The Metaverse Marketplace

Exploring the Drivers of Consumer Purchase Behavior in Metaverse

Sivathanu, Brijesh; Struweg, Ilse; Pillai, Rajasshrie; Janssen, M.F.W.H.A.; Rana, Nripendra P.

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Exploring the Drivers of Consumer Purchase Behavior in Metaverse

Brijesh Sivathanu
https://orcid.org/0000-0003-2505-9140
School of Business and Management, Christ University, Bangalore, India

Ilse Struweg
https://orcid.org/0000-0002-1448-5286
Department of Marketing Management, School of Consumer Intelligence and Information Systems, College of Business and Economics, University of Johannesburg, South Africa

Rajasshrie Pillai
https://orcid.org/0000-0001-6160-3911
Chandragupt Institute of Management, Patna, India

Marijn Janssen
https://orcid.org/0000-0001-6211-8790
Delft University of Technology, The Netherlands

Nripendra P. Rana
https://orcid.org/0000-0003-1105-8729
Queen's Business School, Queen's University Belfast, UK & Humanities and Social Sciences Research Center, Deanship of Scientific Research, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia & Jaipuria Institute of Management, Lucknow, India & College of Business and Economics, University of Johannesburg, South Africa

ABSTRACT

This research explores factors influencing consumer intention to shop in Metaverse E-commerce, an area with limited existing research despite its potential for novel consumer experiences. A quantitative study involving 1,070 respondents used PLS-SEM to analyze a model based on technology readiness dimensions and Metaverse-specific variables. Key findings indicate that optimism and innovativeness are positively associated with consumer shopping intention in Metaverse E-commerce. Conversely, discomfort and insecurity show a negative association. Additionally, a sense of immersion, perceived interactivity, perceived personalization, perceived enjoyment, and perceived serendipity were found to significantly influence shopping intention within Metaverse E-commerce. This study enhances the academic literature on Metaverse shopping by integrating technology readiness dimensions and Metaverse-related constructs. The findings also offer practical insights for managers and marketers in developing effective Metaverse E-commerce strategies.

KEYWORDS:

Consumer Buying Behavior, Technology Readiness, Metaverse, E-commerce, Perceived Serendipity, Shopping Intention, Personalization

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INTRODUCTION

The Metaverse, a burgeoning technological concept, has attracted significant interest (Chakraborty et al., 2024). It is an internet-based virtual reality environment that merges the digital and physical realms, allowing users to interact within an immersive digital space (Koohang et al., 2023). Created through the integration of immersive technologies such as virtual and augmented reality, the Metaverse enables users to engage with each other and their environment in highly interactive ways (Ahn et al., 2024; Belk et al., 2022; Dwivedi et al., 2022). The Metaverse market is projected to reach a value of US$103.6 billion in 2025 and grow at a compound annual growth rate (CAGR) of 37.43% between 2025 and 2030, reaching a market volume of US$507 billion. By 2030, the number of Metaverse users is expected to reach 2.6 billion (Statista, 2023).

E-commerce involves buying and selling in the digital world. Metaverse e-commerce is a virtual reality space that integrates immersive technologies with the Internet to provide consumers with an enhanced, interactive shopping experience (Chen et al., 2023; Xi et al., 2024; Zhang et al., 2023). This immersive environment offers brands and retailers a unique opportunity to improve the shopping experience, similar to physical shopping, by combining the accessibility of online shopping with the sensory features of traditional retail stores (Chen et al., 2023; Xi et al., 2024). Many retail brands, including H&M, P&G Beauty, Nike, Gucci, Tommy Hilfiger, and Givenchy, are using the Metaverse (Dataart, 2022). In India, online retailers such as Amazon and Flipkart are also exploring Metaverse e-commerce (Amazon, 2022; Singh, 2022).

The swiftly evolving technological landscape has given rise to advanced innovations, and Metaverse e-commerce has emerged as a new mode of online shopping (Yoo et al., 2023). In Metaverse e-commerce, consumers can browse virtual stores, try on accessories and clothing in real time, and make purchases with just a few clicks (Chen et al., 2023; Xi et al., 2024). It also enables interactive and personalized shopping experiences, allowing users to customize avatars to represent themselves and engage with virtual sales associates or stylists who provide personalized assistance and suggestions (Hanson-Smith, 2023; Saraf, 2023).

As retail in the Metaverse develops, our understanding, interpretation, and portrayal of its effects on consumer behavior must also evolve. Addressing this need is crucial as the Metaverse increasingly becomes a central aspect of consumer lifestyles (Barrera & Shah, 2023; Gao et al., 2023; Klaus & Manthiou, 2024). Understanding consumer purchase behavior is especially important given that the e-commerce dimension of the Metaverse remains in its early growth phase (Barrera & Shah, 2023; Dwivedi et al., 2023). This study addresses the limited understanding of how retailing and consumer behavior function within Metaverse e-commerce. Scholars have emphasized the need to investigate both consumers' motivations for adopting the Metaverse (Agnihotri et al., 2024) and the barriers that inhibit adoption (Du et al., 2023).

Further, adopting innovative technology and unique experiences offers both benefits and drawbacks to users, resulting in mixed feelings and contradictory opinions. While positive emotions can drive individuals toward embracing innovations, negative emotions may prevent them from doing so (Parasuraman, 2000; Park & Zhang, 2022). In the case of the Metaverse, these mixed feelings may influence the adoption of Metaverse e-commerce (Gao et al., 2023). However, the dimensions influencing these emotions have not been explored. The technology readiness (TR) dimensions reflect an individual's psychological stance toward accepting and integrating novel technologies (Parasuraman, 2000). Hence, we use the TR dimension to examine the impact of these feelings on Metaverse shopping (Parasuraman, 2000; Park & Zhang, 2022). Based on the above discussion, we form the following research question: What are the drivers for intentions to shop in the Metaverse e-commerce?

We respond to the research question by integrating TR dimensions (Parasuraman, 2000) and Metaverse-related variables, such as sense of immersion (Daassi & Debbabi, 2021), perceived interactivity (Gu et al., 2023), perceived personalization (Hanson-Smith, 2023), perceived enjoyment

(Chang et al., 2023; Gu et al., 2023), and perceived serendipity (Liu et al., 2023). The results of this study are important for individuals in managerial and retail positions, as well as those developing and designing the Metaverse. Retailer associations and policymakers can also gain insights from this study to guide policies that enhance consumer safety in Metaverse e-commerce. This investigation represents an initial foray into applying the TR dimension to Metaverse e-commerce shopping and expands the limited body of literature on consumer behavior in this context.

The manuscript includes a literature review, the formulation of hypotheses, and an outline of the research methodology, followed by sections on data analysis and findings, theoretical and practical implications, and limitations and potential directions for future research. It concludes with a summary of the main findings.

