

DTS
4,3

312

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How the metaverse and virtual worlds are redefining fashion marketing and brand engagement

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Abstract

Purpose – This study explores how design, technology and social-psychological factors shape customer experiences in the metaverse, with a focus on the fashion industry in Karnataka, India. It aims to understand how appealing visuals, seamless technology and immersive features enhance customer engagement and loyalty. Using the stimulus-organism-response (S-O-R) framework, the research analyzes how design and technology serve as stimuli, shaping user perceptions and responses. The study addresses the gap between customer expectations and current metaverse experiences, offering strategic insights for businesses to create effective, personalized virtual environments.

Design/methodology/approach – The study investigates the influence of virtual reality (VR) in the metaverse on customer experience, focusing on how it enhances business growth. Data were collected from 389 customers in Karnataka, India, using purposive sampling. The research uses the S-O-R model to analyze the relationship between design, technology and social and psychological factors. The study provides insights into how businesses can use the metaverse to improve customer interactions and engagement.

Findings – The study found that while technology exceeded customer expectations, design factors fell short, indicating dissatisfaction with the visual appeal of metaverse tools. Customer experience and engagement did not meet expectations, indicating room for improvement. Successful businesses prioritize meeting or exceeding customer expectations to foster loyalty.

Originality/value – The research in Karnataka, Southern India, examines the integration of virtual reality, specifically the metaverse, into daily life and its impact on customer experiences. It focuses on aesthetics, technology and social and psychological influences, offering practical recommendations for businesses in this evolving digital landscape.

Keywords Metaverse engagement, Virtual reality integration, Customer experiences in the metaverse, Aesthetics and technology in virtual reality, Psychological factors in the virtual world, Business strategies for the metaverse

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1. Introduction:

The metaverse, which originated in the 1980s and 1990s, has played a pivotal role in shaping the evolution of the fashion industry. This study examines its definition, opportunities, challenges, and relevance to the sector. Structured into three sections, it provides an overview of the metaverse, assesses its advantages, and offers strategic guidelines for fashion brands based on size, target audience, and objectives. By exploring the relationship between digital fashion and consumer engagement, the research highlights gaps between potential and actual impact using literature reviews, industry analysis, customer surveys, and interviews (Mittal & Bansal, 2023). The metaverse is an interactive, shared digital space where users can engage, work, and socialize through avatars. Unlike the traditional internet, it offers an immersive environment where people can “live” and interact in real time. Brands are leveraging this space to create virtual product experiences, enhancing consumer engagement through interactivity, novelty, and immersive storytelling (Cilizoglu, Aslan, Ceyhan, & Yantaç, 2023). A study involving 34 designers from diverse fields examines how they integrate the metaverse into their work, identifying three key themes: ambient experiences, avatar representation, and collaborative interactions in virtual spaces (Gopakumar & Dananjayan, 2023). Within the metaverse, brands merge creativity and reality, offering customers dream-like experiences that blur the line between imagination and the tangible world. These immersive interactions ensure deeper engagement and connection (Rathore, 2017). Artificial Intelligence (AI) plays a crucial role in fashion marketing within the metaverse, particularly in enhancing engagement, creating personalized shopping experiences, and analyzing consumer behavior patterns (Jang & Kim, 2023). In fashion education, avatar customization in metaverse environments has been found to increase engagement, learning expectancy, and value among students (Valaskova *et al.*, 2022). Research into scalable and sustainable businesses in the metaverse suggests that enhanced product data and AI-driven targeting can significantly boost customer engagement. Machine learning-based personalization strengthens the connection between brands and consumers (Rane, Choudhary, & Rane, 2023). Additionally, customer loyalty in the metaverse can be reinforced through gamification, virtual events, social interactions, and augmented reality integrations (Rane *et al.*, 2023). Innovative metaverse business models, such as NFT marketplaces and decentralized autonomous organizations, contribute to enhanced customer satisfaction and competitiveness. The use of v-commerce tools like mobile 3D body scanning further revolutionizes the fashion industry by enabling mass customization, virtual size recommendations, improved inventory management, and targeted marketing strategies (Idrees, Vignali, & Gill, 2023).

Consumer interactions with online fashion retailers in the metaverse have also been analyzed using EEG technology, revealing strong links between video-based tasks and social media engagement. Studies suggest that live selling platforms with video content offer the most effective virtual shopping experiences (Dulabh, Vazquez, Ryding, Casson, & Caratù, 2023). Digital fashion trends within the metaverse depend heavily on collaboration and effective communication among innovators and early adopters, which are critical for maintaining a competitive edge (Kim & Chakraborty, 2024). A multidisciplinary perspective on the metaverse identifies five essential elements—digital mediation, spatial dynamics, immersion, shared environments, and real-time experiences—that influence consumer behavior by shaping identity, social interactions, and perceptions of ownership (Hadi, Melumad, & Park, 2024). Gamification also plays a crucial role in marketing intangible products within the metaverse. A cross-cultural study from Asia and Africa employs PLS-SEM and neural network modeling to assess how gamification impacts consumer-based brand equity. The research suggests that brands maintain authenticity while expanding their presence in the metaverse (Arya, Sambyal, Sharma, & Dwivedi, 2024). As a fusion of physical and digital realities enabled by virtual and augmented reality, the metaverse is reshaping industries, particularly fashion, by redefining customer engagement through immersive experiences. While existing studies focus on technology and user experience, cultural and regional differences remain underexplored. Addressing this gap, research on digital fashion in

Karnataka, India, highlights the disconnect between customer expectations and the delivery of design and technology. Despite its transformative potential, foundational challenges in implementing metaverse technologies persist.

