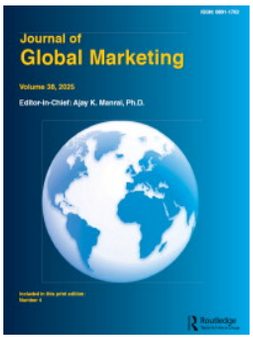

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Customer Experience (CX) in Virtual Realms: A Theories-Contexts-Characteristics-Methodologies (TCCM) Guided Bibliometric Study

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Customer Experience (CX) in Virtual Realms: A Theories-Contexts-Characteristics-Methodologies (TCCM) Guided Bibliometric Study

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ABSTRACT

The study systematically reviews existing literature on customer experience (CX) in virtual realms, with a view to conceptualizing the field and identifying future research avenues. It integrates bibliometric analysis, network analyses with a theories-context s-characteristics-methodologies (TCCM) framework to comprehensively examine the research landscape. Drawing on data from 1460 articles published in 509 journals between 2000 and 2025, the study highlights growing scholarly interest in CX with immersive environments, such as the metaverse. The results show exponential growth in this domain and in widespread international collaboration. Key contributions from this scholarship relate to, amongst other issues, emerging trends, development new frameworks, identification of challenges and opportunities, cross disciplinary insights significantly advancing effective professional practice and impactful theory development on customer experience in virtual realms. Unlike conventional bibliometric studies, this research stands out for its theoretical and methodological rigor, its focus on emerging virtual realms, and emphasis on strategic gaps and research agenda.

KEYWORDS

Customer experience (CX); virtual reality (VR); bibliometric study; preferred reporting items for systematic reviews and meta-analyses (PRISMA); theories-contexts-characteristics-methodologies (TCCM)

JEL CLASSIFICATION CODES

M31; L36; D83

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GRAPHICAL ABSTRACT

Introduction

Customer experience (CX) can be defined as the perceptions and emotions of customers throughout their interactions with the brand, from initial awareness through to purchase and post-purchase engagements (Ali et al., 2024; Deng et al., 2025). In virtual realms, CX is linked to interaction with a product or service brand within immersive digital environments, and includes, but is not limited to, the metaverse, virtual reality (VR), augmented reality (AR), and mixed reality (MR) (Ali et al., 2025). The intersection of cognition, emotions,

sensory, and social reflections in emerging digital immersive technological platforms (Chen et al., 2025) vividly demonstrates how incremental the development of customer experience in virtual realms (Sayed & Abutaleb, 2025) has been in digital marketing, digital business, and digital retailing (Ghesh et al., 2024). Due to the dynamic nature of digital technology, sustained by increasing research and development in artificial intelligence (AI) (Nyagadza & Bashar, 2025), customer experience in virtual realms is growing (Keng et al., 2025) and set to change the narrative in the "*phygital retailing*" arena (Zhu et al., 2024). Phygital retailing is the integration of physical and digital environments to produce a seamless immersive CX, by leveraging technologies, such as AR, smart mirrors, QR codes, RFID, and mobile applications (Deng et al., 2025). The aim is to improve in-store interactions with the convenience and richness of digital commerce (Lin et al., 2024). It is predicted that this unprecedented growth in phygital retailing will cause a radical and disruptive digital revolution in terms of how customer-enterprise interactions improve (Ali et al., 2024) and enhance digital customer experience and services. The logic behind such developments is that artificial intelligence (AI)-enabled applications (Cheng et al., 2024) and/or virtual realms increasingly promote accessibility, flexibility, brand integration, seamless navigation, connectivity, emotional satisfaction, and exceptional personalization (Lin et al., 2024). This results in techno-functional driven customer experience (Batat, 2022). In recent years, there has been significant scholarly interest in the Fourth Industrial Revolution (4IR)-related techno-functional digital technologies (such as Artificial Intelligence (AI) (Nyagadza & Bashar, 2025), Internet of Things (IoT), Robotics, Blockchain Technology, Augmented Reality (AR), Virtual Reality (VR), Three Dimensional (3D) Printing, Advanced Analytics, Non-Fungible Tokens (NFTs), Cyber Physical Systems, devices for avatar controls and haptics and Cloud Computing (CC), among others (Ali et al., 2024), digital marketing, social commerce, electronic commerce and digital business discourses, which are fundamental to the development and growth of the novel customer experience in virtual realms (Sayed & Abutaleb, 2025). Integrating technology is crucial, since it enables business organizations to offer their customers delightful and memorable experiences in their journey across various interactive virtual-physical touchpoints (Ali et al., 2024). In addition, emerging immersive technologies, such as the metaverse have enabled and will enable these organizations to engage their customers in novel ways (Hassan et al., 2023; Nyagadza & Bashar, 2025). Furthermore, these technologies could improve customer engagement and influence customer purchase intentions (Ghesh et al., 2024). Virtual immersive technologies also enable customers to interact in real-time, combining computer-generated items with the physical world (Cheng et al., 2024). In their quest to enhance customer experience, these technologies pave the way for virtual product trials, try-ons, and search for and acquisition of information (Keng et al., 2025).

Despite the extensive research on traditional customer experience, relatively little attention has been given to the domain of customer experience in virtual realms (Keng et al., 2025). Notwithstanding the growing impact and focus on customer experience in virtual realms or environments, in areas related to *e*-commerce and virtual customer service, many researchers have been focused on usability, interface design, or general basic metrics of customer satisfaction. However, many major aspects remain underexplored. Specifically, there is dearth of research on the way immersive technologies, such as virtual reality (VR) affect emotional engagement or long-term brand loyalty. Only a few studies have analyzed in depth customer experience in social virtual spaces, such as metaverse, where customer interactions are more complex and identity driven. In addition, the impact of artificial intelligence powered virtual agents in influencing trust and perceived empathy also remains insufficiently explored. Gaps, such as these are significant, since virtual realms are becoming increasingly central to the way brands engage customers. For this reason, understanding the hidden psychological and emotional dimensions of customer experience is important to coming up with transformative, human-centered experiences. Evidence from

prior published literature (empirical studies, anecdotal, and reports) indicates a paucity of practical and theoretical research conducted with a view to ensuring sustainable digital marketing. Unlike previous bibliometric studies, which were largely focused on co-citation networks, keyword clustering, or PRISMA-based systematic reviews, this comparative study uniquely integrates the TCCM (Theories-contexts-characteristics-methodologies) framework to provide structured bibliographic insight, revealing deeper theoretical and methodological aspects that earlier studies have overlooked. This study, therefore, allows for the identification of underused theories, emerging experiential contexts, and methodological gaps in the domain of customer experience in virtual environments. Moreover, the study adds value to existing literature as it unpacks a novel concept by applying a different methodology from that applied in other studies. The study also contributes to the adoption, application, and strategic development of practice and theory directly connected to customer experience in virtual realms. It seeks to address the following research questions:

- **RQ1:** What is the annual publication and citation trend in the research domain of customer experience in virtual realms?
- **RQ2:** What are the most influential documents, contributing countries, impactful sources, and prolific authors in the domain of customer experience in virtual realms?
- **RQ3:** What are the research clusters shaping knowledge in the domain of customer experience in virtual realms?
- **RQ4:** Which theories-contexts-characteristics-methodologies (TCCM) are the most influential in shaping research within the field of customer experience in virtual realms?

The study is organized sequentially and systematically to connect relevant sub-sections. It begins with the introduction and contextualization of the study, followed by the research methodology, results and discussion, theoretical, social, and practical implications, and finally the conclusion, limitations, and future research directions.

Research methodology

This study employs state-of-the-art bibliometric analysis, network analysis, and the TCCM framework. Similar techniques have been applied in social research studies to study and comprehensively report on the existing research structure, gaps, and studies that could potentially bridge them (Paul et al., 2021; Sharma et al., 2020). Table 1 below shows the four-step methodology used to explore customer experience research on a metaverse platform. The Scopus database was selected to search for and extract relevant studies, since it is one of the most widely used databases, with more than 27000 peer reviewed journals indexed in the business and economics category (Hassan et al., 2023).

Firstly, a search was conducted for relevant studies on the Scopus database using several Boolean (AND, OR) combinations of keywords: ("customer experience" OR "user experience") AND ("metaverse" OR "virtual reality" OR "immersive technology"); ("customer experience" OR "consumer experience" OR "digital experience") AND ("metaverse" OR "virtual worlds" OR "virtual reality") AND ("customer engagement" OR "satisfaction" OR "brand experience"); ("customer journey" OR "customer experience") AND ("augmented reality" OR "mixed reality" OR "extended reality") AND ("immersive experience" OR "digital platforms"). The data obtained was then extracted using .csv file for further analysis.