LITERATURE REVIEW

Metaverse Adoption Studies

Research on Metaverse buying and shopping behavior has examined impulsive buying behavior (Dan Quan et al., 2024) and purchase intention (Payal et al., 2024) using the stimuli–response–organism framework. This framework suggests that environmental cues (stimuli) influence an individual's (organism) mental and emotional reactions, which in turn shape their behavioral intentions (Mehrabian & Russell, 1974). However, in the Metaverse, stimuli are highly dynamic, ranging from interactive elements to social and visual cues, which makes defining and measuring them challenging.

Further, Metaverse purchase intention has been examined through self-expression theory, media richness theory, and behavioral reasoning theory (Ahn et al., 2024; Payal et al., 2024; Pillai et al., 2023; Zhang et al., 2023). Research has also explored the potential of the Metaverse for shopping using uses and gratifications theory (Pillai et al., 2025). In addition, studies have investigated purchase intention related to fashion products (Agnihotri et al., 2024; Park, 203) and luxury products (Jiang et al., 2023), as well as brand experience in the Metaverse (Yu et al., 2024). Furthermore, shopping intention has been studied in relation to augmented reality (Alimamy & Gnoth, 2022; Barta et al., 2023), AR mobile apps (Saleem et al., 2022), AR beauty product purchases (Whang et al., 2021), experiential augmented reality (Watson et al., 2018), virtual reality (Hou et al., 2019), and virtual marketplace shopping (Nayak et al., 2022). Thus, Metaverse e-commerce shopping represents a novel innovation.

As the Metaverse is a novel technology, it is necessary to understand consumer readiness to use it. TR comprehensively provides a comprehensive explanation of consumer preparedness for new technology and reflects both the benefits consumers perceive and their attitudes toward technology (Parasuraman & Colby, 2015; Son & Han, 2011). Therefore, this study considers TR. To our knowledge, no research has examined TR (Parasuraman, 2000; Parasuraman & Colby, 2015) in relation to the Metaverse. Accordingly, we investigate consumers' purchase intention using TR. Previous studies have applied TR in the context of m-commerce (Roy & Moorthi, 2017), unmanned convenience stores (Park & Zhang, 2022), and smart shops (Chang & Chen, 2021).

This study investigates how retailing and consumer behavior function within Metaverse e-commerce. Accordingly, TR and Metaverse-related factors should be considered when exploring consumer adoption. As a novel shopping technology, the Metaverse may also evoke serendipity—when consumers unexpectedly encounter a product, service, or experience they were not actively seeking, which can trigger strong emotional responses (Grange et al., 2019, p. 225). Prior research suggests that serendipity can foster positive emotions toward shopping (Grange et al., 2019). Hence, this study examines its role in adopting new shopping technologies such as the Metaverse.

Technology Readiness

TR refers to consumers' inclination to adopt and use new technologies for personal and professional purposes. This concept suggests that individuals' decisions to embrace new technologies are shaped by

psychological factors that either encourage or discourage adoption (Parasuraman, 2000). TR consists of four dimensions (Parasuraman & Colby, 2015): (a) *optimism*, a positive view of technology and its potential to improve lives; (b) *innovativeness*, an inclination to be a technology pioneer and early adopter; (c) *discomfort*, a sense of being overwhelmed by or lacking control over technology; and (d) *insecurity*, distrust in technology's reliability and concerns about privacy.

Individuals with high TR tend to accept and perceive new technologies positively, whereas those with lower TR often display skepticism and anxiety toward technology. These differing levels of readiness shape consumer behavior, influencing their interactions with and perceptions of e-commerce and online services (Chang & Chen, 2021; Kim & Han, 2023; Park & Zhang, 2022; Thomas-Francois & Somogyi, 2022). Perspectives on technology vary—some view it positively, while others are more critical—and these attitudes can coexist. Studies on technology acceptance confirm the influence of TR on consumer adoption behavior (Fu et al., 2024; Kim & Chiu, 2019; Roy & Moorthi, 2017; Tavera-Mesías et al., 2023).

The TRI 2.0 scale is versatile, applicable across different constructs and nations for research purposes (Parasuraman, 2000), and its effectiveness has been validated in multicultural contexts (Parasuraman & Colby, 2015). However, TR is dynamic and develops with experience and familiarity over time. External factors, such as others' experiences, broader societal shifts, and marketing initiatives, also play a role. Exploring consumers' TR can therefore help organizations implement novel technologies more effectively.

TR has been applied to studies of advanced shopping technologies, including unmanned stores, m-commerce, online shopping, smart shops, and self-checkout grocery stores (Chang & Chen, 2021; Mukerjee et al., 2019; Mummalaneni et al., 2016; Park & Zhang, 2022; Roy & Moorthi, 2017).

Metaverse-Related Variables

Perceived Interactivity

Interactivity allows consumers to participate in modifying content and information and to engage within a real-time environment (Ballantine, 2005). Research on shopping technologies has shown an association between interactivity and shopping intention (Pillai et al., 2020). The Metaverse is an interactive platform that enables consumers to communicate with friends and create personalized avatars (Wintergarden, 2023). Therefore, interactivity is considered in this study.

Sense of Immersion

The sense of immersion can be considered from two perspectives: technology-related and user-related, reflecting the degree to which consumers feel engaged in the experience (Daassi & Debbabi, 2021). Immersive experiences are a key feature of the Metaverse and may influence consumers' shopping behavior (Saraf, 2023). Therefore, this study examines the sense of immersion.

Perceived Personalization

In today's digitally driven shopping environment, consumers expect personalization, which provides tailored information based on individual needs. Personalization has been shown to influence consumers' shopping behavior (Hanson-Smith, 2023). A Metaverse shopping platform can offer personalized products, content, and information to customers, potentially affecting purchase intention (Riegger et al., 2022). Therefore, this study examines the impact of personalization on consumers' shopping intentions.

Perceived Enjoyment

Consumers engage with shopping technology to seek enjoyment and pleasure (Yeo et al., 2017). Research has shown that perceived enjoyment positively influences shopping behavior (Pillai et

al., 2020). The Metaverse offers attractive shopping features and an immersive environment where consumers can enjoy the experience. Therefore, perceived enjoyment is included in this study.

