fig. 9.

It is important to acknowledge that sustainability is commonly associated primarily with the environmental dimension in e-commerce businesses (Viu-Roig and Alvarez-Palau, 2020). In many studies employing the SEM method to explore the relationship between e-marketplaces and sustainability, the focus has been on identifying factors that influence consumers’ decision-making towards ecological or sustainable purchases. For instance, Muralidharan et al. (Muralidharan et al., 2016) conducted a study among the Millennial population in India and the United States, finding that environmental awareness serves as a mediating variable in facilitating effective ecological purchases. Similar findings were reported by Rahlin and Gualin (Rahlin and Gualin, 2023) in their research conducted in Malaysia, where subjective norms and consumer attitudes, which are associated with the development of environmental consciousness, emerged as key predictors of consumers’ intention to engage in ecological purchases. Additionally, Joshi and Rahman (2017) discovered that consumer awareness of sustainability and environmental concern were significant predictors of sustainable purchasing intentions among consumers in Delhi. Consequently, it is expected that the environmental dimension would exert a stronger influence on the perception of sustainability in an e-marketplace among consumers, compared to the economic and social dimensions.

In addition to the environmental dimension, the technological dimension also holds significant influence on the perception of sustainability in an e-marketplace. This can be attributed to the fact that an e-marketplace is a technology-driven business, where factors such as usability, reliability, accessibility, and stability of the digital platform play a vital role in users’ decision to engage with the services of an e-marketplace, thereby ensuring its long-term sustainability. The research conducted by Dabija et al. (2023) highlights the importance of sustainable performance in collaborative economy platforms in Romania as a key predictor for achieving success in their business model. This finding aligns with the results of the present study, where the technological dimension emerges as the most significant predictor for the development of a sustainable business model. Both studies emphasize the crucial role of technology in ensuring the sustainability and long-term viability of e-marketplace platforms.

The significant results obtained from the SEM model indicate that the observed variables (indicators) representing the latent variables (sustainability dimensions) are reliable. This reinforces the credibility of the descriptive assessments made for these dimensions. The statistical significance of the observed variables provides evidence that the measurements used to assess the sustainability dimensions are valid and can be considered as reliable indicators of the underlying constructs. Consequently, our findings indicate the pivotal role of technology in shaping sustainable business models for e-marketplaces. Ensuring high reliability, seamless service continuity, and optimal platform usability emerge as critical factors to provide a superior customer experience marked by quality service, effortless user interaction with technology,