Thereafter, the data was screened using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) framework, as shown in Figure 1. This framework improves the quality, transparency, and reporting of systematic

Table 1. The four-stage review methodology.

Main information about data	
Description	Results
Timespan	2000–2025
Sources (journals, books, etc.)	509
Documents	1460
Annual growth rate %	22.78
Average age of document	2.89
Average citations per document	34.09
Authors	3938
Authors of single-authored documents	114
Single-authored documents	119
Co-authors per document	3.44
International co-authorships %	38.22

Source: Authors' conception (2025).

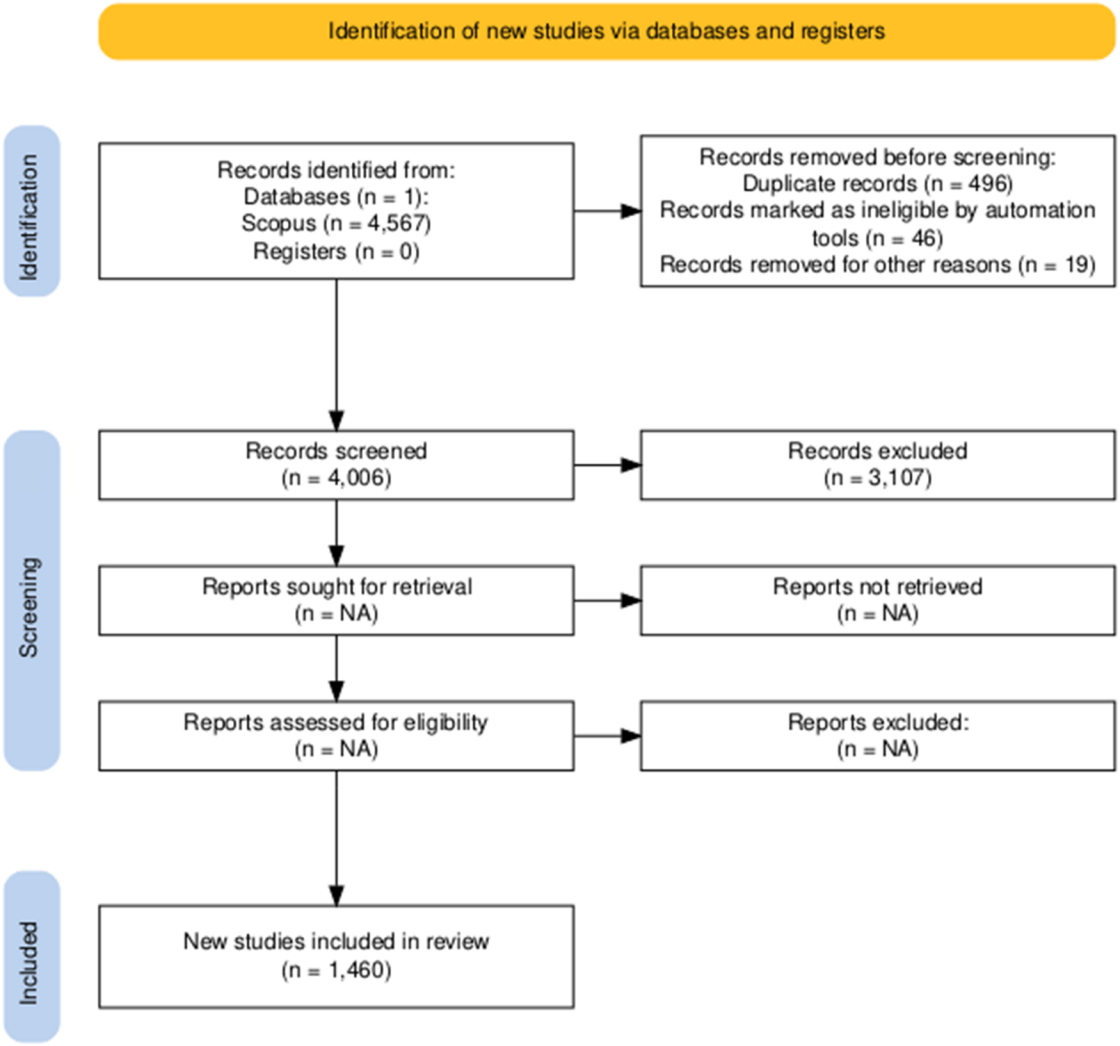

Figure 1. The PRISMA framework.
Source: Authors' conception (2025).

reviews, and is one of the most used for systematic literature reviews (Geaney et al., 2013).

The initial search returned 4567 documents, which were extracted in .csv format for further data processing and analysis. The dataset was screened for duplicates, and 496 documents were removed, 46 documents of these because they did not have the authors' details, while 19 documents lacked proper affiliations and other vital information. 561 documents were therefore removed before applying exclusion criteria.

The remaining 4006 documents were screened using inclusion criteria set down to examine the state of customer experience on metaverse research. Only research articles were included in the data set, and other document types, such as reviews, conference papers, book chapters, short notes, etc., were excluded. 1962 documents were excluded at this stage. A total of 39 articles published in languages other than English were also excluded.

Thereafter, each article title and abstract were examined to ensure that its central theme was customer experience research on metaverse platforms. At this stage, 545 articles were removed. Based on the above inclusion criteria, 3107 articles were removed, leaving only 1460 articles for further analysis.

Based on the PRISMA framework, 1460 papers were included in the study and further analyzed using Biblioshiny tool of the R software. R provides exceptional capabilities for scientific data mapping through its Biblioshiny application that allows researcher to have deeper insight into the research streams and evolutions (Wasiq, Bashar, Nyagadza, et al., 2024). Similar methods have

been applied by scholars in the fields of social science. Some well-known studies are "Adoption and applications of blockchain technology in marketing: A retrospective overview and bibliometric analysis," "Bibliometric and Scientometric analysis on CSR practices in the banking sector," "A bibliometric review of the development in e-tourism research" (Hassan et al., 2023; Rabbani, Alshaikh, et al., 2021; Singh & Bashar, 2023). Descriptive bibliometric insights, such as publication trends, best author(s), most influential journal(s), most contributing countries etc., were gathered using Biblioshiny.

The VOSviewer application—one of the most widely used tools for visualizing the scientific landscape in a given research discipline—was used to run cluster analysis to discover research streams and themes in the domain of customer experience in metaverse (Rabbani, Bashar, et al., 2021). Some well-known studies that have applied network analysis techniques are "A bibliometric review of online impulse buying behavior literature," "Current state and future directions of green and sustainable finance: a bibliometric analysis," "The influence of Covid-19 on consumer behavior: a bibliometric review analysis and text mining" (Naeem et al., 2023; Rabbani, Bashar, et al., 2021; Wasiq, Bashar, Khan, et al., 2024). The co-citations and Keyword co-occurrence analysis would be conducted using VOSviewer to analyze relationships among authors and keywords.

The TCCM framework is the final step in the analysis process. It is one of the methods most applied in synthesizing research outputs in terms of theories, contexts, characteristics, and methodologies to give a comprehensive idea of the overall understanding and underlying gaps in each domain of research. Some of the studies that adopted TCCM are "The influence of Covid-19 on consumer behavior: a bibliometric review analysis and text mining," "Why is the Interest in Blockchain Still on the Decline? Blockchain Challenges, Review, and Research Agenda," "Panic buying research: A systematic literature review and future research agenda" (Billore & Anisimova, 2021; Hentzen et al., 2022; Saurabh et al., 2022). To ensure coding reliability, two researchers independently classified 20% of articles ($n = 176$), achieving strong inter-rater agreement (Cohen's kappa = 0.82–0.88 across TCCM dimensions). Discrepancies were resolved through consensus with a metaverse CX expert. Results were validated through expert review (10% sample, 89% agreement). Table 1 below summarizes the four-stage review methodology.

Results and discussion

Data characteristics

Table 2 below describes important characteristics of the data. It depicts research trends in consumer experience in metaverse marketing. The sample data in this analysis was collected from 2000 to 2025 and consists of 1460 articles published in 509 journals/sources. These documents are written by 3938 authors.