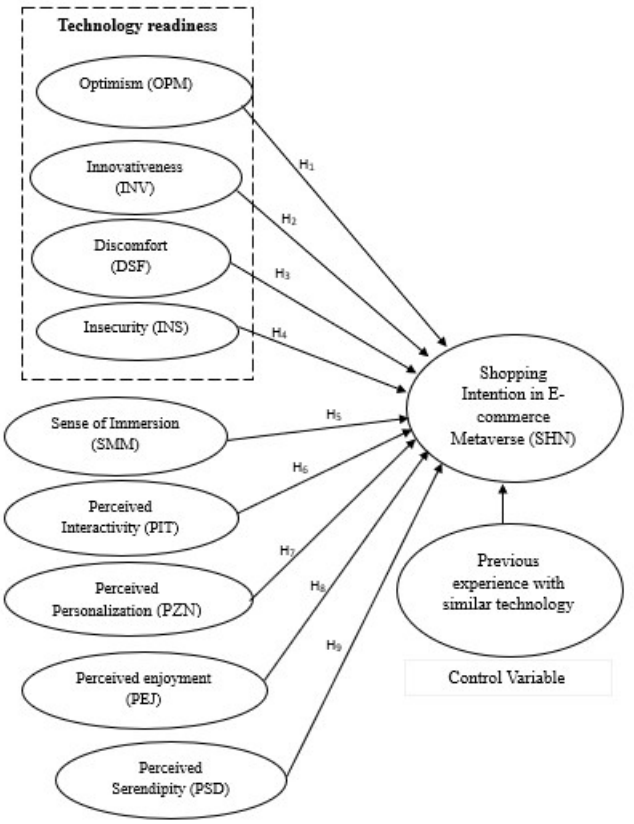
Perceived Serendipity

Serendipity refers to discovering valuable or interesting things that were actively sought (Parker, 2008). In marketplaces, the experience of serendipity has been linked to consumer purchase behavior (Kim et al., 2021). The Metaverse e-commerce environment offers shopping experiences beyond the traditional search-and-find pattern, allowing consumers to encounter new brands, products, and avatars unexpectedly.

PROPOSED MODEL DEVELOPMENT

This study uses the four dimensions of TR (Parasuraman & Colby, 2015) to examine purchase intention in Metaverse e-commerce. As the Metaverse e-commerce platform is novel to consumers, understanding their TR is essential. In addition, we include variables related to Metaverse technology, such as sense of immersion (Daassi & Debbabi, 2021), perceived interactivity (Ahn et al., 2024), perceived personalization (Riegger et al., 2022), perceived enjoyment (Venkatesh, 2000), and perceived serendipity (Liu et al., 2023). Prior experience with similar technologies may also influence shopping intention; therefore, experience is included as a control variable (see Figure 1).

Figure 1. Proposed Research Model



HYPOTHESES FORMULATION

Optimism in the context of technology adoption refers to consumers' positive outlook toward new technologies, believing that these innovations can improve their lives by providing greater flexibility, better control over their environment, and increased efficiency in completing tasks. Optimistic users are more likely to embrace and adapt to new technologies because they anticipate the potential benefits these technologies offer, which can support their intention to use them (Tavera-Mesías et al., 2023).

Optimism has been associated with the adoption of novel shopping technologies (Pillai et al., 2020) and influences consumer buying behavior in contexts such as unmanned retail stores (Park & Zhang, 2022) and online shopping (Kim & Han, 2023). In the Metaverse, shoppers can try on clothes, accessories, or makeup virtually using digital avatars, reducing the uncertainty often associated with online shopping (Hanson-Smith, 2023). Customers can also view and interact with products in three-dimensional space, gaining a better sense of the item's look, feel, and scale (Bruni et al., 2023). Therefore, the following hypothesis is proposed:

H1: Optimism is positively associated with shopping intention in Metaverse e-commerce.

Innovativeness reflects the tendency to pioneer the adoption of new technologies and to act as an influential advocate for their acceptance (Chang & Chen, 2021). Consumers with innovative mindsets are more likely to experiment with and adopt novel technologies (Park & Zhang, 2022). Studies show a positive association between innovativeness and the acceptance of new technologies (Blut & Wang, 2020), as well as adoption and purchase intention in contexts such as unmanned retail stores (Park & Zhang, 2022), AR applications (Plotkina et al., 2022), and 3D-printed fashion products (Lyu et al., 2023). Shopping in the Metaverse through 3D or VR technology can also provide an experience that rivals or even surpasses traditional retail by allowing customers to engage with products in a more immersive way (Koohang et al., 2023). Accordingly, innovative consumers are expected to try shopping in the Metaverse before it becomes mainstream, helping to establish early use cases and validation for others. Therefore, the following hypothesis is proposed:

H2: Innovativeness has a positive association with shopping intention in Metaverse e-commerce.

Technology-related discomfort encompasses feelings of anxiety and unease, which can significantly affect consumers' willingness to engage with technological advancements (Parasuraman, 2000). "Discomfort reflects a feeling of being overwhelmed by technology and not having control over it" (El Barachi et al., 2022, p. 2). Although discomfort often has a negative influence on consumer intentions, this is not always the case (Martens et al., 2017). Prior research shows that discomfort negatively affects shopping behavior in artificial intelligence (AI)–based retail stores (Pillai et al., 2020), online shopping (Wang et al., 2023), and smart shops (Chang & Chen, 2021). In the Metaverse, the complexity of navigating virtual environments or the less tangible nature of the shopping experience compared with physical stores may lead to discomfort.

Additionally, consumers may feel anxious about the quality of virtual try-ons, the accuracy of product representations, or the use of avatars in place of human customer service, which differs from the personal interactions they are accustomed to (Germain, 2022). Such apprehensions may negatively influence shopping intentions. Therefore, the following hypothesis is proposed:

H3: Discomfort is negatively associated with shopping intention in Metaverse e-commerce.

Engagement with technology and feelings of insecurity are often linked to disbelief and skepticism (El Barachi et al., 2022). Insecurity typically arises when individuals feel anxious about using new

technology due to a lack of confidence in its reliability, safety, or effectiveness (Kuo et al., 2013). This insecurity can hinder the acceptance of novel technologies (Parasuraman & Colby, 2001). Its negative influence has been documented in consumer shopping behavior related to smart shops (Chang & Chen, 2021), online apparel shopping (Myin & Watchravesringkan, 2024), and AI-based retail stores (Pillai et al., 2020).

Consumers experiencing insecurity with technology may be reluctant to rely on technological solutions, fearing that they could fail at critical moments (Parasuraman & Colby, 2001). In the Metaverse, insecurity is likely tied to concerns about the complexity and unfamiliarity of the environment, as well as issues of data security, privacy, and transaction safety. Shoppers may feel uncertain about the accuracy of product representations, the reliability of virtual transactions, and the protection against cyber threats in such a digital space (Kumar et al., 2023). Therefore, the following hypothesis is proposed:

H4: Insecurity is negatively associated with shopping intention in Metaverse e-commerce.

A sense of immersion refers to the mental absorption and deep involvement with a software interface, to the point where the user's awareness of the physical environment is diminished (Sekhavat & Zarei, 2018). One of the distinguishing features of the Metaverse is its ability to provide a virtual environment that mirrors aspects of the physical world, offering a realistic and immersive experience. In Metaverse e-commerce, customers can create avatars to represent themselves in a realistic 3D environment and use these avatars to try products in ways that simulate real-life experiences (Darbinyan, 2022).