2. Review of literature:

The metaverse, a rapidly evolving virtual universe, has gained prominence due to technological advancements and the impact of the COVID-19 pandemic. Businesses are increasingly utilizing it to enhance brand presence by creating virtual storefronts, hosting events, and collaborating with influencers (Jain, 2023). A study involving 164 metaverse users found that avatar-self congruence and flow play a mediating role between avatar purchase intention and virtual product purchase intention. This finding highlights the importance of high-quality avatar customization in driving consumer engagement. As a digital realm that integrates augmented reality (AR) and virtual reality (VR), the metaverse is reshaping consumer experiences. The rise of virtual influencers presents both opportunities and challenges, influencing the future of influencer marketing (Damaševičius & Zailskaitė-Jakštė, 2024). Digital fashion, which combines avatars, VR, AR, animation, AI, and blockchain technology, is transforming the fashion industry. Businesses are leveraging these innovations for social media marketing, while customers can explore smart electro-clothing embedded with electronics, further enhancing the virtual shopping experience (Sayem, 2022). The metaverse is revolutionizing communication, business, and work dynamics, with the fashion industry actively developing marketing strategies tailored to this digital landscape (Rodríguez Sanchez and Garcia-Badell, 2023).

The fashion industry's expansion into the metaverse presents opportunities for brand promotion, revenue generation, and new marketing platforms. A study examines how collaborations between fashion brands, technology developers, and consumers contribute to this evolution, offering a framework for future research and practical applications. The integration of digital and physical spaces within the metaverse is transforming fashion retail, requiring brands to navigate challenges related to adoption, privacy, regulation, payment systems, and NFTs (Mogaji, Dwivedi, & Raman, 2024). Using qualitative research and grounded theory, another study explores the motivations behind luxury and fast fashion brands entering the metaverse, positioning it as a strategic platform for brand expansion (Maria, De Lorenzi, Corallo, & Messeni Petruzzelli, 2024). As a 3D virtual network, the metaverse is gaining traction as a marketing tool for fashion brands. However, limited research exists on its direct impact on brand experiences and marketing strategies. A thematic analysis identifies current metaverse marketing tactics and proposes a theoretical framework to assess their influence on brand equity (Park and Lim, 2023). The trillion-dollar fashion industry has doubled its output since 2000 but also faces sustainability challenges. Digitalization and environmental concerns are driving the industry toward sustainable solutions, with the metaverse emerging as a tool to enhance e-commerce, improve consumer decision-making, and provide competitive advantages (Periyasami and Periyasamy, 2022).

Consumption patterns within the metaverse are evolving, as a study based on semi-structured interviews with 13 metaverse users and professionals redefines five key consumption values: utilitarianism, social identity, personalization, hedonism, and personal beliefs. The Metaverse's growing presence in fashion brand marketing offers immersive experiences, fosters community engagement, and generates new revenue streams. However, challenges such as data privacy, diversity, inclusion, and adoption barriers remain (Chrimes & Boardman, 2023). With AI playing a crucial role, research highlights the economic potential of virtual fashion, surveying digital avatars and their interactions with fashion items while analyzing emerging applications and future developments (Mu et al., 2024). The metaverse allows consumers to adopt avatars and own virtual property, presenting opportunities for the fashion industry to revolutionize supply chain design, embrace circular economy models, and reduce environmental impact (Yan, 2022). Research into younger consumers' engagement with metaverse fashion marketing examines how brands like Nike, Vans, Gucci, Supreme,

Forever 21, Ralph Lauren, and NASCAR are leveraging digital platforms to connect with their audience (Patruti, Zbucnea, & Pînzaru, 2023). Established brands are integrating AI, machine learning, and VR into their digital strategies, reshaping consumer experiences and merging digital technology with physical fashion collections (Joy, Zhu, Peña, & Brouard, 2022).

Consumer interactions with brands in the metaverse are increasing, leading to significant investments in virtual platform marketing. This interaction enhances engagement and brand loyalty while highlighting the high adoption rates of metaverse technologies (Barrera & Shah, 2023). Business models within the fashion and retail sectors are incorporating AR and VR to facilitate remote engagement and customer interactions (Periyasami & Periyasamy, 2022). Advanced metaverse interactions utilize scene, object, sound, speech recognition, and motion rendering, ensuring a seamless, multimodal user experience while addressing concerns about data security, privacy, and software integrity (Dwivedi *et al.*, 2022). Customer engagement in metaverse-mediated environments is shaped by media richness, which enhances perceived realism and influences future visit intentions. These insights help developers and marketers optimize resource allocation and engagement strategies. The Metaverse's growing role in fashion marketing is evident in its positive impact on brand awareness, particularly for SMEs looking to expand their digital reach. A critical analysis of consumer engagement evolution from Web 2.0 to the metaverse examines the role of VR and AR, highlighting how Marketer-Generated Content affects key engagement components such as interactivity and vividness.