Only 114 of the documents analyzed were found to be single-authored and the rest were produced collaboratively. Table 2 also demonstrates the important aspect of aging, with the average age of all the documents analyzed standing at 2.89, showing the recency of research in customer experience on metaverse. The average number of citations per document stands at 34.09, reflecting the use and application of these studies by scholars. This data shows exponential growth in this domain and collaboration among authors throughout the world.

Annual publications and citations trend

The following Figure 2 is a visual representation of the publications and citation trends in the research domain of customer experience on metaverse. The blue line indicates the number of

Table 2. Data characteristics.

Step	Procedure	Tool/technique	Purpose
1	PRISMA screening	Scopus, Excel, R ShinyApp	Systematically identify and filter relevant studies
2	Bibliometric analysis	R-bibliometrix, Biblioshiny	Quantify publication trends, citations, and influential works
3	Network analysis	VOSviewer	Analyze relationships between authors and keywords
4	TCCM framework	Excel (manual coding)	Synthesize theories, contexts, characteristics, and methods in the literature

Source: Authors' conception (2025).

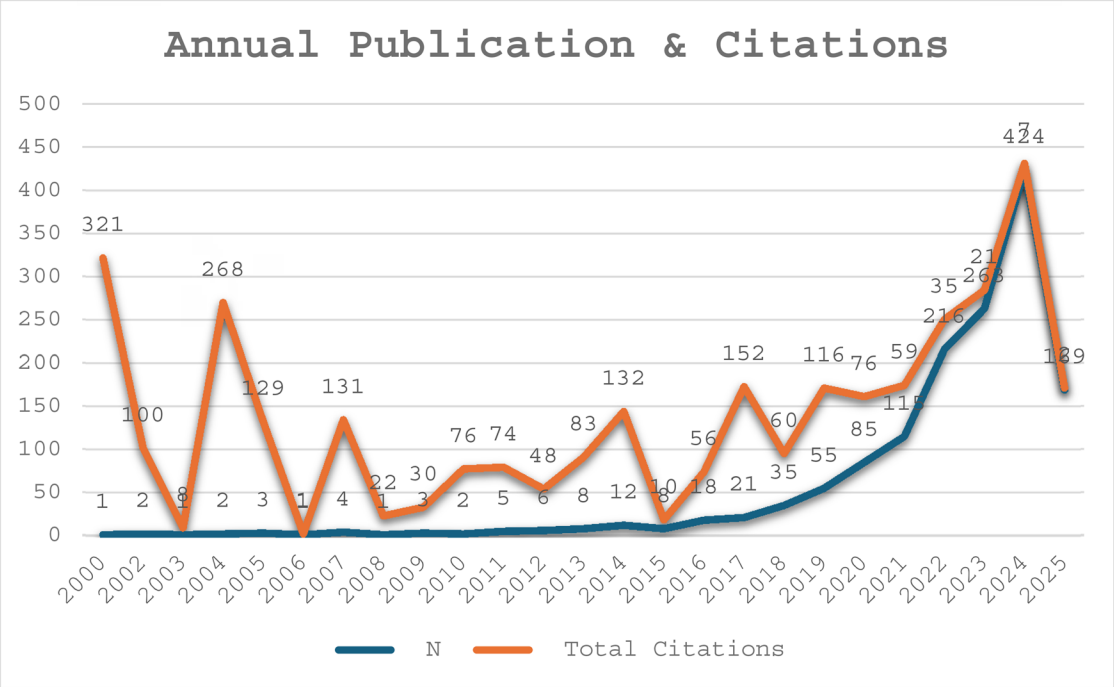

Figure 2. The publication and citations trends in CX on metaverse research.
Source: Authors' conception (2025).

Table 3. Top 10 most influential authors.

Most influential authors					
Based on total citations		Based number of papers		Based on *h*-index	
Author	Total citations	Author	Number of papers	Author	*h*_index
Hollebeek LD	1607	Rather Ra	14	Rather Ra	12
Mahr D	1367	Hollebeek LD	14	Hollebeek LD	11
De Ruyter K	1273	Mahr D	12	Mahr D	11
Flavián C	1682	De Ruyter K	10	De Ruyter K	10
Buhalis D	1255	Chylinski M	9	Chylinski M	9
Grewal D	1655	Hilken T	10	Hilken T	9
Roggeveen Al	1360	Keeling DI	9	Keeling DI	9
Hoffman DI	2183	Khan I	10	Khan I	8
Novak TP	2183	Heller J	9	Heller J	7
Yung Y-F	2183	Liu Y	10	Liu Y	7

Source: Authors' conception (2025).

articles published annually and the brown line represents the total number of citations (Figure 2). It is worth noting that the published articles have been heavily cited, despite being low in number, demonstrating the interest of the scientific community in this area of research. Publications registered a steady increase, since 2000, for almost a decade (2011–2012), followed by an increasing trend (2013–2018) and an exponential increase as of the data extraction date.

The publication citations present upward trends in this research domain, providing greater insight into the evolution of metaverse consumer experience, consumer visibility, and research quality in the field of metaverse marketing and consumer engagement.

Prolific authors

Table 3 shows the impact of authors based on total citations, number of papers, and *h*_index. The top author is "Hollebeek LD"—whose total number of citations is 1607—who is ranked second best author in terms of number of papers published and h-index, having published 14 articles and 12 h-indices respectively. The second most influential author—based on total number of citations—is "Mahar D," whose works have

been cited 1367 times, and who is ranked third based on number of papers published (12) and h-indices (11). The third author in this table—based on total citations—is "De Ruyter K," who is ranked 4th, based on published papers (10) and citations (1273).

Other authors have also contributed significantly to the understanding of virtual environments and the development of consumer experience, consumer engagement, and consumer brand engagement on the metaverse platform.

Influential journals

The most influential journals in research on consumer experience on the metaverse platform are presented in Table 4 hereafter. It depicts important sources based on total citations, numbers of papers, and *h*_index. The "Journal of Retailing and Consumer Services" is the top ranked journal and attracted the highest number of citations (3915). The journal has published 87 articles and achieved an *h*_index of 37. This journal is ranked first in all formats in terms of total number of citations, number of papers, and *h*_index.

The "Journal of Business Research" is ranked second in terms of total citations (3736), number of papers published (40), and has attracted 21 of *h*_index. The third source/journal is the "International Journal of Contemporary Hospitality Management," which has 1686 citations, published 39 articles, and received 15 *h*_indices. Various sources/journals with large number of papers may not be very influential if they have not garnered enough citations. Other sources/journals indicate an increase in the number of articles published over the period under consideration. The table indicates recent trend sources/journals will continue publishing on various aspects of consumer experience and consumer engagement in the field of metaverse marketing research, and new journal/sources will add some value in the future. It also reveals that most sources/journals started publishing articles on metaverse marketing, consumer experience, and engagement with the evolution of metaverse platforms.

Top contributing countries

The top 10 countries contributing to the research and development of metaverse customer experience are shown in Figure 3.

China is the top ranked country in terms of publications, with 668 published articles. India and the USA are second and third ranked contributing countries, with 539 and 428 published articles, respectively. It is evident that the large economies like India and China are spending heavily in the understanding, adoption, and application of immersive technologies to engage with

Table 4. Top 10 most influential sources.

Top 10 important sources					
Based on total citations		Based on numbers of papers		Based on *h*_index	
Source	Citations	Source	No of papers	Source	*h*_ index
Journal of Retailing and Consumer Services	3915	Journal of Retailing and Consumer Services	87	Journal of Retailing and Consumer Services	37
Journal of Business Research	3736	Journal of Business Research	40	Journal Of Business Research	21
International Journal of Contemporary Hospitality Management	1686	International Journal of Contemporary Hospitality Management	39	International Journal of Contemporary Hospitality Management	15
International Journal of Hospitality Management	1469	International Journal of Retail and Distribution Management	30	International Journal of Retail and Distribution Management	15
International Journal of Information Management	1746	International Journal of Hospitality Management	29	International Journal of Hospitality Management	14
Technological Forecasting and Social Change	1492	Journal of Services Marketing	18	Computers In Human Behavior	13
Journal of Service Management	1572	Psychology And Marketing	20	International Journal of Information Management	12
Journal of Retailing	1346	Technological Forecasting and Social Change	23	Journal of Services Marketing	12
Journal of Interactive Marketing	1441	Sustainability (Switzerland)	36	Psychology and Marketing	12
Marketing Science	2183	Cogent Business and Management	19	Technological Forecasting and Social Change	12

Source: Authors' conception (2025).

Figure 3. Top 10 countries in publications.
Source: Authors' conception (2025).

Table 5. Top 10 most influential research papers.