Metaverse technology allows customers to examine products from multiple angles, navigate 3D stores, and interact with items in ways that closely resemble real-world shopping (Chen et al., 2023; Daassi & Debbabi, 2021; Dincelli & Yayla, 2022; Mogaji et al., 2023; Zhang et al., 2023). This immersive environment can heighten consumer engagement, providing a detailed and interactive shopping experience that may encourage and enhance shopping activities (Pillai et al., 2023). Therefore, the following hypothesis is proposed:

H5: A sense of immersion is positively associated with shopping intention in Metaverse e-commerce.

Interactivity refers to the extent of control consumers have over the flow of communication during Metaverse use (Ahn et al., 2024; Li et al., 2023). The interactivity of new technology plays an important role in consumer technology acceptance (Pantano et al., 2017) and also affects purchase behavior in the Metaverse (Ahn et al., 2024). In this study, interactivity is considered as consumers' ability to control their shopping activities, such as navigating, interacting with others, creating avatars, and viewing products of their choice. This interactivity in the Metaverse may influence consumer shopping behavior (Kim, 2021). Therefore, the following hypothesis is proposed:

H6: Perceived interactivity is positively associated with shopping intention in Metaverse e-commerce.

Personalization seeks to deliver content that captures consumers' interest and is a key tactic in marketers' strategic approach. It involves recognizing individual consumers by providing customized content tailored to their unique preferences and needs (Ho et al., 2011; Tam & Ho, 2006). Perceived personalization has a significant influence on consumers' shopping intention (Pillai et al., 2020), and research on augmented reality supports this effect (Smink et al., 2020). However, some studies suggest that personalization may also lead to resistance to purchasing behavior (Cai & Mardani, 2023). In the Metaverse, personalization can range from avatars and environments to targeted advertising and product offerings, creating a more engaging and relevant experience for each user. Such

personalization can deepen user engagement and loyalty, making the experience more resonant and memorable. Therefore, the following hypothesis is proposed:

H7: Perceived personalization is positively associated with shopping intention in Metaverse e-commerce.

Perceived enjoyment refers to the extent to which consumers find using systems enjoyable, independent of anticipated performance outcomes (Davis et al., 1992; Prashar et al., 2019). Research shows that perceived enjoyment influences consumers' purchase behavior (Aruldoss et al., 2023; Jebarajakirthy et al., 2021; Yuan et al., 2018), a finding confirmed in the context of AR mobile applications (McLean & Wilson, 2019) as well as AR and VR shopping technologies (Ruusunen et al., 2023; Xi et al., 2024). In the Metaverse, shopping offers enjoyment derived from the interactive and immersive features of the virtual environment (Ahn et al., 2024; Jackson et al., 2014). Consumers can experience pleasure from exploring 3D virtual stores, trying on products virtually, and socializing with avatars, independent of the practical outcomes of making purchases (Xi et al., 2024). Therefore, the following hypothesis is proposed:

H8: Perceived enjoyment is positively associated with shopping intention in Metaverse e-commerce.

Marketplace serendipity occurs when consumers unexpectedly discover a product, service, or experience they did not intentionally seek, leading to a unique set of emotional reactions (Kim et al., 2021). In online shopping, serendipity is defined as the "finding of unexpected but valuable product-related information" (Grange et al., 2019, p. 225). This feeling is considered positive among consumers and has been shown to influence online buying behavior (Anguera de Sojo et al., 2013; Matt et al., 2014). Serendipitous information can sometimes be especially valuable, creating an "Aha" moment during online shopping (Grange et al., 2019; Makri et al., 2014). The Metaverse may also facilitate serendipitous product discoveries or experiences in virtual shopping, which can enhance consumer happiness and engagement in online retail environments. In addition, the social features of the Metaverse allow users to interact with others who may recommend or showcase items the shopper had not planned to search for, further enabling serendipitous encounters that may influence consumer shopping behavior. Therefore, the following hypothesis is proposed:

H9: Perceived serendipity is positively associated with shopping intention in Metaverse e-commerce.

RESEARCH METHODOLOGY

Design of Research Survey Instrument

The constructs were developed using the TR variables of the present study (optimism, innovativeness, discomfort, and insecurity). The remaining study variables were adapted from prior research and modified as shown (with references) in Appendix I. The university's ethics committee approved the questionnaire and the sampling approach.

It is important to determine whether any additional effects exist beyond the hypothesized relationships in the model. To control for variations among respondents due to prior experience with comparable shopping technologies (Ulfert et al., 2022), a control variable was included. We added two questions at the end of the questionnaire:

1. Do you know of any comparable shopping technologies?

2. Have you previously used a similar technology for shopping?

We contacted five subject matter experts from retail management associations and the retailing industry who hold top management positions and are responsible for strategic management and technology implementation. These experts were asked to provide opinions and suggestions on the survey instrument. Based on their feedback, we modified the questionnaire to ensure face validity. The questionnaire was then operationalized using a 5-point Likert scale, and a pre-test was conducted with 80 consumers. The results showed that Cronbach's alpha values were satisfactory.

Sampling and Data Collection

Data were collected through an in-person (offline) survey conducted over ten months in markets, shopping malls, and airports across metro cities in India. These locations were randomly selected to approach respondents. To ensure a representative sample, a systematic random sampling method was used, whereby every tenth customer exiting the markets, shopping malls, and airports was invited to participate in the survey.

A qualifying question filtered respondents, following extant research (Shukla, 2010). Participants were asked to list the e-commerce websites and mobile apps they used for online shopping, ensuring that only those with prior online shopping experience were included in the final dataset. To clarify the concept of Metaverse e-commerce shopping, respondents were shown a Metaverse e-commerce shopping video. Using Metaverse-enabled VR headsets, they were then provided with a shopping experience, and pilot data were collected. Based on the findings of the pilot test, the final data were collected using systematic random sampling. In the final survey, 1,750 respondents were approached, and 1,420 questionnaires were completed. Of these, 1,070 were found suitable for data analysis, yielding a response rate of 61.14% (see Table 1 for respondent details).