Beyond fashion, the metaverse is also influencing destination marketing, particularly for Gen-Z consumers. A theoretical model based on consumer factors—such as time spent, social presence, and virtual experiences—reveals that these elements significantly impact engagement and visit intentions. Traditional advertising channels are being reimaged in this virtual space, allowing marketers to deliver immersive brand experiences and targeted advertising campaigns using AR overlays. Retailing in blockchain-based virtual worlds like Decentraland remains in its early stages, driven by major events and marketing strategies focused on customer engagement. A study analyzing transaction and spatial data from Ethereum and Polygon PoS blockchains sheds light on economic activity within these virtual environments. The role of digital marketing in customer experience is becoming increasingly significant, emphasizing the need for brands to adapt to the rapidly evolving digital landscape.

3. Theoretical background & hypothesis proposal

The metaverse enables activities in virtual environments that are more convenient and cost-effective than traditional internet platforms. This reduction in cost contributes to environmental and social benefits (Hennig-Thurau & Ognibeni, 2022). Augmented reality (AR) merges virtual objects with the real world, while virtual reality (VR) immerses individuals in entirely virtual spaces. AR influences preferences and behaviors by integrating virtual content into the real environment. Mixed reality (MR), which combines real and virtual elements, creates an experience where distinguishing between the two becomes challenging. The metaverse, leveraging VR and AR, offers customers realistic 3D digital experiences through advanced equipment (Bloomberg, 2022). The metaverse facilitates real-world-like experiences in industries such as clothing, cosmetics, furniture, and jewelry. This has spurred investments in advanced devices and technologies, driving a low-cost distribution model while increasing revenue. Applications of the metaverse in AR, VR, and broadband connections support seamless online transactions and enhanced consumer experiences (Dwivedi *et al.*, 2022).

3.1 Hypothesis proposed

The metaverse captivates users by offering immersive experiences that encourage continuous engagement. When users find value in these interactions, they become more invested in the

virtual space, recognizing the significance of the time spent within it. Avatars play a crucial role in navigating different digital environments, allowing users to interact seamlessly and participate in virtual economies. Key media richness factors—such as multiple sensory cues, real-time feedback, and personalized interactions—enhance the perceived realism of the metaverse. This heightened sense of immersion positively influences customer engagement, leading to increased usage and a greater likelihood of returning. The design of metaverse platforms is fundamental in attracting and retaining users. Thoughtfully crafted virtual spaces simulate real-world environments, creating memorable and engaging experiences. As a 3D virtual world that merges realities, the metaverse has gained prominence due to technological advancements in virtual reality (VR) and augmented reality (AR) (Choi & Kim, 2017; Hendaoui, Limayem, & Thompson, 2008). Forecasts predict that the global metaverse market will reach \$280 billion by 2025, with VR-related growth expected to rise from \$33 billion in 2020 to \$338.1 billion by 2025, and potentially up to \$2.4 trillion by 2030 (Lee, Trimi, Byun, & Kang, 2011). The development of metaverse platforms is shaping the broader technology landscape, driven by advances that enable seamless access to computing resources (Papagiannidis & Bourlakis, 2010). Engaging design elements contribute to customer satisfaction by enhancing entertainment content. The ability to blend real-world experiences with a 3D digital environment fosters active participation (Zhang, Chen, Hu, & Wang, 2022). Moreover, the application of digital twin designs, whether in 2D or 3D, significantly influences customer experiences and behavioral intentions.

H1. Metaverse design has a positive impact on customer experience.

Incorporating avatars and blockchain infrastructure enriches the customer experience by creating a clear and immersive virtual reality. Technologies like VR and AR further enhance user engagement, making interactions more dynamic. Meanwhile, AI-driven robots are becoming increasingly prevalent in industries such as retail, hospitality, and services, offering automated support and companionship. The demand for social robots—those designed for direct consumer interaction—has grown significantly, surpassing that of manufacturing robots. These robots serve various functions, including conversation, assistance, and companionship (Gibbs, 2016). AI is also transforming customer interactions at tourist destinations by providing personalized experiences. Additionally, metaverse technologies are reshaping libraries by creating interactive, immersive learning environments that connect institutions with global audiences.

H2. Technological advancements positively impact customer experience.

Social factors also play a crucial role in metaverse adoption. Traits such as openness to new experiences, self-efficacy, and social identity influence user behavior and engagement. A sense of belonging and shared experiences can reshape social structures and consumer habits. Routine shopping activities, such as grocery purchases, involve varying levels of involvement. While perishable goods require frequent attention, longer-shelf-life products demand less immediate interaction (Tsydybey, 2014). This study examines consumer behavior concerning branded, durable grocery items such as cereals and oils. The rise of Online Grocery Retailing (OGR) in India reflects a broader shift toward convenience-driven shopping. Despite challenges, OGR presents immense potential, as perceived social benefits and trust influence loyalty, brand perception, and purchase intent.

H3. Social factors positively impact customer experience.

Psychological influences significantly affect metaverse engagement. Users seek enjoyment and a sense of achievement, which motivates them to continue participating in virtual experiences. Consumers are drawn to memorable and emotionally enriching experiences, contributing to overall well-being and satisfaction. To foster engagement, businesses frequently host special events that encourage interactive participation (Pine & Gilmore, 1999; Sun & Ko, 2016). Experiential marketing strategies, which appeal to the senses and emotions,

can shape consumer behaviors by triggering both rational and emotional responses (Schmitt, 1999). Research on customer engagement underscores the importance of interactive experiences in strengthening relationships between businesses and consumers, ultimately increasing voluntary participation.