Most significant papers				
Author	Journal	Title of papers	Total citations	TC per year
Novak TP	Marketing Science	Measuring customer experience in online environments: A structural modeling approach	2183	83.96
Flavián C	Journal of Business Research	The impact of virtual, augmented and mixed reality technologies on the customer experience	872	124.57
Grewal D	Journal of Retailing	Customer experience management in retailing: an organizing framework	740	82.22
Matarazzo M	Journal of Business Research	Digital transformation and customer value creation in Made in Italy SMEs: A dynamic capabilities perspective	676	135.20
Buhalis D	Journal of Service Management	Technological disruptions in services: Lessons from tourism and hospitality	663	94.71
Sun Y	Electronic Commerce Research and Applications	How live streaming influences purchase intentions in social commerce: An IT affordance perspective	658	94.00
Zhang H	Information & Management	What motivates customers to participate in social commerce? The impact of technological environments and virtual customer experiences	644	53.67
Chung M	Journal of Business Research	Chatbot e-service and customer satisfaction regarding luxury brands	598	99.67
Hoyer WD	Journal of Interactive Marketing	Transforming the customer experience through new technologies	583	97.17
Hollebeek LD	Journal of Interactive Marketing	Digital content marketing's role in fostering consumer engagement, trust, and value: Framework, fundamental propositions, and implications	510	72.86

Source: Authors' conception (2025).

customers virtually to grow metaverse commerce. Other countries, such as the UK, South Korea, and Italy are also contributing articles relating to the field of metaverse marketing and consumer experience.

Influential research papers

Table 5 shows the most influential research papers, detailing the authors, title of paper, journal/sources, total citations, and total citations per year. The most influential paper registered is "Measuring the customer experience in online environments: A Structural Modelling Approach," which was published in journal of marketing science in the year 2000. This paper is ranked top and attracted 2183 citations globally and ~84 total citations annually.

It reveals the importance of customer experience in online environments to researchers around the globe. The second most influential paper is "The impact of virtual, augmented and mixed reality technologies on the customer experience," published in the Journal of Business Research in 2019. This article has been cited 872 times globally and registered a total of 124 citations per year. This article has gained a lot of attention globally from scholars and researchers about customer experiences with metaverse marketing tools, such as virtual reality, augmented reality, and mixed reality. The third most influential research paper, "Customer Experience Management in Retailing: An Organizing Framework," was published in the Journal of Retailing in 2017. It has attracted significant total global citations (740) and an annual total of 82

Table 6. Top 10 most influential affiliations.

Affiliation	Articles
Maastricht University	41
Hong Kong Polytechnic University	35
University of Naples Federico II	28
Lebanese American University	25
Yonsei University	25
University of Central Florida	24
University of Houston	20
Bina Nusantara University	19
Manchester Metropolitan University	19
Hanyang University	18
Saudi Electronic University	18
Swinburne University of Technology	18

Source: Authors' conception (2025).

citations. It is worth noting that all top three articles on consumer experience on metaverse are intended for business and marketers to design the metaverse marketing strategies for consumers.

Influential affiliations

The most influential affiliations contributing to the study's understanding of the phenomenon of customer experience on metaverse platform are presented in Table 6. This table represents the number of articles published by corresponding affiliations. "Maastricht University" is the most influential affiliation, having published 41 articles on consumer experience related research.

Maastricht University is a well-recognized public research university in the Netherlands whose researchers have placed great importance on understanding the consumer experience and metaverse marketing. "The Hong Kong Polytechnic University" is the second most influential affiliations and has published 35 quality articles in the domain of consumer experience and metaverse virtual platform. This university is ranked 67 among the best global universities and leading research in multiple domains, such as the social sciences. The "University of Naples Federico II" is ranked third in the table, having published 28 top quality research papers on various aspects of customer experience and metaverse marketing. Various other universities in the table have also contributed noteworthy publications on customer experience and metaverse platform.

Co-citations analysis

Co-citations analysis is used to explore the relatedness of two articles being cited together by a third article, showing that these works are similar in nature, having same core research theme (Hassan et al., 2023). Co-citations analysis was used to explore the most important research themes in the domain of customer experience on metaverse. The analysis was conducted using VOSviewer application, and only authors with 10 or more citations were selected in network creation. The co-citations network thus obtained is presented in Figure 4. It is made up of three clusters. The largest cluster consists of 421 authors, who investigated immersive technologies and user experience. One of the prominent authors in this cluster is Kim J, who published important papers including, amongst others, "Impact of artificial intelligence (AI) chatbot characteristics on customer experience and customer satisfaction," "Augmented reality in delivering experiential values: moderating role of task complexity," "Immersive interactive technologies and virtual shopping experiences: Differences in consumer perceptions between augmented reality (AR) and virtual reality (VR)."

Authors, such as Sarsted, M., Hair, J. F., Fornell, C., etc., have investigated the importance of 3D technologies like AR/VR, Human Computer Interactions, and how these help users in perceiving, exploring, navigating, and having an overall experience on metaverse (Hamilton et al., 2021). Researchers also investigated important factors influencing metaverse, such as design factors for metaverse application (Calandra et al., 2024), and the cognitive and behavioral response of customers to metaverse technologies (Zuo & Shen, 2024), etc.

The second largest cluster of this network—presented in green—contains the works of 336 authors. Their research focuses on the psychological behavior of the consumer in the metaverse. Some key authors in this cluster are Wang Y, Zhang Y, Li X, Wang Z, Li H, who investigated various aspects of human psychological response to immersive virtual environments (Tan & Salo, 2023). Some noteworthy studies in this cluster are "AI and Supportive Technology Experiences of Customers with Visual Impairments in Hotel, Restaurant, and Travel Contexts," "The Impact of AI-Personalized Recommendations on Clicking Intentions: Evidence from Chinese E-Commerce,"

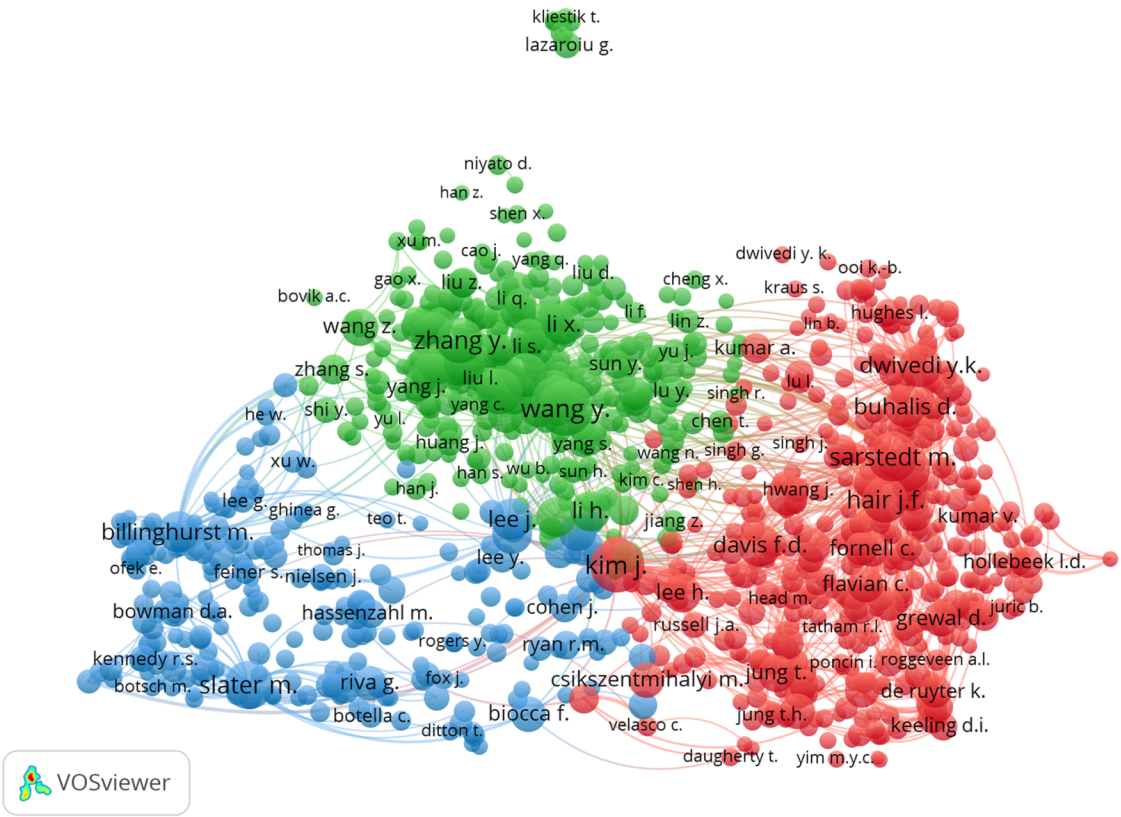

Figure 4. Co-citation analysis.
Source: Authors' conception (2025).