Table 1. Details of Respondents (*N* = 1,070)

Demographic	Characteristics	Numbers	Percentage (%)
Gender	Male	578	54
	Female	492	46
Level of education	Undergraduate	235	22
	Graduate	364	34
	Postgraduate and above	471	44
Age	18–24 years	225	21
	25–34 years	439	41
	35–44 years	278	26
	45 and above	128	12
Income per month in Indian rupees	Less than 50,000	193	18
	50,000–99,999	278	26
	100,000–149,999	310	29
	150,000 and above	289	27

Validity and Reliability

The *t*-test yielded a *p*-value of 0.41, indicating that non-response bias was not present (Armstrong & Overton, 1977; Tsou & Hsu, 2015) between the early group (701 respondents) and the later group (369

respondents) within the total of 1,070 questionnaires used for analysis. Common method bias was not a significant concern in this dataset, as Harman's single-factor test showed that a single factor accounted for only 27.13% of the variance (Wang et al., 2018). Liang et al. (2007) recommended using the variance inflation factor for assessing common method bias in partial least squares structural equation modeling (PLS-SEM). In our dataset, all variance of inflation values were below the threshold of 5 (see Appendix I), confirming that multicollinearity and common method bias are not issues (Kock, 2017). Additionally, a marker variable—insomnia (ISA)—was employed, as it bears no conceptual relevance to the model's constructs (Chin et al., 2012; Rönkkö & Ylitalo, 2011; Shiau & Chau, 2016). Analysis of this marker variable further supports that common method bias does not affect the data.

DATA ANALYSIS AND RESULTS

Measurement Model, Reliability, and Validity

PLS-SEM is particularly suited for estimating models with complex relationships, even with small sample sizes (Hair et al., 2019; Khan et al., 2019; Shiau et al., 2019). It provides a flexible approach because it does not rely on the normal distribution assumptions required by maximum likelihood methods used in testing models with covariance-based structural equation modeling (Hair et al., 2019; Khan et al., 2019; Shiau et al., 2019). Moreover, PLS-SEM has been widely applied to study consumer shopping behaviors (Dogra et al., 2023; Jebarajakirthy et al., 2021; Pillai et al., 2023; Xi et al., 2024) and technology adoption (Mohiuddin et al., 2023), making it an appropriate method for this research.

The conceptual model and hypotheses were assessed using PLS-SEM (Hair et al., 2019). The results indicated strong internal consistency among the variables, with Cronbach's alpha exceeding 0.70, demonstrating reliability (Nunnally, 1978). Additionally, all constructs showed composite reliability values above 0.60, further confirming internal consistency and reliability. Convergent validity was also established, with average variance extracted (AVE) values exceeding 0.50 (Hair et al., 2019).

Table 2 presents the intercorrelations between determinants and compares the off-diagonal AVE values. Discriminant validity is established, as the corresponding AVE values are greater than the squared correlations (Fornell & Larcker, 1981). Further, Table 3 depicts the heterotrait–monotrait ratio of correlation values below 0.85, which ensures the discriminant validity (Henseler et al., 2014).

Table 2. Fornell–Larcker Discriminant Validity

Constructs	OPM	INV	DSF	INS	SMM	PTT	PZN	PEJ	PSD	SHN
OPM	**0.828**									
INV	0.598	**0.836**								
DSF	0.682	0.701	**0.859**							
INS	0.673	0.612	0.550	**0.853**						
SMM	0.548	0.602	0.561	0.604	**0.858**					
PTT	0.491	0.474	0.598	0.535	0.397	**0.859**				
PZN	0.438	0.602	0.491	0.475	0.488	0.546	**0.870**			
PEJ	0.574	0.368	0.566	0.468	0.392	0.401	0.496	**0.873**		
PSD	0.431	0.401	0.393	0.485	0.446	0.397	0.335	0.461	**0.847**	
SHN	0.481	0.496	0.564	0.458	0.391	0.487	0.451	0.312	0.381	**0.874**

Note. OPM = X; INV = X; DSF = X; INS = X; SMM = X; PTT = X; PZN = X; PEJ = X; PSD = X; SHN = X.

Table 3. Heterotrait–Monotrait Ratio of Correlations

Constructs	OPM	INV	DSF	INS	SMM	PTT	PZN	PEJ	PSD	SHN
OPM										
INV	0.459									
DSF	0.351	0.529								
INS	0.488	0.403	0.671							
SMM	0.431	0.394	0.366	0.541						
PTT	0.542	0.491	0.467	0.501	0.593					
PZN	0.541	0.401	0.539	0.491	0.461	0.614				
PEJ	0.398	0.378	0.510	0.469	0.513	0.503	0.632			
PSD	0.521	0.416	0.366	0.491	0.304	0.326	0.431	0.582		
SHN	0.535	0.465	0.379	0.391	0.335	0.452	0.341	0.367	0.431	

Note. OPM = X; INV = X; DSF = X; INS = X; SMM = X; PTT = X; PZN = X; PEJ = X; PSD = X; SHN = X.

Structural Model

After validating the measurement model for reliability and validity, we conducted a path analysis using the structural model (see Figure 2).

Figure 2. Validated Research Model

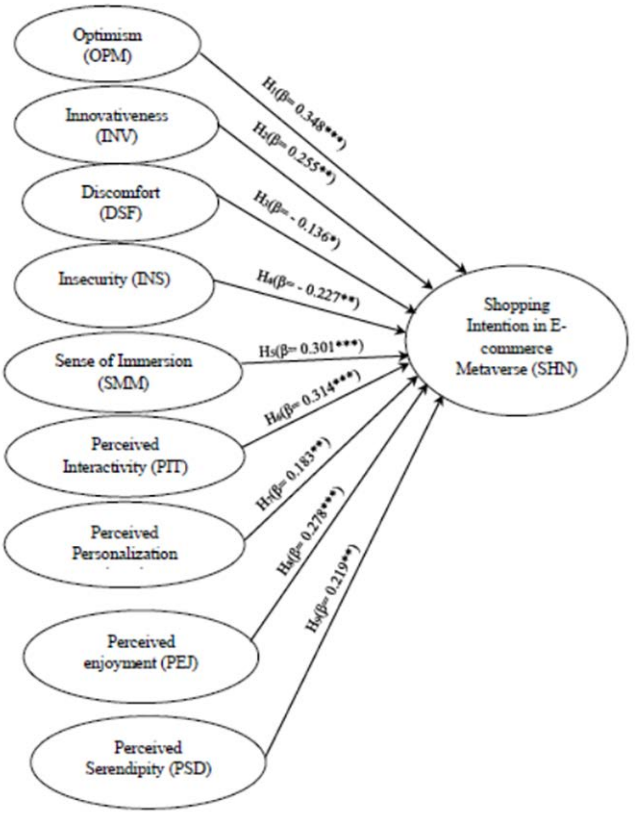


Table 4. Path Coefficients

Hypothesis	Path	Path coefficient	*t*-statistic
H_1	OPM→ SHN	0.348***	6.831
H_2	INV→ SHN	0.255**	3.268
H_3	DSF→ SHN	−0.136*	1.782
H_4	INS → SHN	−0.227**	2.491
H_5	SMM→ SHN	0.301***	5.812
H_6	PIT→SHN	0.314***	6.041
H_7	PZN → SHN	0.183**	2.281
H_8	PEJ →SHN	0.278***	4.519
H_9	PSD → SHN	0.219**	2.396

Note. OPM = X; INV = X; DSF = X; INS = X; SMM = X; PTT = X; PZN = X; PEJ = X; PSD = X; SHN = X.