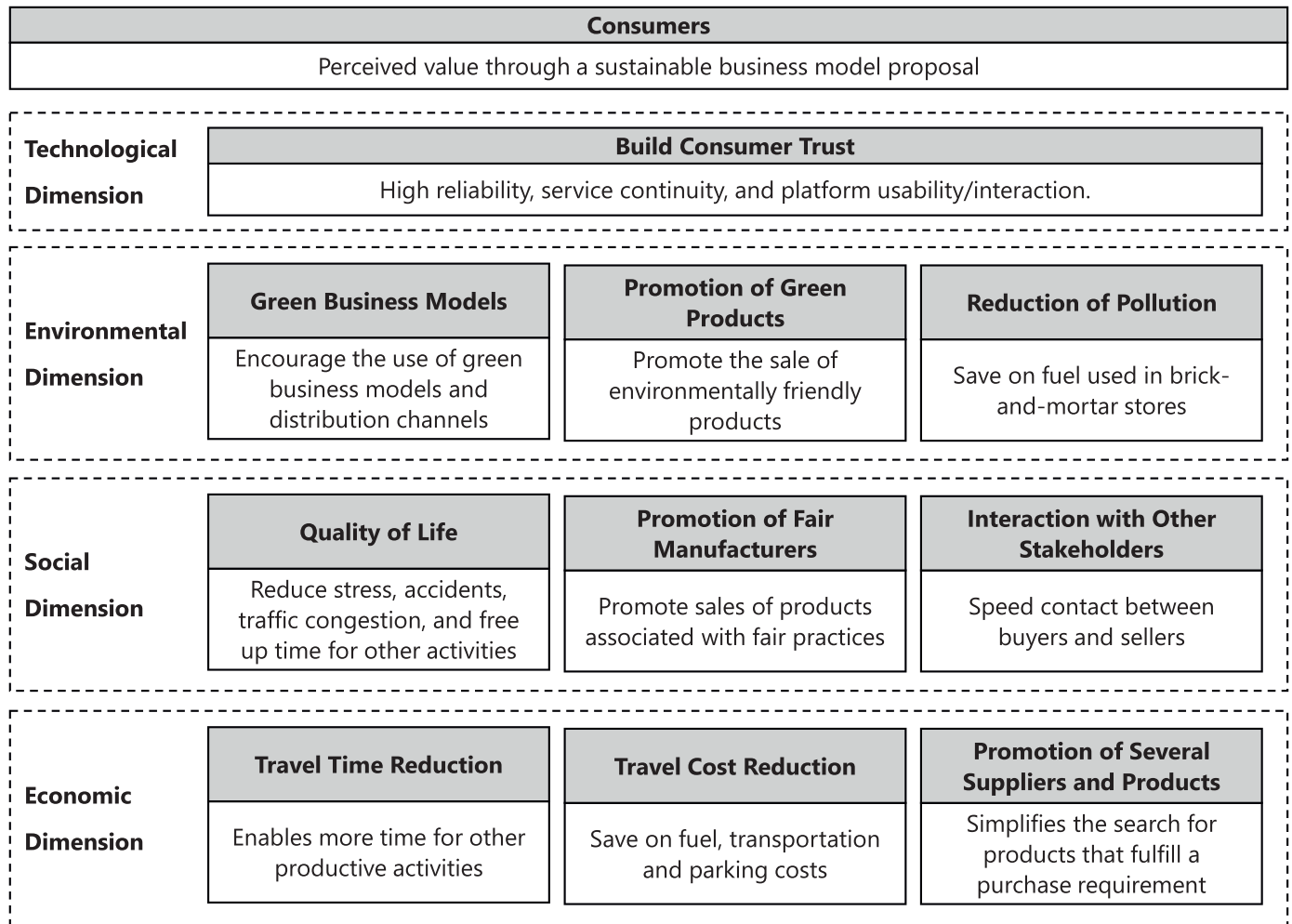
**Table 4**  
Construct reliability and internal consistency of the SEM.

Latent Variables	Cronbach’s alpha	CR ( $\rho_a$ )	CR ( $\rho_c$ )	AVE
Economic Dimension	0.953	0.956	0.962	0.782
Environmental Dimension	0.934	0.935	0.958	0.884
Social Dimension	0.916	0.922	0.941	0.800
Technological Dimension	0.938	0.943	0.950	0.729
Sustainable Business Model	0.832	0.985	0.872	0.630

**Table 5**  
Heterotrait-Monotrait ratio matrix.

	Economic Dimension	Environmental Dimension	Social Dimension	Technological Dimension	Sustainable Business Model
Economic Dimension	-	0.729	0.786	0.356	0.574
Environmental Dimension	0.729	-	0.813	0.366	0.657
Social Dimension	0.786	0.813	-	0.458	0.645
Technological Dimension	0.356	0.366	0.458	-	0.606
Sustainable Business Model	0.574	0.657	0.645	0.606	-

**Sustainable E-Marketplace Business Model / Consumer-Centric Value Proposition**



**Fig. 9.** The sustainable business model for e-marketplaces.

and a foundation of trust. These results align with research conducted in China, where data reliability is held in high regard as a safeguard against fraudulent activities (Lahkani et al., 2020). Similarly, the significance of factors like perceived usefulness, ease of use, and reputation in influencing consumers' intention to engage with e-commerce systems has been demonstrated (Tong and Xiong, 2022). Echoing these trends, a study in Brazil revealed that trust in the intermediary platform not only mitigates perceived risk but also positively impacts purchase intention, further emphasizing the role of technology in cultivating a trustworthy and secure e-marketplace environment (Malak et al., 2021).