"The Impact of Virtual Technology on Students' Creativity: A Meta-Analysis," etc. This cluster also sheds light on the demographic variables and other motivational antecedents and how they shape behavior in virtual environments (Liow et al., 2022). One important theme in this cluster is consumers' mental level and well-being following prolonged exposure to virtual environments (Zhu et al., 2023).

The smallest cluster of this co-citation network is made up of 243 authors, who investigated essential components of AI driven learning and engagement on metaverse (Al Seiari et al., 2023). Key contributing authors are Slater M, Riva G, Bowman D.A, Fox J, Ryan J.M, etc. They explored the role of interactive virtual learning systems, personalization, and brand experience in overall customer engagement on the metaverse (Hudson, 2022; Saraf et al., 2023). Important studies in this cluster include, amongst others, "Usability and Users' Experience of Executive-Functions Innovative Tool (Exit 360°)," "Beyond Traditional Training: Integrating Data from Semi-Immersive VR Dual-Task Intervention in Parkinsonian Syndromes. A Study Protocol," "Modelling the Social Networking Experience Objectifying the Subjective." The cluster explores the use of metaverse technologies by businesses and educators to leverage training purposes and sales tactics through AI-driven personalized virtual engagements (Wasiq, Bashar, Nyagadza, et al., 2024; Yuan et al., 2023).

Cross-cluster connections

Technology-psychology interface

The largest cluster focuses on immersive technologies, feeding directly into the second cluster's psychological research, which suggests that user experience designs are fundamentally shaping mental health outcomes in virtual environments.

Experience-learning nexus

The consumer experience research from the first cluster intersects with the AI-driven learning research of the third cluster that indicates that entertainment and educational metaverse applications share similar engagement mechanisms.

Critical ramifications

Methodological convergence

The clustering reveals an emerging consensus around human-centered design principles, with authors across clusters emphasizing user perception, cognitive load, and behavioral adaptation as core evaluation metrics.

Scalability challenges

The demographic and motivational factors identified in the psychological cluster suggest that metaverse adoption may face significant barriers relating to individual differences in technology acceptance and digital literacy.

Ethical implications

The convergence of AI personalization (the smallest cluster) with research on psychological well-being (second cluster) raises questions about manipulative design practices and the need for protective frameworks in virtual environments.

Commercial-academic divide

The business applications' focus on multiple clusters indicates potential tension between the commercial exploitation of engagement mechanisms and academic concerns about user welfare and authentic learning outcomes.

Measurement standardization

The diversity of methodological approaches across clusters suggests an urgent need for standardized metrics to evaluate metaverse effectiveness across different domains and user populations.

Keywords co-occurrence analysis

The keyword co-occurrence analysis is a method used to investigate the semantic identical keywords being used in a research article. When many authors are using similar keywords, a research stream evolves. We deployed VOSviewer application to create a keywords co-occurrence network, including only those keywords used in the analysis that occurred at least 45 times. The network so obtained is made up of four clusters, as shown in Figure 5.

The largest cluster of this network contains 486 keywords and contains research themes relating to immersive technologies and user experience. This cluster shed light on technological bases and sensory experiences in the virtual world (Hudson, 2022). The most prominent keywords in this cluster are virtual reality (Lee et al., 2023), augmented reality (Wasiq, Bashar, Nyagadza, et al., 2024), human computer interaction (Kliestik et al., 2022), user's experiences (Kliestik et al., 2022), helmet-mounted displays, haptic interfaces, tactile feedback, three-dimensional computer graphics, quality of experience (QoE), bandwidth, delay, task analysis, teleoperation, vibration (AlGerafi et al., 2023; Ario et al., 2022). Studies in this cluster focus on the interactions of hardware and software in providing amazing experiences to users on the metaverse. It also includes important aspects, such as feedback mechanism, digital availability like bandwidth, etc.

The cluster presented in green is the second largest of the network and is made up of 350 keywords. It explores human elements in virtual environments by examining physiological responses, cognitive processes, and psychological states (AlGerafi et al., 2023; Ario et al., 2022). It considers the response of the human body and mind to virtual stimuli. The important keywords in this cluster include, amongst others, *human, physiology, young adult, hand brain computer interface, motion, phobic stimulation, postural balance, body equilibrium, diseases, color, perception, cognition, psychology, anxiety, electroencephalography*. The keyword electroencephalography shows that research studies are being conducted for measuring the brain activities of the users with the help of a small sensor attached to the scalp (Ario et al., 2022). It is one of the most evolving neuromarketing concepts and widely applied in consumer research.

The third cluster is represented in blue and consists of 141 keywords. A careful examination of this cluster reveals that it focuses on human behavior and research methodologies in the metaverse (Saboune, 2022). The most frequently occurring keywords in this cluster are adult, aged, very elderly, stroke, clinical article, psychometry, priority journal, surgical training, treatment

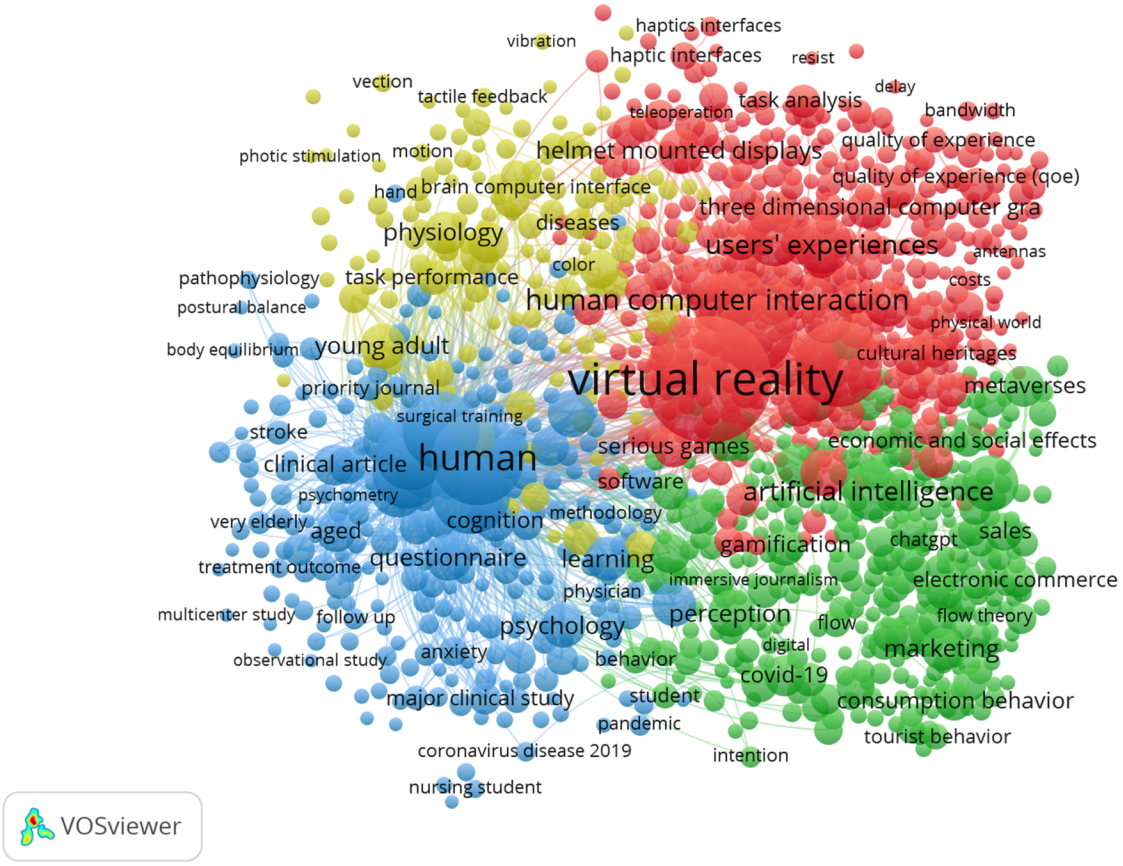

Figure 5. Keywords co-occurrence analysis.
Source: Authors' conception (2025).

outcome, questionnaire, follow-up, multicenter study, observational study, major clinical study, learning, behavior, intention, etc. This cluster shows how various research methods are deployed to study and understand the user's behavior on the metaverse platform. It suggests that consumer behavior on the metaverse is dynamic and rapidly changing, such that specific or mixed methods are necessary to study and understand its dynamics (Koni & Ashwini, 2023).