Analysis of Structural Model

As shown in Figure 2 and Table 4, optimism ($\beta = 0.348$, $p = 0.001$) and innovativeness ($\beta = 0.255$, $p = 0.01$) positively influence shopping intention in Metaverse e-commerce (SHN),

confirming H1 and H2. Discomfort ($\beta = -0.136$, $p < 0.05$) and insecurity ($\beta = -0.227$, $p < 0.01$) negatively affect SHN, confirming H3 and H4. The sense of immersion ($\beta = 0.301$, $p < 0.001$), perceived interactivity ($\beta = 0.314$, $p < 0.001$), personalization ($\beta = 0.183$, $p < 0.01$), perceived enjoyment ($\beta = 0.278$, $p < 0.001$), and perceived serendipity ($\beta = 0.219$, $p < 0.01$) has a positive association with SHN, supporting H5–H9.

Additionally, there was no significant difference in shopping intention between participants with prior experience with similar technology and those without. Consequently, the control variable—previous experience with similar technology—was not included in hypothesis testing. The Metaverse represents a distinctive and immersive digital environment that differs substantially from prior technologies. Its unique features and experiences can render previous experience less relevant.

DISCUSSION

This work identifies factors affecting Metaverse shopping intention using TR. Optimism (H1) positively influences the intention to shop in the Metaverse, supporting prior research on m-commerce adoption (Roy & Moorthi, 2017). Consumers with optimism toward technology tend to perceive Metaverse shopping as more effective and faster (Ramaseshan et al., 2015) and can examine products thoroughly in a 3D environment before purchasing.

Innovativeness (H2) also positively affects shopping intention. Consumers high in innovativeness are drawn to novel technologies and enjoy experimenting with them, aligning with research on AI-based shopping technology (Pillai et al., 2020). Such consumers may explore Metaverse shopping out of curiosity and fascination. They often seek information about emerging technologies, which can lead to a deeper understanding and quicker adoption of platforms like the Metaverse. Additionally, innovative users often share their experiences with others, further promoting adoption.

In contrast, discomfort (H3) and insecurity (H4) inhibit shopping intention (Chang & Chen, 2021; Mukerjee et al., 2019; Mummalaneni et al., 2016), which contradicts some research on virtual grocery shopping (Thomas-Francois & Somogyi, 2022). In Metaverse e-commerce, consumers may perceive the environment as complex or difficult to understand due to discomfort with new technology. Navigating virtual environments and using avatars can be challenging. Consumers may feel insecure because there is no human or physical interaction. They may experience anxiety over data privacy, skepticism about transaction security, and mistrust due to potential technical issues.

Further, a sense of immersion (H5) contributes to shopping intention in the Metaverse, supporting previous studies (Daassi & Debbabi, 2021; Pillai et al., 2023). While shopping in the Metaverse, consumers may feel fully present in the virtual environment, experiencing a level of immersion that can make them momentarily forget the real world (Dominguez, 2023; Mogaji et al., 2023). The immersive experience is enhanced through 3D and virtual reality technologies, which allow consumers to interact with products in ways that closely mimic physical reality (Chen et al., 2022). The results also show that perceived interactivity (H6) positively influences shopping intention in the Metaverse, in line with research on online and advanced shopping technologies (Ahn et al., 2024; Pillai et al., 2020). Using 3D technology, consumers can view products from multiple angles, compare options, and interact with friends online for feedback, with these interactive features encouraging purchases in the Metaverse.

Personalization (H7) was found to be an important predictor of Metaverse shopping intention, supporting findings from studies on augmented reality (Alimamy & Gnoth, 2022) and contrasting with research on smart shopping technology (Riegger et al., 2022). In the Metaverse, consumers can create customized avatars and receive personalized shopping deals and product suggestions based on their searches and past purchases, allowing them to shop according to their preferences. The results also indicate that perceived enjoyment (H8) is an antecedent of shopping intention (Aruldoss et al., 2023; Xi et al., 2024). The Metaverse offers a novel and immersive shopping experience, making the process enjoyable. The use of three-dimensional virtual spaces enables

consumers to explore and interact with products in ways that traditional online shopping cannot. Avatars and virtual reality technology make shopping feel like a game or event rather than a chore, which can enhance enjoyment and increase the likelihood of shopping in the Metaverse.

Lastly, the results show that perceived serendipity (H9) also positively influences shopping intention (Kim et al., 2021), diverging from some prior research on consumer purchase behavior (Liang et al., 2022). Serendipity in the Metaverse offers a promising avenue for shopping. The platform can recreate the experience of unexpectedly discovering items or stores, similar to wandering through a physical retail space. Such discoveries add an element of surprise and delight, making the shopping experience more memorable. The Metaverse can expose consumers to new products, virtual stores, and brands they might not have sought intentionally, thereby enhancing excitement and fostering shopping intention.

Theoretical Implications

This is the first study to apply the TR dimension in the context of Metaverse shopping, showing that innovation and optimism have a positive association, whereas discomfort and insecurity have a negative one. Because people's interactions with new technologies vary depending on their traits and characteristics, this research identifies TR as a personality-like characteristic that reflects positive or negative inclinations toward adopting new technologies. Individuals with high TR are more open and enthusiastic about technological innovations, while those with low TR are more reluctant and doubtful about using new technologies (Chang & Chen, 2021). The theoretical contribution of this work lies in extending the discussion of how TR influences consumer behavior, particularly in the Metaverse. While earlier studies have mainly examined adoption factors, this study is the first to investigate why consumers may not adopt the Metaverse. It also introduces consumer psychological preparedness as a key element in understanding Metaverse adoption, combining TR with Metaverse-specific constructs.

This study responds to the academic call for research into Metaverse shopping (Dwivedi et al., 2022; Gao et al., 2023; Hadi et al., 2023; Klaus & Manthiou, 2024) by examining factors such as sense of immersion, perceived interactivity, perceived personalization, perceived enjoyment, and perceived serendipity that influence shopping intention in the Metaverse. Prior literature has discussed immersion as a reason for shopping (Pillai et al., 2023) and its effect on attitude (Daassi & Debbabi, 2021). This study extends that discussion by showing its impact on purchase intention (Dwivedi et al., 2022). It also makes a unique contribution to research on serendipity by revealing its influence in the context of Metaverse shopping (Kim et al., 2021). In addition, by examining perceived enjoyment and serendipity, the study deepens our comprehension of consumers' hedonic responses, addressing calls for exploratory research (Klaus & Manthiou, 2024). The findings further shed light on personalization in the Metaverse and its effect on shopping behavior. Although prior studies note that personalization can sometimes create apprehension (Riegger et al., 2022), this research highlights its positive role in shaping shopping intention in the Metaverse. Taken together, the study enriches the limited literature on Metaverse shopping behavior.