H4. Psychological factors positively impact customer experience.

Tracking customer experience is essential for understanding consumer behavior and overall satisfaction in the metaverse. The integration of physical and digital elements influences experiences both in physical stores and online interactions. Customer engagement is shaped by psychological, cognitive, and emotional responses to brand interactions, as outlined by Patterson, Yu, and De Ruyter (2006). Beyond transactions, customer engagement extends to non-transactional behaviors, such as helping other users and sharing brand-related content on social media (Gummerus, Liljander, Weman, & Pihlström, 2012). Enthusiastic participation fosters a deeper sense of commitment, leading to stronger engagement with brands. Personalized interactions further enhance customer experiences, creating stronger emotional connections and brand loyalty.

H5. Customer experience positively influences customer engagement.

4. Methodology

This study explores the impact of virtual reality (VR) in the metaverse on customer experience, focusing on how customers can interact with products in a virtual environment, enhancing business growth. The research, conducted in Karnataka (Southern India), uses purposive sampling to gather data from 389 customers who have experienced the metaverse. The questionnaire, developed after interviews with store managers using metaverse technology, focuses on the role of design, technology, social, and psychological factors in shaping customer experiences. Data analysis was carried out using SPSS and AMOS 24. The study builds upon the Stimulus-Organism-Response (S-O-R) model, which examines how external stimuli, such as design and technology, influence customer experience (organism) and engagement (response) in the metaverse. The research provides a theoretical framework to analyze the relationships between the independent variables (stimuli) and dependent variables (customer experience and engagement). By drawing on contemporary studies on metaverse technologies, consumer behavior, and their applications in business, the paper offers valuable insights into how businesses can use the metaverse to improve customer interactions and enhance engagement. This methodology ensures that the research objectives are effectively addressed while contributing to the understanding of the metaverse impact on customer behavior and business growth.

5. Data analysis

In the analysis phase, a comprehensive examination of the demographic profile of the study participants was conducted to ensure a representative sample. This involved scrutinizing key characteristics such as age, gender, educational background, and professional experience. Factor loadings were then assessed to determine the strength and significance of relationships between observed variables and latent constructs in the proposed model. Gap Analysis is carried out by measuring the difference between the perception and the Expectation of the customer, perception is the feeling associated with the customer on experiencing the metaverse. The measures of mean has been taken to understand the performance of metaverse, as the Actual experience has it exceeded their expectation on metaverse or not, the following table and the graph shows the difference or the gap between the customers expectation and

DTS
4,3

their actual perception on the design and Technology Factor of metaverse, and the Customer Experience and Engagement in metaverse.

318

5.1 Results

The test results in Table 1 reveals a predominantly male population, with 56.81% of participants being female. The majority of participants are aged less than 25 years (39.59%), with a younger age group. The majority of participants reside in urban areas (40.97%), followed by semi-urban (31.88%), and rural (18.25%) locations. Education qualifications are mainly under-graduate (52.96%), with 31.11% having post-graduate qualifications or higher. The employment distribution is diverse, with participants in the private sector (42.16%), business (31.62%), and public sector (26.22%).

The test result in Table 2 shows a gap analysis of five designs reveals significant discrepancies between customer expectations and actual perceptions. Design 4 underperforms, Design 3 fails, and Design 1 shows dissatisfaction. Design 5, Design 2, and Design 5 are closer to meeting expectations, with Design 2 being the most positively perceived. The data emphasizes the need for targeted improvements to enhance customer satisfaction.

Table 1. Demographic profile of the respondents

	Variables	Count	Percentage
Gender	Male	168	43.19%
	Female	221	56.81%
Age	Less than 25 years	154	39.59%
	26 to 35 years	126	32.39%
	36 to 45 years	69	17.74%
	More than 45 years	40	10.28%
Location of residence	Urban	194	49.87%
	Semi-urban	124	31.88%
	Rural	71	18.25%
Education qualification	School education	62	15.94%
	Under graduation	206	52.96%
	Post graduate or more	121	31.11%
Employment	Private sector	164	42.16%
	Business	123	31.62%
	Public sector	102	26.22%
Monthly income	Less than Rs. 25,000	73	18.77%
	Rs. 25,001 to Rs. 50,000	187	48.07%
	Rs. 50,001 to Rs. 75,000	62	15.94%
	More than Rs. 75,000	40	10.28%

Source(s): Results from Primary data

Table 2. Gap score for design factor

Factors	Perception	Expectation	Gap score
Design 1	3.6	4.5	-0.9
Design 2	3.8	4	-0.2
Design 3	3.2	4.2	-1
Design 4	3.1	4.18	-1.08
Design 5	3.8	4.15	-0.35

Source(s): Results from Primary data

The test result in Table 3 shows the analysis of technology-related factors shows a positive gap between customer perceptions and expectations, indicating high satisfaction. Technology 2 and 4 are particularly strong, exceeding customer expectations. This indicates superior technological performance, innovation, reliability, and high-quality services. This positive perception strengthens customer loyalty, enhances brand reputation, and provides a competitive edge.