The last and smallest cluster of this network consists of 141 keywords, represented in blue. It is centered around important concepts relating to the metaverse and emerging concepts (Munna et al., 2023). The most influential keywords in this cluster are metaverses, artificial intelligence, serious games, software, gamification, immersive journalism, physician, flow theory, marketing, consumption behavior, tourist behavior, economic and social effects, cultural heritage, ChatGPT, sales, electronic commerce, etc. This shows the application of metaverse technologies and applications for entertainment, information dissemination, economic activities, and societal issues (Efendioglu, 2023). Keywords, such as ChatGPT, AI reveal the importance of these technologies in shaping overall consumer experience on metaverse (Wasiq et al., 2023).

Cross-cluster connections

Hardware-human interface

The largest cluster's focus on haptic interfaces and tactile feedback directly correlates with the second cluster on physiological responses and postural balance research, revealing how sensory technology design impacts human neurological adaptation.

Methodology-experience bridge

The third cluster's research methodologies (questionnaires, observational studies) are being applied to measure user experiences and quality of experience (QoE) concepts from the largest cluster,

establishing empirical frameworks for virtual environment evaluation.

Behavioral-commercial nexus

The keywords of the smallest cluster, relating to consumption behavior and electronic commerce, connect with the third cluster's behavioral intention research, suggesting that commercial metaverse applications are driving methodological innovations in consumer psychology.

Neurological-application convergence

The electroencephalography research from the second cluster intersects with the smallest cluster's serious games and gamification concepts, indicating that brain-computer interfaces enable personalized virtual experiences.

Critical ramifications

Technical-biological optimization

The convergence of bandwidth/concerns about delays (largest cluster) with physiological responses (second cluster) suggests that network infrastructure limitations may directly impact user health and cognitive performance in virtual environments.

Methodological fragmentation

The diversity of research approaches in the third cluster indicates that metaverse behavioral studies lack standardized evaluation protocols, potentially limiting reproducibility and cross-platform comparisons.

Demographic stratification

Age-related keywords (young adult, aged, very elderly) in the third cluster, combined with the second cluster's cognitive processes, suggest that metaverse adoption may create digital divides based on neuroplasticity and technological familiarity.

Therapeutic-commercial tension

The medical keywords (stroke, surgical training) in the third cluster, alongside commercial applications (sales, marketing) in the smallest cluster, reveal potential conflicts between therapeutic efficacy and profit-driven engagement optimization.

AI integration imperative

The prominence of keywords relating to ChatGPT and artificial intelligence in the smallest cluster, combined with human-computer interaction research from the largest cluster, indicates that AI-mediated interfaces are becoming essential for metaverse scalability and personalization.

TCCM framework

The TCCM framework was drawn up from the selected research papers. The data sample of 1460 publications was evaluated to determine their inclusion in the TCCM analysis. To ensure analytical consistency and relevance, a multi-stage exclusion criterion was applied. First, 168 studies were excluded for lack of explicit theoretical engagement, since they neither cited established theories nor proposed conceptual frameworks relevant to the research domain being studied. Next, 134 methodologically inadequate papers—such as case studies, those with poorly described research designs, and insufficient sample sizes—were removed. Finally, 80 publications were excluded due to contextual mismatches, including studies focusing on old digital technologies that are no longer in use and have relatively little applicability in metaverse research. This filtering process aligned with systematic review best practices (Sharma et al., 2020), leaving 878 high-quality articles that met the criteria for TCCM synthesis. In addition to spotlighting theories, such as the TAM, Flow Theory, and the Grounded Theory, this study also provides crucial theoretical gaps in the study of CX metaverse research. Theories, such as the Assemblage Theory and Perceived Value Theory are invaluable to the debate on digital environments and assessments of immersive CX. However, they are barely applied in scholarly literature, highlighting an important gap for future research that could benefit CX providers and customers, given the key role AI plays in shaping customer journeys in the metaverse. Theories, such as the Self-Determination Theory and Cognitive Appraisal Theory could present an

opportunity to deepen comprehension of user motivation, autonomy as well as emotional engagement in the CX metaverse.

Theory

The top 15 most frequently applied theories in customer experience research were identified, as shown in Table 7. The Technology Acceptance Model (TAM) emerged as the most frequently used theory, appearing in 309 studies. This shows the significant orientation of researchers toward understanding behavioral aspects relating to metaverse and user acceptance or adoption of a new technology (Bassiouni & Meshreki, 2025). The reference to the Flow Theory in 169 studies highlighted researchers' inclination toward examining user engagement (Zuo & Shen, 2024), immersion, or optimal experience, especially in games, learning, or creative work (Neugebauer et al., 2024). The application of Grounded Theory was evident in 101 studies, showing researchers' focus on generating a new theory from qualitative data without predefined frameworks (Chen et al., 2025). TAM and Flow Theory are deductive frameworks. TAM explains technology adoption through perceptions and Flow Theory describes user engagement. Grounded Theory, however, is an inductive qualitative methodology used to generate theory from data rather than testing predefined hypotheses. The inclusion of these theories in the table below is based on the frequency of its occurrence in the reviewed literature and not on its role as an application in theoretical framework.

Table 7. Top 15 theories in the research domain of customer experience in the metaverse.

Theory	Frequency
Technology Acceptance Model (TAM)	309
Flow Theory	169
Grounded Theory	101
Elaboration Likelihood Model	50
Motivation Theory	28
Social Cognitive Theory	26
Affordance Theory	24
Construal Level Theory	21
Self-Determination Theory (SDT)	21
Cognitive Appraisal Theory	19
Stimulus-Organism-Response (S-O-R) Theory	19
Social Identity Theory	17
Unified Theory of Acceptance and Use of Technology (UTAUT2)	17
Perceived Value Theory	7
Assemblage Theory	3

Source: Authors' conception (2025).

However, other theories were also featured, with researchers applying Elaboration Likelihood Model ($n = 50$) to processing persuasive messages (Feijoo et al., 2025), and Motivation Theory ($n = 28$), to studying what drives human behavior in user engagement (Cheng, 2025). Social Cognitive Theory ($n = 26$) and Affordance Theory ($n = 24$) were also frequently applied, investigating learning through observation, behavioral change, environmental influence on behavior, or understanding how features of an object or system invite certain actions, especially in design or human-computer interaction (Qiu et al., 2024; Wang et al., 2024).

Theories, such as Construal Level Theory ($n = 21$), Self-Determination Theory (SDT) ($n = 21$), Cognitive Appraisal Theory ($n = 19$), and Stimulus-Organism-Response (S-O-R) ($n = 19$) feature, to some degree, in researches focused on psychological distance (time, space, social) affecting perception or decision-making and analyzing autonomy, competence, and relatedness (Cheng et al., 2024; Li et al., 2025; Qiu et al., 2024; Tyack & Mekler, 2024). This also shows the shift toward exploring people's emotional response toward external stimuli and UX.

The application of other theories, such as Social Identity Theory ($n = 17$), UTAUT2 ($n = 17$), Perceived Value Theory ($n = 7$), and Assemblage Theory ($n = 3$) suggest that researchers are interested in exploring emerging areas through modeling technology using variables, such as habit, hedonic motivation, value-for-money and exploring complex systems or networks made up of human and non-human actors, especially in sociotechnical or postmodern research (Goyal & Deshwal, 2024; Hu et al., 2024; Kim & Kyung, 2025; Zhu et al., 2024). However, despite their relevance, these frameworks remain underexplored and reflect potential gaps in current metaverse customer experience research. Perceived Value Theory studies behavioral aspects of users' cost-benefit evaluation and loyalty in virtual economies, yet it has been least used theory in metaverse studies. Similarly, Assemblage Theory examines the diverse digital, social, and material elements affecting user experiences, making it

possible to understand the complexity of the metaverse (Goyal & Deshwal, 2024). This theory is not used extensively in exploring technology adoption, user immersion, experiential and value-based perspectives, etc. Future research could benefit from incorporating the above-mentioned theories to capture the holistic nature of virtual customer engagement.