Practical Implications

This study explores the drivers of Metaverse shopping intention through the lens of TR. The findings show that optimism, innovativeness, immersion, interactivity, personalization, enjoyment, and serendipity positively influence purchase intention in the Metaverse, while discomfort and insecurity have a negative effect.

The findings of this study are relevant to those involved in managing, retailing, developing, and designing Metaverse experiences. Consumers' innovativeness and optimism influence their shopping intentions. Marketers can leverage this by offering engaging shopping experiences and hosting live virtual events such as fashion shows, product launches, and interactive workshops to attract innovative customers and generate excitement around new products. As these consumers are often early adopters of Metaverse shopping, marketers can encourage them to recommend it to friends by providing referral

incentives. Metaverse e-commerce companies can also appeal to these consumers by highlighting innovative features such as avatars and by gamifying the shopping experience.

Discomfort and insecurity were found to negatively influence consumers' shopping intentions. To overcome these inhibitors, managers must simplify user interfaces, strengthen security measures, provide adequate customer support, and ensure transparency in data handling on Metaverse shopping platforms. Developing strong cybersecurity and privacy protections can further enhance consumer comfort and trust. In addition, offering a seamless, real-time shopping experience can ease adoption. Developers and retailers should address these concerns by ensuring intuitive navigation, realistic product representations, robust data security, and reliable customer support to smooth the transition into Metaverse-based commerce.

The findings also reveal that personalization influences consumers' shopping intentions. Designers and developers can enhance personalization by linking Metaverse shopping platforms with social media and other online profiles to gain a comprehensive view of consumer preferences. They can also leverage insights from community interactions, forums, and trends within the Metaverse to predict and tailor product offerings to community interests. In addition, AI-driven personal shopping assistants can recommend products based on customer preferences, past behavior, and current trends. Highly detailed avatars that closely resemble users' physical appearance can provide realistic virtual try-on experiences, while interactive features allow customers to personalize outfits and receive real-time feedback. Furthermore, algorithms can generate realistic avatar features, skin textures, and body proportions, which users can customize to match their individual preferences.

This study also shows that a sense of immersion positively influences shopping intention. Designers and developers can enhance immersion by providing high-quality visuals and employing devices that deliver tactile feedback to simulate the touch and feel of materials and products, thereby enriching the sensory shopping experience. In addition, 3D spatial audio can be adapted to users' locations and actions within the virtual space, mirroring real-world sound dynamics. Beyond visual and auditory feedback, designers may also explore ways to engage other senses indirectly, such as offering scent descriptions or enabling food and beverage samples to be requested for real-world delivery.

As shown in the results, interactivity influences consumers' shopping intentions. Marketers can ensure that all virtual objects are interactive—able to be picked up, moved, and manipulated—to replicate the tactile experience of shopping. They can also design engaging narratives or gamified shopping experiences that encourage users to explore different aspects of the virtual store. In addition, marketers and designers can incorporate dynamic interaction programs with non-player characters, such as virtual sales assistants or other shoppers, to replicate the social aspect of shopping. Hosting live events, fashion shows, and social gatherings within the Metaverse can further create a sense of community and shared experience.

The results show that perceived enjoyment and serendipity positively influence shopping intention. Marketers can ensure an enjoyable and serendipitous experience in the Metaverse by using algorithms to occasionally insert unexpected, personalized recommendations or pop-up events during a user's shopping journey. They can also offer mystery boxes or surprise items for purchase and create systems of random rewards or discounts that users can earn by exploring different areas or engaging in various activities within the Metaverse. Additionally, retailer associations can develop policies to safeguard individual data, prevent payment-related fraud, and address unethical data hacking.

Limitations and Future Research Directions

Although this study offers significant insights, it also has certain limitations. Including multiple countries in future research could shed light on cultural influences on consumers' shopping behavior and allow for comparative cross-cultural analyses. This study considered TR and variables such as sense of immersion, perceived interactivity, personalization, enjoyment, and serendipity. Future research could examine actual usage of Metaverse e-commerce, as well as loyalty and satisfaction. The darker side of the Metaverse could also be studied in the context of e-commerce and its impact on

consumers' shopping behavior. In addition, adoption behavior and the challenges retailers face with Metaverse platforms warrant further exploration. As this immersive technology places consumers in a different world, experimental studies could be conducted to investigate its effects across various demographics and cultures. Comparative studies could also examine differences between traditional marketplace shopping, traditional e-commerce, and Metaverse shopping.

CONCLUSION

This study aimed to examine the dimensions influencing consumers to shop in Metaverse e-commerce, a novel shopping technology recently introduced in developing countries. It considered the concept of TR and Metaverse-related variables, including sense of immersion, perceived interactivity, perceived personalization, perceived enjoyment, and perceived serendipity. The proposed research model was evaluated using the PLS-SEM approach, which effectively explained the behavioral intention to shop. The findings revealed that innovation and optimism positively influence shopping intention, whereas insecurity and discomfort have a negative effect. In addition, sense of immersion, perceived interactivity, perceived personalization, perceived enjoyment, and perceived serendipity were found to have positive associations with shopping intention.

CONFLICTS OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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CORRESPONDING AUTHOR

Correspondence should be addressed to Ilse Struweg; istruweg@uj.ac.za

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APPENDIX

Table 5. Operationalization of Constructs

Construct	Items	Item loading	α	CR	AVE	Adapted from
Technology Readiness						
Optimism (OPM) VIF: 1.327	New shopping technologies such as Metaverse e-commerce are convenient for shopping.	0.822	0.835	0.873	0.687	(Parasuraman, 2000; Parasuraman & Colby, 2015; Rojas-Mendez et al., 2017)
	Metaverse e-commerce helps people maintain a good quality of life.	0.842				
	Metaverse e-commerce helps people manage their shopping effectively.	0.814				
	Metaverse e-commerce makes my life more efficient and effective.	0.829				
	I like Metaverse e-commerce because it allows me to shop easily in a realistic virtual environment.	0.836				
Innovativeness (INV) VIF: 1.608	People generally contact me for guidance when shopping in Metaverse e-commerce.	0.831	0.821	0.864	0.699	
	I usually shop using new technologies such as Metaverse e-commerce.	0.846				
	I usually understand new technologies such as Metaverse e-commerce without anyone's help.	0.833				
	I am always attracted to new trends in Metaverse e-commerce shopping technology.	0.814				
	I would find fewer difficulties than others when shopping with novel shopping technology such as Metaverse e-commerce.	0.856				
Discomfort (DSF) VIF: 1.416	If others know more advanced Metaverse e-commerce shopping technology than I do, they may take advantage of me.	0.849	0.833	0.872	0.739	
	I find it difficult to understand the technical support provided in new technologies such as Metaverse e-commerce and its avatars.	0.858				
	I feel that new technologies such as Metaverse e-commerce are not designed appropriately and are difficult for individuals to use and understand.	0.861				
	The instructions for using new technologies such as Metaverse e-commerce are difficult to understand because they are not written in simple language.	0.858				
	I feel that advanced technologies used in Metaverse e-commerce would always fail at the worst possible time.	0.871				
Insecurity (INS) VIF: 1.327	I do not feel safe shopping in Metaverse e-commerce.	0.842	0.829	0.852	0.728	
	The human touch is essential when shopping in Metaverse e-commerce.	0.839				
	I don't feel confident when I have to shop in Metaverse e-commerce.	0.883				
	I am anxious that while shopping in Metaverse e-commerce, someone will misuse my avatar or my information.	0.846				
	I do not feel safe sharing my financial information in Metaverse e-commerce.	0.855				