Regarding the environmental dimension of sustainable business models, it is imperative for e-marketplaces to effectively communicate their commitment to endorsing environmentally friendly products and curbing pollution by shortening fuel consumption from travel. This can incentivize the adoption of eco-conscious business models and sales channels. A pragmatic approach entails e-marketplaces evaluating the

environmental ramifications of online purchases by utilizing pertinent key performance indicators that encompass consumer behaviors (Mangiaracina et al., 2016). Furthermore, a comparative assessment of carbon emissions stemming from online versus offline purchases can be furnished to encourage consumers to minimize supplementary shopping expeditions and maximize the items per delivery, thereby reducing environmental impacts (Van Loon et al., 2015). In addition, e-marketplaces could enhance ethical consumerism and advance eco-friendly products, aligning with the preferences and values of consumers (Martins et al., 2020; S. Yang et al., 2017).

In terms of economic advantages, the value proposition embedded within the e-marketplace business model should accentuate pivotal aspects such as the reduction of travel expenses and time, alongside the capability to efficiently explore and compare from multiple suppliers for diverse products or services. E-marketplaces should communicate to consumers that purchasing products on these platforms allows them to

spend more time on other productive activities, facilitates the search for multiple products to satisfy a purchase requirement, and saves costs associated with fuel, transportation, and parking. This value proposition can be substantiated by employing models designed to assess cost savings conferred by electronic markets, as demonstrated in the work proposed by Loro and Mangiaracina (2022). By employing such models, e-marketplaces can quantitatively demonstrate the cumulative savings obtained when consumers opt for digital market transactions. Notably, these findings support the conclusions provided by Sfenrianto et al. (2018), who indicated that key factors driving online purchases in Indonesian e-marketplaces include the appeal of lower costs, fast delivery, and product availability.

Concerning the social benefits, this study indicates that a sustainable business model for e-marketplaces should focus on reducing stress on buyers due to traffic congestion, preventing traffic accidents, promoting the sale of products associated with fair practices, and accelerating contact between customers and suppliers. Therefore, it is crucial for the value proposition of e-marketplaces to convey to consumers the benefits of opting for digital market transactions. This encompasses not only improved quality of life and increased personal leisure time but also seamless interaction with sellers and a positive impact on manufacturers that uphold fair and ethical practices. This message can effectively communicate that e-marketplaces not only offer a convenient and time-efficient way to shop but also contribute to broader social and economic welfare. Previous studies support these findings, exposing that making purchases faster and spending less time on unnecessary activities has a strong positive effect on consumers' behavioral intentions (Tong and Xiong, 2022). Furthermore, the enhancement of mobility plans and distribution systems associated with e-commerce platforms and e-marketplaces directly correlates with the enhancement of citizens' overall quality of life (Arnold et al., 2018; Maltese, Gatta et al., 2021). These considerations resonate particularly well in the context of the contemporary fast-paced lifestyle, which highlights the importance of providing diverse leisure opportunities (Barska and Wojciechowska-Solis, 2020; Hawlitschek et al., 2018). Similar studies support our results, indicating that e-marketplaces can promote fair-trade conditions and ethical products (S. Yang et al., 2017), fair remuneration to support local economies (Barska and Wojciechowska-Solis, 2020), and motivate consumers to support national artisans and purchase fair trade handmade products (Martins et al., 2020).

In summary, the findings of this study provide evidence for the reliability and validity of the constructs used. The high values of Cronbach's alpha and composite reliability indicate the internal consistency and reliability of the measures. The satisfactory average variance extracted (AVE) values demonstrate convergent validity, supporting the consistency of the model. The structural model also demonstrates satisfactory structural validity, as the four dimensions of sustainability explain a significant portion of the variance in the sustainability business model. Based on these findings, it is recommended that digital platform managers focus on developing sustainable business models that align with consumers' perceptions and support their needs across multiple dimensions of sustainability. This can be achieved by prioritizing the usability and stability of the digital platform, ensuring a seamless and reliable user experience, reducing pollution and the time and cost of the purchase process, expanding the range of products and suppliers, improving the quality of life for consumers, and supporting fair business practices and green business models.