The test result in Table 4 shows the analysis of customer experience factors shows a significant negative gap between perception and expectation, indicating customer dissatisfaction. Customer Experience 2 has the largest gap, indicating a significant underperformance. Other factors, such as service quality, personalization, responsiveness, and emotional engagement, also show unmet expectations. The organization needs to prioritize improvements to align with customer expectations.

The test result in Table 5 shows the study of Customer Engagement reveals a significant gap between customer expectations and perceptions, indicating a need for improvement. The most significant gap is in Customer Engagement 3, with a score of 1.25 compared to an expectation of 3.59. This suggests dissatisfaction with communication, personalized interaction, and limited involvement initiatives. Businesses need to reevaluate engagement strategies.

The test results in Table 6 evaluated the reliability and validity of measurement instruments, assessing internal consistency, stability, convergent and discriminant validity, and Heterotrait-

Table 3. Gap score for technology factor

Factors	Perception	Expectation	Gap score
Technology 1	4.8	3.6	1.2
Technology 2	4.6	3	1.6
Technology 3	4.4	3.1	1.3
Technology 4	4.8	3.21	1.59

Source(s): Results from Primary data

Table 4. Gap score for customer experience factor

Factors	Perception	Expectation	Gap score
Customer Experience 1	2.8	3.2	-0.4
Customer Experience 2	2.5	3.45	-0.95
Customer Experience 3	2.4	2.87	-0.47
Customer Experience 4	2.6	3.25	-0.65

Source(s): Results from Primary data

Table 5. Gap score for customer engagement factor

Factors	Perception	Expectation	Gap score
Customer Engagement 1	1.65	3.56	-1.91
Customer Engagement 2	1.89	3.47	-1.58
Customer Engagement 3	1.25	3.59	-2.34
Customer Engagement 4	1.26	3.16	-1.9

Source(s): Results from Primary data

Table 6. Factor loadings, reliability and validity measures

Factors	Indicators	Mean	S.D	Factor Loadings	Cronbach Alpha	Composite Reliability	AVE
Design	Design5	4.56	0.242	0.663	0.824	0.862	0.531
	Design4	3.89	0.146	0.849			
	Design3	3.96	0.218	0.614			
	Design2	3.25	0.287	0.712			
	Design1	3.65	0.276	0.933			
Technological factors	Technical4	3.67	0.105	0.855	0.823	0.828	0.515
	Technical3	4.27	0.251	0.824			
	Technical2	4.16	0.368	0.745			
	Technical1	4.24	0.389	0.587			
Social factors	Soci4	4.87	0.467	0.799	0.876	0.771	0.589
	Soci3	3.67	0.224	0.601			
	Soci2	3.98	0.256	0.741			
	Soci1			0.660			
Psychological factor	PSY4	3.85	0.299	0.742	0.789	0.745	0.553
	PSY3	3.48	0.372	0.888			
	PSY2	3.89	0.138	0.728			
	PSY1	3.56	0.189	0.777			
Experience	Exp1	4.65	0.263	0.803	0.776	0.761	0.562
	Exp2	3.48	0.144	0.763			
	Exp3	3.17	0.422	0.780			
	Exp4	3.67	0.186	0.934			
Customer engagement	CUS_ENG1	3.24	0.62	0.853	0.816	0.782	0.637
	CUS_ENG2	4.32	0.391	0.614			
	CUS_ENG3	4.56	0.127	0.536			
	CUS_ENG4	4.87	0.146	0.663			

Source(s): Results from Primary data

Monotrait (HTMT) ratio. Hypothesis testing was performed to analyze relationships in the conceptual framework. Factor loadings indicated internal consistency, Cronbach’s alpha value was over 0.7, and composite reliability was calculated with a 0.7 benchmark. Convergent validity assessed convergent validity, with all unobserved constructs having AVE values above 0.5.

The test results in [Table 7](#) shows the discriminant validity measures the extent to which each construct is distinct of the other construct, the discriminant validity was assessed using [Fornell and Larcker \(1981\)](#), as values in the diagonal bold are the square root of AVE and other values are inter-variable correlations. The values in each row to be less than the Squared AVE Value. Thus, the discriminant validity for the constructs was established.

Table 7. HTMT ratio

	Design	Technological Factors	Social factors	Psychological Factor	Experience	Customer Engagement
Design						
Technological factors	0.729					
Social factors	0.336***	0.718				
Psychological factor	0.124†	0.241***	0.668			
Experience	0.175*	0.413***	0.355***	0.625		
Customer engagement	0.342	0.316	0.413	0.573	0.738	

Source(s): Results from Primary data

The test results in Table 8 reveals that design in the metaverse positively impacts customer experience, with technological, social, and psychological factors playing significant roles. It also highlights the importance of optimizing customer experience for deeper engagement, emphasizing the need for customer engagement.

The test results in Table 9 found that design, technological, social, and psychological factors positively impact customer experience and engagement. Design, technological, social, and psychological factors account for 48.9% and 64.4% of the variance, respectively. Customer experience also had a significant impact, accounting for 62.4% of the variance in customer engagement.