Context

In the contextual analysis of customer experience research in the metaverse, a diverse yet thematically converging set of focus areas was identified. Within the 878 studies analyzed, ten dominant contexts emerged, as shown in Table 8, which could be further divided into 4 dominant contexts:

Customer experience in the metaverse

The end-to-end experience that customers go through in virtual retail environments, namely: Customer Journey (Alexander et al., 2025), Immersive Experience (Xu et al., 2025), Virtual Product Experience (Na et al., 2024), and Virtual Customer Service (Issac Sam et al., 2025). These contexts may be grouped together to identify a construct that is directly related to touchpoints, seamless service, and ensuring user satisfaction in digital spaces. Research focused on customer journeys typically describes the stages users go through from awareness to post-purchase. The Virtual Customer Service investigates how brands can replicate or innovate support mechanisms in metaverse settings, ranging from avatars to real-time service desks, affecting user satisfaction and loyalty (Qu et al., 2023). The immersive experience and virtual product experience are also tied to flow, interaction design, sensory or emotional involvement in metaverse environments (Abumalloh et al., 2024).

Table 8. Context and description of factors influencing customer experience in metaverse.

	Context	Description
1	Metaverse retailing	How consumers browse, interact with products, and make purchases within virtual stores.
2	Brand engagement	Strategies and methods that brands use in the metaverse to connect with and engage consumers.
3	Immersive experience	The impact of virtual reality, augmented reality, and mixed reality elements on user interaction and feeling of presence.
4	Customer journey	Analysis of the stages and touchpoints that customers experience while interacting with brands and services in the metaverse.
5	Social interaction	How users connect, form communities, and interact with each other within virtual environments and its effect on experience.
6	Virtual product experience	How consumers perceive, evaluate, and interact with digital goods and virtual representations of physical products.
7	Trust and security	Factors influencing user confidence in metaverse platforms, transactions, and the protection of their data and digital assets.
8	Virtual customer service	Methods and effectiveness of providing support and assistance to customers within metaverse environments.
9	Well-being and ethics	Examination of the psychological impact of, and ethical considerations arising from, extended engagement in the metaverse.
10	Industry-specific applications	How the metaverse and customer experience are being uniquely shaped and applied across different sectors (e.g., fashion, tourism, gaming).

Source: Authors' conception (2025).

Brand and consumer engagement

These contexts reflect the ways in which consumers engage with brands and communities, building connections through interactive or social means (Nawaz et al., 2025). These two major elements emerged while examining the factors describing brand relationships with consumers in the metaverse. Researchers found these elements to be strongly associated with immersive branding, gamification, and personalized marketing, which impact consumer attitudes and behaviors (Xu et al., 2023). Brand engagement is also a widely studied area as it focuses on how companies leverage virtual platforms to build connections with consumers (Wang et al., 2025).

Trust, ethics, and well-being

Focused on consumers' psychological comfort, data protection, ethical issues, and mental/physical health in virtual environments, these contexts have gained prominence in emerging research areas (X-J et al., 2025). Concerns around privacy, data protection, and platform reliability have become critical for user retention. Studies are also exploring these factors in the context of digital addiction, data privacy, ethical advertising, and psychological safety.

Metaverse-specific retail and industry use

These cover the broader context of how retailing and other sectors are adapting to and using the metaverse. Metaverse Retailing was a prominent,

with researchers investigating how consumers navigate, evaluate, and purchase products within immersive virtual stores (Kim et al., 2025). This study's empirical findings have theoretical and practical implications for metaverse retailing and the customer experience journey. This includes exploring sectoral case studies (e.g., fashion, automotive, real estate) and how metaverse retail is being customized for different industries or sectors (Gleim et al., 2025).

Characteristics

Table 9 outlines ten key characteristics of customer experience research in the metaverse. The antecedents that primarily influence user perceptions and behaviors within metaverse environments are immersive technology quality, user interface and experience design (UI/UX), personalization, and security (Batch et al., 2024; Lobo et al., 2025; Xia & Shannon, 2025). These factors can be characterized as foundational to the ways in which users interpret and engage with virtual experiences. Factors, such as user demographics, technological familiarity, cultural context, and the regulatory landscape can be identified as moderators that clearly impact the nature of users' responses (Hossain et al., 2024; Ma et al., 2025; Skubis, 2025; Whittaker, 2025). On the other hand, constructs, such as perceived immersion, usability, social connection, trust, and emotional resonance can be identified as mediators (Bunea et al., 2024; Garrison et al., 2025; Moreira et al., 2024; Pillai et al., 2025). These mediators allow for an understanding of the processes through which the antecedents transform into experiential outcomes. Lastly, the outcomes reveal the core dimensions of customer experience through presence, flow, satisfaction, loyalty, trust, and behavioral intention, as represented in immersive digital settings (Jp & Weyers, 2024).

To enhance theoretical coherence, the CX characteristics were grouped into broader thematic domains: psychological, technological, experiential, and social. This classification provides a structured view to understand the influence of various features on CX in virtual environments (see Table 10).

Personalization and interoperability

These two characteristics were found to influence the customer journey in the metaverse. Personalization essentially helps to customize

Table 9. Characteristics of CX research in metaverse.

Antecedents	Descriptions	Moderators	Mediators	Outcome (CX effects)
Immersive technology quality	Realism and responsiveness of VR/AR, haptics, and sensory feedback.	Type of device, user technology familiarity	Perceived immersion, sensory stimulation	Presence, flow experience, satisfaction
UI/UX design	Intuitive, seamless navigation and interface logic in 3D space.	Digital literacy, age	Perceived ease of use, system usability	Enjoyment, reduced friction, continued usage intention
Personalization	Customizing avatars, experiences, and environments based on user preferences.	Privacy concerns, culture, user identity orientation	Relevance, identification, personal fit	Emotional engagement, loyalty, willingness to co-create
Interoperability	Asset/identity transfer across platforms or virtual worlds.	Platform openness, regulation, tech standards	Perceived control, convenience	Trust in ecosystem, cross-platform engagement
Social presence and community	Real-time social interaction and a sense of belonging.	Personality traits, network effects	Social connection, collective identity	Community loyalty, social engagement, co-experience value
Security and privacy	Safety of personal data, assets, and identity.	Prior experiences, regulation, platform reputation	Trust, perceived risk	Platform loyalty, willingness to share data, advocacy
Brand authenticity	Genuine brand integration and storytelling in virtual space.	Brand congruence with user values	Emotional resonance, brand credibility	Brand trust, emotional loyalty, intention to purchase
Gamification	Use of rewards, levels, missions to drive engagement.	Motivation type (intrinsic/extrinsic), reward type	Enjoyment, perceived challenges	Deeper engagement, stickiness, behavioral intention
Content quality and storytelling	Narrative strength and content richness of virtual experience.	Attention span, content format	Narrative transportation, emotional connection	Memory recall, brand affinity, immersive satisfaction
Accessibility and inclusivity	Ease of access for users with diverse abilities and backgrounds.	Socioeconomic status, device access	Perceived fairness, empowerment	User satisfaction, equitable participation, inclusion loyalty

Source: Authors' conception (2025).

Table 10. Characteristics of CX research in metaverse.

Domain	Characteristics
Psychological	Trust, attitude, satisfaction, loyalty, perceived value, emotional engagement
Technological	Immersion, interactivity, presence, telepresence, gamification
Experiential	Flow, enjoyment, convenience, esthetics, surprise, novelty
Social	Co-creation, personalization, community engagement, social presence

Source: Authors' conception (2025).

experiences to meet individual preferences and make them emotionally engaging. These experiences lead to deeper user engagement, increased loyalty, and a greater willingness to respond in virtual spaces (Hu et al., 2024). However, the effectiveness of personalization is determined by privacy concerns, cultural differences, and users' comfort in sharing personal information online. These factors affect how engaged users are and how much information they are willing to share. Interoperability, meanwhile, refers to the seamless transfer and usability of digital identities, assets, and avatars available through multiple metaverse platforms (Sm & Jm, 2023). Therefore, personalization and interoperability seem to be working together to create tailored experiences and a unified digital ecosystem, enhancing overall user experience in immersive environments.