## 6. Conclusions

This study analyzed the preferences and perceptions of consumers in e-marketplaces to provide insights and guidelines for sustainable business models based on economic, social, environmental, and technological dimensions. A survey conducted in Colombia described e-marketplace platform use, finding that young adults with higher education levels are more aware of and engaged with e-marketplaces. The

main reasons for using e-marketplaces include accessing product information for better prices, saving time, and finding diverse products/services. However, lack of platform knowledge, preference for offline shopping, and distrust of e-commerce discourage non-users. Therefore, it is suggested to include e-commerce content in elementary and higher education curricula to promote the benefits of online shopping and enhance understanding of existing data protection policies and security in financial transactions through e-commerce.

The statistical validation through SEM reinforces the credibility and robustness of the descriptive analysis, confirming that the observed relationships and importance ratings are not merely coincidental but have a solid empirical foundation. Consequently, the study emphasizes the importance of e-marketplace business models and their customer-oriented value proposition in effectively communicating and guaranteeing high levels of usability and stability in the digital platform. Given that e-marketplaces are technology-based businesses, ensuring seamless operations and transactions becomes crucial. Furthermore, it is essential to inform consumers about the benefits of participating in digital platforms, particularly highlighting the environmental dimension, which was found to have the most significant influence on the development of a sustainable business model for e-marketplaces according to the perceptions of the surveyed consumers. However, while the environmental dimension holds greater significance, it is important not to neglect the economic and social dimensions. Although these dimensions may not be perceived as significantly influential towards the sustainable business model by consumers according to the SEM, they should still be ensured to establish a solid foundation for sustainability within the business model.

Likewise, the sustainable business model should effectively demonstrate to consumers how it contributes to reducing pollution and emissions through decreased trips to physical stores and the availability of eco-friendly products within the e-marketplace. Technological features that foster trust and emphasize the intermediary role of digital platforms are crucial. The study's findings also highlight that consumers perceive economic benefits through time and cost savings in e-marketplaces, along with a wider product selection from various suppliers. From a social standpoint, enhanced quality of life and support for ethical business practices are primary benefits seen in e-marketplaces, while promoting environmentally conscious business models aligns with consumers' environmental priorities. Considering these findings, a sustainable e-marketplace business model should define and convey a value proposition that streamlines consumers' ability to discover multiple products, meet purchase needs efficiently, and eventually save on fuel, transportation, and parking expenses. Furthermore, a consumer-centric approach should highlight the support for manufacturers committed to fair practices, offer increased leisure time, and facilitate meaningful interactions between buyers and sellers.

Thus, this value proposition must be evidenced in improved business processes that support e-marketplace platforms and in communication with consumers, where they can perceive the economic, social, and environmental benefits of purchasing on reliable and easy-to-use digital platforms. In this way, the theoretical contribution of this study is the definition of a sustainable business model for e-marketplaces, based on technological, economic, social, and environmental dimensions, as well as their respective indicators. This sustainable business model forms the value proposition to consumers, offering high reliability, usability, and continuity of services on digital platforms, reducing pollution levels, contributing to convenience, and improving quality of life.

Future research in this area could benefit from conducting studies with a broader geographical coverage to examine the outcomes under different e-commerce and e-marketplace dynamics. Additionally, conducting case studies focused on specific digital platforms would provide more precise insights and allow for the design and adaptation of customized sustainable business models. Furthermore, the development of sustainability indices for e-marketplaces is recommended, capturing the perspectives and perceptions of various stakeholders to

systematically evaluate their performance and progress in achieving sustainability goals.

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Not applicable because the paper does not involve research on animals or human subjects under the Bioethics Act, it has not induced or influenced the psychological or social behavior of the respondents.

## CRedit authorship contribution statement

**Jose Alejandro Cano, Abraham Allec Londoño-Pineda:** Conceptualization, Methodology, Software, Investigation, Writing – review & editing, Project administration. **Emiro Antonio Campo, Sergio Augusto Fernández:** Validation, Resources, Funding acquisition. **Jose Alejandro Cano, Abraham Allec Londoño-Pineda, Emiro Antonio Campo:** Formal analysis, Data curation. **Jose Alejandro Cano:** Writing – original draft preparation, Visualization. **Abraham Allec Londoño-Pineda, Emiro Antonio Campo, Sergio Augusto Fernández:** Supervision. All authors have read and agreed to the published version of the manuscript.

## Declaration of Competing Interest

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

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