Figure 1 shows a conceptual framework categorized into design, technological, and social factors that influence customer engagement. These factors cumulatively impact customer experience, directly influencing engagement. The diagram shows a hierarchical order, with design factors at the top and social factors at the bottom. Design factors include visual appeal and usability, while technological factors involve platforms and tools for customer interaction. Social factors have 14 times the influence on customer engagement.

Figure 2 shows that the study uses a structural equation model to evaluate the relationship between design, technological factors, social factors, and psychological factors on customer experience and engagement. The results show that design, technological factors, social factors, and psychological factors have a positive and significant impact on customer experience, supporting hypothesis H1, H2, H3, and H4. The squared multiple correlation for Social Media Marketing Adoption is .489, indicating that 48.9% of the variance in customer experience is accounted for by these factors. Customer experience also has a positive and significant impact on customer engagement, accounting for 64.4% of the variance.

Table 8. Hypothesis results

Hypothesis	<i>p</i> -value	Significant/Not Significant
Design in metaverse has positive impact on the Customer Experience	***	Significant
Technological factor has positive impact on the Customer Experience	***	Significant
Social factor has positive impact on the Customer Experience	0.096	Not Significant
Psychological factors of customers have positive impact on the Customer Experience	0.001	Significant
Customer Experience has positive impact on the Customer Engagement	***	Significant

Source(s): Results from Primary data

Table 9. Results of structural equation modeling

Dependent variable	Direction of impact	Independent variable	Estimate	S.E	C.R	P
EXP	<—	DES	0.278	0.061	4.585	***
EXP	<—	TEC	0.449	0.103	4.359	***
EXP	<—	SOC	0.072	0.043	1.663	0.096
EXP	<—	PSY	0.222	0.068	3.275	0.001
CUS_ENG	<—	EXP	0.593	0.081	7.317	***

Source(s): Results from Primary data

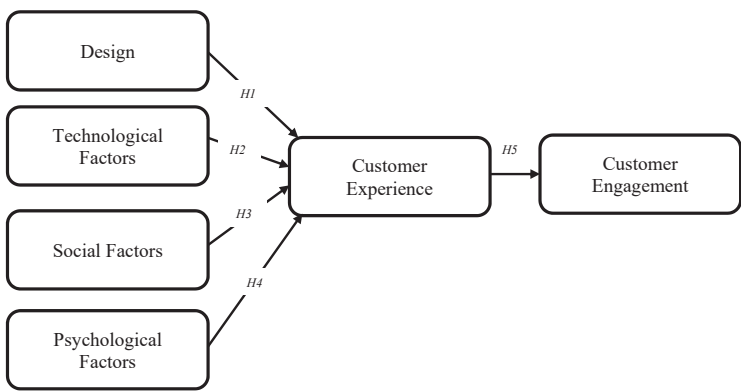


Figure 1. Conceptual model. Source: Authors’ own construct

Figure 3 shows the radar chart on the “Technology Factor” shows that customer perceptions consistently exceed expectations across four technological dimensions. This positive gap suggests customer satisfaction with the technological aspects provided, indicating strong performance and efficient service delivery. This could enhance customer confidence, loyalty, and competitive advantage. The difference between expectations and perceptions could also indicate opportunities for better communication or marketing of high-value technology.

Figure 4 shows the “Technology Factor” radar chart compares customer expectations and perceptions across four technology-related dimensions. Perception scores significantly exceed expectations, indicating high customer satisfaction. Technology 2 and 4 show the highest differences, while Technology 1 and 3 have strong positive gaps. This suggests the organization is meeting or exceeding customer expectations in technological capabilities and performance, promoting customer loyalty and competitive advantage.

Figure 5 shows the radar chart shows a significant gap between customer expectations and actual perceptions across all four dimensions of Customer Experience. The largest gap is in Customer Experience 2, with a score of 2.5 compared to an expectation of 3.45. This suggests a systemic issue in delivering expected customer value and calls for targeted improvements in customer engagement strategies.

Figure 6 radar chart shows a significant gap between customer perceptions and expectations in four dimensions of Customer Engagement. Expectations are higher than perceptions, with the largest gap in Customer Engagement 3. This suggests disengagement and underperformance of current engagement efforts. To improve customer satisfaction, organizations should develop personalized strategies, enhance communication, increase interactivity, and deliver value-driven experiences.

6. Discussion and conclusion

The study examines the impact of design, technology, and social-psychological factors on customer experience in the metaverse, particularly within the fashion industry. It highlights the importance of appealing designs and the right technology in creating positive virtual experiences, which enhance customer engagement and loyalty. Understanding these factors is crucial for businesses aiming to meet or exceed customer expectations and foster long-term relationships. The research also explores how the metaverse, enabled by VR and AR technologies, is transforming industries by merging physical and digital realities. It focuses on Karnataka, India, a region known for its technological innovation, and examines the unique dynamics of digital fashion in the metaverse. The findings reveal a gap between customer expectations and perceptions regarding design and technological elements, offering insights