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Table 5. Continued

Construct	Items	Item loading	α	CR	AVE	Adapted from
Technology Readiness						
Sense of immersion (SMM) VIF: 1.291	Shopping in Metaverse e-commerce is a different experience; while physically in my room, my mind is fully immersed in the virtual realm.	0.873	0.817	0.847	0.737	(Daassi & Debbabi, 2021)
	The immersive quality of Metaverse e-commerce may cause me to lose awareness of my physical surroundings.	0.826				
	My focus could be so entirely captured by shopping in Metaverse e-commerce that I would likely neglect everything else happening before and after.	0.863				
	Metaverse e-commerce offers a compelling, immersive world that vanishes abruptly once the shopping experience concludes.	0.879				
	Metaverse e-commerce shopping has the potential to make me completely oblivious to my physical environment.	0.836				
	I might become so engrossed in Metaverse e-commerce shopping that I lose awareness of my immediate surroundings.	0.864				
Perceived interactivity (PIT) VIF: 1.571	Metaverse e-commerce helps me view products from different angles.	0.868	0.843	0.874	0.739	(Ballantine, 2005; Kim et al., 2023; Pillai et al., 2020)
	My avatar streamlines the process of finding products that meet my needs in the Metaverse shopping environment.	0.844				
	Metaverse e-commerce facilitates comparison shopping for the products I need.	0.856				
	Metaverse e-commerce websites offer highly appealing experiences.	0.863				
	Metaverse e-commerce sites are interactive and adapt to provide customized product information.	0.867				
Perceived personalization (PZN) VIF: 1.648	Metaverse e-commerce provides personalized avatars based on appearance and preference.	0.861	0.816	0.845	0.757	(Smink et al., 2020)
	I have a very personal experience while shopping in Metaverse e-commerce.	0.882				
	Metaverse e-commerce fulfills my shopping needs.	0.853				
	Metaverse e-commerce is personally relevant to me when shopping.	0.883				
Perceived enjoyment (PEJ) VIF: 1.469	I expect Metaverse e-commerce shopping to be a pleasant experience.	0.862	0.831	0.862	0.763	(Davis et al., 1992; Pillai et al., 2020)
	I anticipate that Metaverse e-commerce shopping will be stimulating.	0.869				
	I believe I will find Metaverse e-commerce shopping enjoyable.	0.877				
	I anticipate a relaxing and stress-free shopping experience within Metaverse e-commerce.	0.886				
Perceived serendipity (PSD) VIF: 1.624	Metaverse e-commerce introduces me to products that suit my needs, which I had not planned to buy.	0.861	0.826	0.847	0.719	(Grange et al., 2019)
	Metaverse e-commerce can offer surprising yet beneficial discoveries.	0.839				
	In Metaverse e-commerce, I come across appealing products worth considering, even if they were not part of my original search.	0.852				
	Metaverse e-commerce presents unexpected and fascinating product discoveries.	0.841				
Shopping intention in Metaverse e-commerce (SHN)	I expect to be shopping in the Metaverse e-commerce marketplace soon.	0.875	0.822	0.881	0.764	(Lian & Yen, 2014; Shi et al., 2020)
	I expect to shop regularly in the Metaverse e-commerce marketplace.	0.823				

Note. CR = composite reliability; AVE = average variance extracted; VIF = variance inflation factor.

Brijesh Sivathanu is a professor in the School of Business and Management at Christ University, Bengaluru, Karnataka, India. He has published more than 50 papers indexed in Scopus, the Australian Business Deans Council Journal Quality List, the Web of Science, and the Social Sciences Citation Index in reputed international peer-reviewed journals. His current research interests include information systems, technology adoption, AI, Internet of Things, marketing analytics, and their applications across service industries.

Ilse Struweg is an associate professor of marketing management in the Department of Marketing Management, School of Consumer Intelligence and Information Systems, College of Business and Economics at the University of Johannesburg. She received her PhD in Communication Management from the University of Pretoria, South Africa. Her research focuses on consumer behavior, brand management, and strategic integrated communication. Her work has been published in journals such as the Journal of Retailing and Consumer Services, the Journal of Computer Information Systems, the Journal of Marketing Communication, European Business Review, and Public Relations Review.

Rajasshrie Pillai completed her Post-doctoral degree from IIT Kharagpur and PhD in management. She is a Professor at Chandragupt Institute of Management Patna, Patna. She is a life member of the National HRD Network(NHRDN), India, and the Indian Society of Training and Development (ISTD). Her research interests are technology adoption, human resource management, and consumer behaviour. Her research has been published in journals such as: Information Technology and People, International Journal of Hospitality Management, Journal of Retailing and Consumer Services, Production Planning and Control, Journal of Business Research and Technovation. She has rich experience of twenty years in teaching, research, and administration.

Marijn Janssen is a full professor in information and communications technology and governance and head of the information and communications technology section in the Faculty of Technology, Policy and Management at Delft University of Technology, the Netherlands. His research interests include orchestration, governance, shared services, intermediaries, open data, and infrastructures within constellations of public and private organizations. More information is available at www.tbm.tudelft.nl/marijnj.

Nripendra P. Rana is a Professor in Digital Marketing and Systems and the Head of Department for International Business, Entrepreneurship and Marketing at the Queen's Business School of Queen's University Belfast, UK. His current research interests focus primarily on adoption and diffusion of emerging ICTs, e-commerce, m-commerce, digital and social media marketing and the role of artificial intelligence on the consumer decision-making and behaviour. He has published more than 350 papers in a range of leading academic journals, conference proceedings, books etc. Some of such journals where his papers got published include British Journal of Management, European Journal of Information Systems, Annals of Tourism Research, Public Management Review, European Journal of Marketing to name a few.