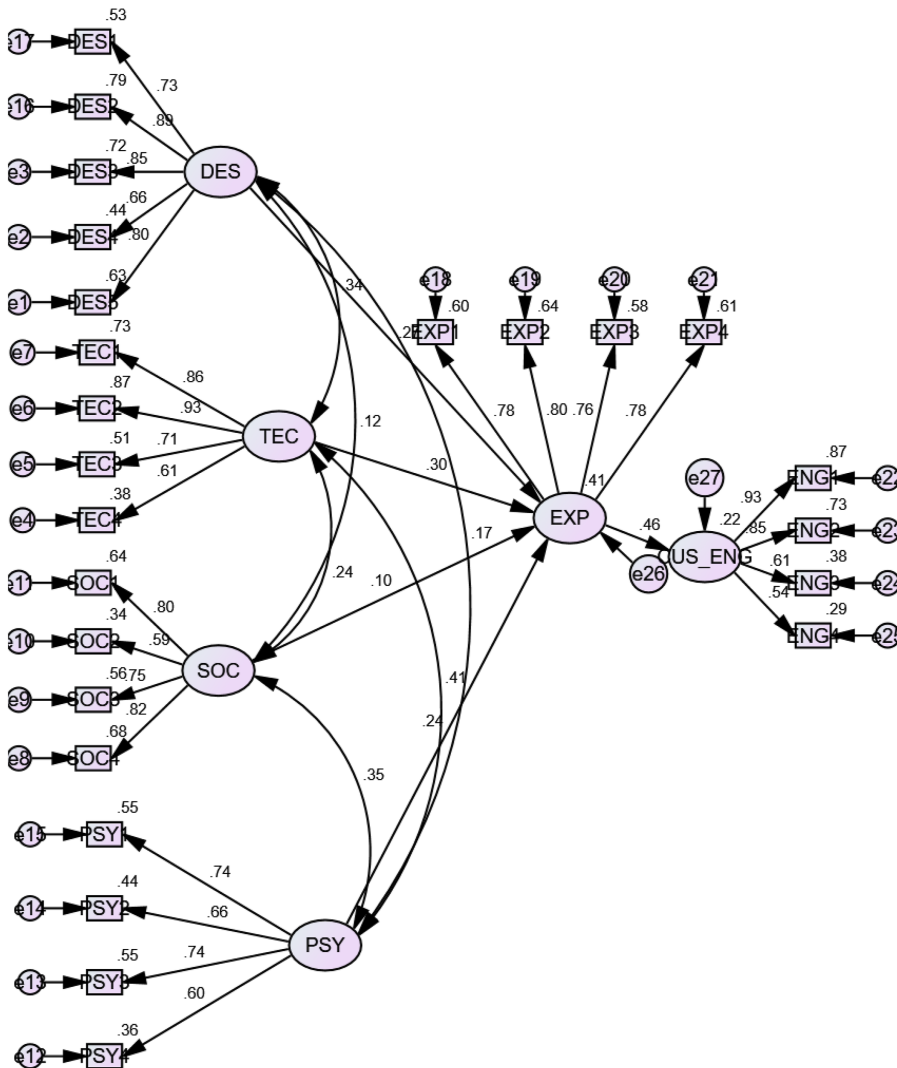


Figure 2. SEM diagram. Source: Authors' construct based on the values calculated from the tables

for businesses to improve digital engagement strategies. The study contributes to the S-O-R (Stimulus-Organism-Response) model by clarifying how design and technology act as stimuli, customer experience serves as an organism-level process, and engagement is the response. By addressing the interplay of design, technology, and social-psychological factors, the research provides actionable insights for businesses to align their metaverse innovations with consumer needs and expectations. This can guide the development of more effective and immersive virtual experiences, ultimately fostering sustained customer engagement and loyalty.

The study highlights the importance of design, technology, and social-psychological factors in shaping customer experiences in the metaverse. Businesses must focus on appealing visuals and appropriate technology to enhance virtual reality experiences, while understanding the interconnectedness of these factors for success. Customer satisfaction, driven by

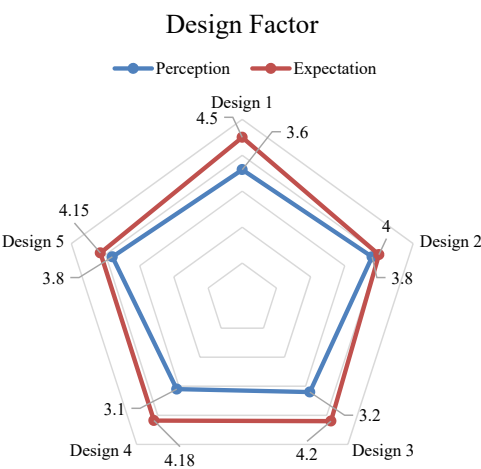


Figure 3. Gap score for design factor. Source: Results from Primary data

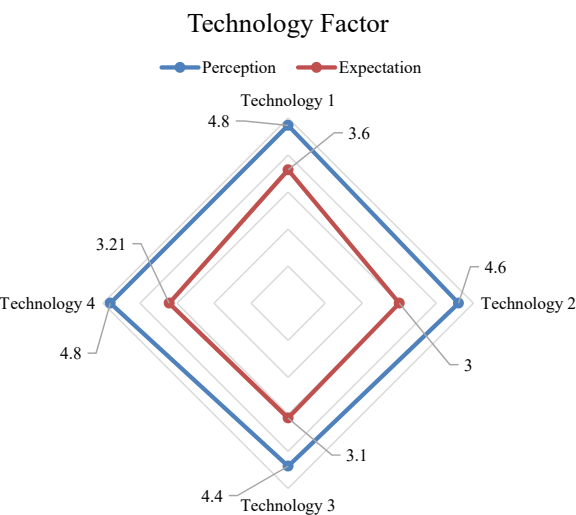


Figure 4. Gap score for technology factor. Source: Results from Primary data

thoughtful design and seamless technology integration, is essential for sustained engagement and loyalty. The research emphasizes fostering immersive, interactive experiences through gamification, personalized interactions, and community-building features. To ensure equitable access, companies should address barriers like high VR/AR equipment costs and digital literacy gaps. The study, while focused on the fashion industry, offers insights for other sectors like education, healthcare, and retail, encouraging the use of AR/VR for personalized experiences and virtual training programs to improve customer engagement.

6.1 Practical implications

The metaverse is a growing digital landscape for businesses, offering immersive virtual experiences for customer engagement. Success requires high-quality 3D environments,

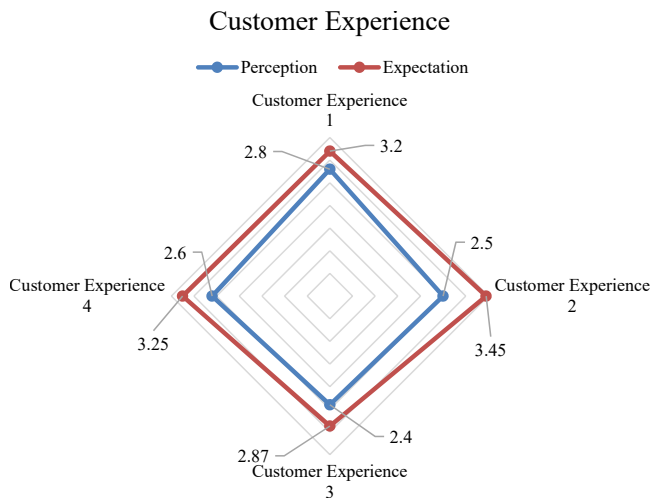


Figure 5. Gap score for customer experience factor. Source: Results from Primary data

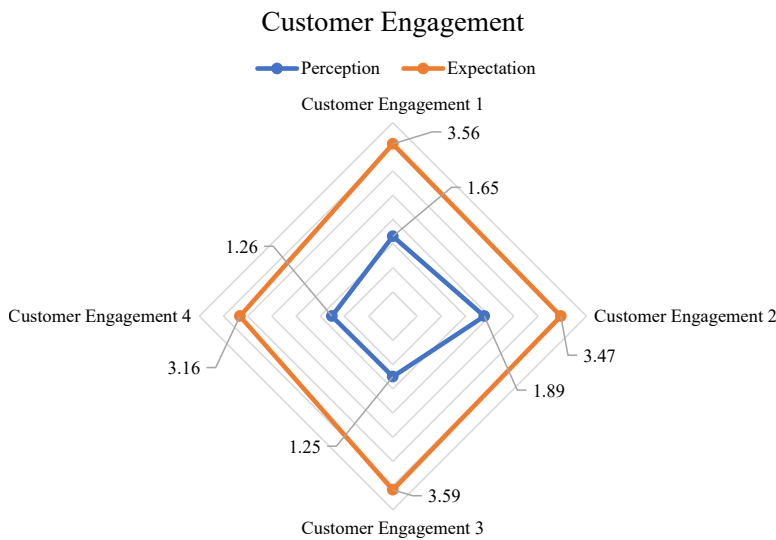


Figure 6. Gap score for customer engagement factor. Source: Results from Primary data

seamless technology integration, and understanding human behavior. Personalization and aligning virtual experiences with customer expectations foster long-term engagement and loyalty. Industries like clothing, cosmetics, electronics, and automobiles are leveraging the metaverse for sustained customer engagement.

6.2 Theoretical implications

The rise of the metaverse in business has notable theoretical implications, highlighting the need for seamless virtual environment integration, personalized experiences, and

understanding social-psychological factors. It underscores the importance of leveraging the metaverse across various industries to drive customer engagement and loyalty. This shift in marketing strategies calls for innovation and adaptation. The S-O-R model, which focuses on stimuli (external factors) that provoke internal responses, is applied to the metaverse. The stimulus factors include design aspects like beauty and user interface, technological factors like performance and interactivity, social elements like community-building and presence, and psychological factors such as individual perception and emotional involvement in the virtual world. This framework guides businesses in creating more engaging, personalized, and impactful metaverse experiences for customers.

6.3 Limitations and scope for future research

The metaverse offers potential for businesses, but it faces challenges such as technology accessibility, cost and resource constraints, user experience and satisfaction, ethical and legal considerations, cultural and diversity considerations, long-term engagement and loyalty, and measurement and evaluation metrics. Accessibility to advanced technology may be a barrier for smaller businesses or regions with limited infrastructure. Cost-effective solutions and resource optimization techniques could make metaverse adoption more feasible for businesses of all sizes. Understanding user feedback mechanisms and iterative design approaches could enhance user satisfaction. Ethical and legal considerations, cultural and diversity considerations, and standardized metrics for measuring metaverse strategies are also essential for unlocking its full potential.

Gap Analysis for the Design Factor:

Table 2 and Figure 6: Gap Scoring for Design, Technology, and Customer Factors.

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