Social presence, community, security, and privacy

Crucial elements that guide users' metaverse experiences are social presence and security/privacy. These may be identified as the foundational pillars of trust. Social presence refers to feeling connected to others in real-time and creating a sense of belonging to a group and shared interests. This connection enhances the overall experience, making it more engaging and interactive. The experience of social presence is influenced by personality traits or individual characteristics that shape how users interact and engage, as well as network effects influenced by the size and activity of user communities, making the experience more dynamic and engaging (Fa et al., 2023; Lee et al., 2024). In other words, users are likely to perceive strong social bonds and communal involvement. At the same time, security and privacy play a critical role in developing user confidence. As individuals navigate in virtual environments, they become more concerned about data protection and identity security. These concerns relate to past experiences and platform credibility. Platforms with robust and transparent security protocols build higher levels of trust. This encourages users to share data on, remain loyal to, and advocate for the platform (Sd, 2024).

Brand authenticity and gamification

Two other key factors that can be grouped are brand authenticity and gamification, which enhance user engagement. These are vital in influencing user perceptions created through virtual experiences and making them more engaging and immersive. Accordingly, when the brand's core values align with user expectations, it leads to greater credibility and trust (X-J et al., 2025). Authenticity further increases loyalty and the likelihood of enhancing positive attitudes toward the brand. Gamification involves motivational elements, such as rewards, challenges, etc., resulting in sustained engagement. The impact of these elements depends on factors, such as the type of motivation they evoke and the structure of the rewards provided (Bai et al., 2024). Enjoyment and perception serve as mediators in shaping users' involvement and their continued interaction with the platform (Rese et al., 2017).

Content quality, storytelling, and accessibility and inclusivity

The immersive power of the metaverse depends on content quality and the strength of storytelling. Rich content and narratives are means of narrative transportation that can increase emotional engagement (Sreejesh & Ghosh, 2025). This plays an important role in shaping user outcomes, such as memory retention, brand affinity, and overall immersive satisfaction. These effects are moderated by users' attention spans and the format in which content is delivered. These are also critical factors because of their inclusiveness for the users' diverse backgrounds (Ma et al., 2025). The contextual variables moderate user experience. Perceptions of fairness and personal empowerment remain the mediators that influence outcomes, such as satisfaction, inclusive engagement, and loyalty.

Table 11. Top 15 methodologies used in the research domain of customer experience in metaverse.

Research method	Estimated frequency
Survey research	250
Experimentation (controlled experiments)	180
Ethnography/netnography	100
Structural equation modeling (SEM) approach	80
Systematic literature review approach	65
Qualitative case study approach	50
Thematic analysis approach	45
Mixed-methods research design	40
Content analysis	30
Physiological measures (eye-tracking, EEG, GSR)	20
PRISMA (preferred reporting items for systematic reviews)	15
Simulation and modeling	10
Action research approach	5
Bibliometric analysis approach	5
Fuzzy Delphi, DEMATEL, and DANP techniques	5

Note: It should be noted that methodological strategies listed in the table, such as structural equation modeling, content analysis, ethnography, and experimental design, were identified as commonly used approaches in the reviewed literature. These are not methodologies applied in this study, in which analysis is based solely on bibliometric and network techniques, followed by manual classification of theories, contexts, characteristics, and methodologies using the TCCM framework.
Source: Authors' conception (2025).

Methods

Research on customer experience in the metaverse is primarily data-driven, applying empirical methods. Out of the 878 research documents examined, as indicated in Table 11 below, survey-based studies are the most popular method ($n = 250$). Experiments are the second most used method ($n = 180$). This reveals a strong interest in determining cause-and-effect relationships. Qualitative methods like ethnography and netnography ($n = 100$) registered a significant increase. They allow researchers to delve deeper into the social dynamics and cultural aspects of virtual communities.

Case studies ($n = 50$) and thematic analysis ($n = 45$) are also part of this methodology, offering more authentic ways of understanding experiences. Interestingly, more advanced statistical tools, such as Structural Equation Modeling (SEM) appear in about 80 studies, showing that the diversity of applications are inclined toward theory testing and model validation. Significantly, 65 studies applied for Systematic Literature Reviews (SLR), followed by 15 using PRISMA protocol to map out existing knowledge and identifying gaps. Mixed-method approaches ($n = 40$) were used to bridge the gap between numbers and narratives, providing a fuller picture of user behavior and motivations. Physiological techniques, such as eye-tracking, EEG, or skin conductance were used in about 20 cases, using biometric data to measure immersive experiences in new ways. However, some approaches and techniques like action research, bibliometric analysis, Fuzzy Delphi, and DEMATEL featured in only a few studies, showing a significant gap in the application of these tools.

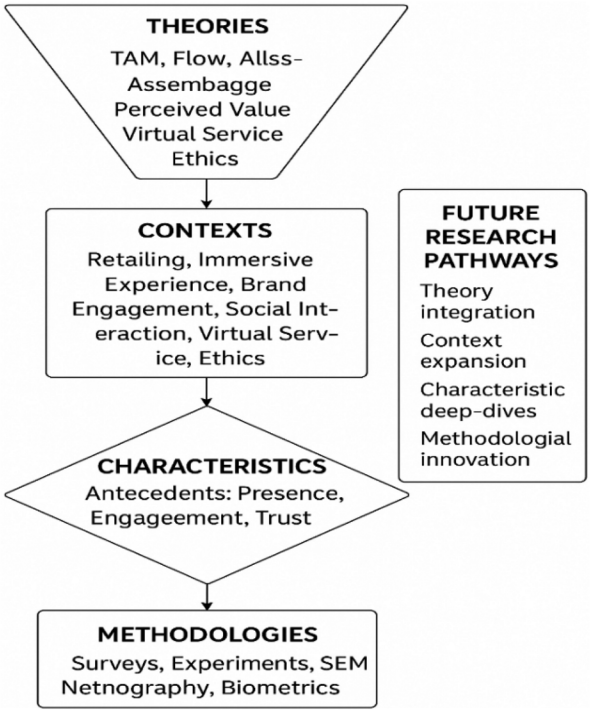

Figure 6. Conceptual roadmap synthesizing TCCM insights into customer experience in virtual realms.
Source: Authors' conception (2025).

Figure 6 depicts the conceptual roadmap synthesizing TCCM insights into customer experience in virtual realms. This model illustrates how foundational theories inform key contextual domains, which shape the experiential characteristics of virtual customer interactions and are explored through diverse methodological approaches. The framework highlights priority pathways for future research, including theory integration, context expansion, deeper exploration of CX characteristics, and methodological innovation.

Implications of the study

Table 12 shows the uniqueness of this study as compared to previous bibliometric studies on customer experience.

Table 12. Uniqueness of this study in comparison to previous studies on customer experience.

Aspect	Previous CX studies	Current study	References
Timeframe	Up to 2020	2000–2025	Lemon & Verhoef, 2016; Wasiq, Bashar, Nyagadza, et al., 2024
Focus	General CX	Virtual realms CX	Dwivedi et al., 2022; Homburg et al., 2017
Methodology	PRISMA or co-citation analysis	Integrated TCCM + bibliometric	Paul et al., 2021; Zupic & Čater, 2015
Theoretical coverage	Limited to dominant theories	15+ theories including emerging frameworks	Hoffman & Novak, 2018; Payne et al., 2020
Practical guidance	Minimal	Decision tree + implementation framework	Batat, 2022; De Keyser et al., 2020
Emerging technology focus	Limited	Metaverse, AI, phygital integration	Beck & Ryu, 2023; Bolton et al., 2018

Source: Authors' conception (2025).

As seen in schematic Table 12, the following sections address the social, practical, and theoretical implications of the current study.

Theoretical implications

This study makes several important theoretical contributions to evolving literature on customer experience, particularly within virtual and immersive environments, such as the metaverse and other digitally mediated realms.

Positioning within existing theory

This research engages with foundational theories in marketing and service science, including Service-Dominant Logic (Vargo & Lusch, 2004), Flow Theory (Csikszentmihalyi, 1990), Technology Acceptance Models, such as the TAM by Davis (1989) and the UTAUT by Venkatesh et al. (2003). These frameworks have historically guided understanding of how users co-create value, interact with digital interfaces, and adopt emerging technologies. By mapping how these theories have been adapted (or underutilized) in virtual contexts, this study highlights a noticeable fragmentation in how theoretical foundations are applied in customer experience literature across digital and immersive platforms.

Contributions to theory development

The bibliometric and TCCM-guided analysis uncovers three significant theoretical advances. It introduces emerging constructs, such as immersive engagement, avatar-based identity formation, and virtual co-presence, which extend beyond traditional customer experience models. The study provides a contextual extension of existing theories into virtual, AI-augmented, and metaverse-driven experiences, emphasizing the need to reconceptualize "presence," "authenticity," and "value co-creation" when physical environments are removed. In addition, theoretical relationships are refined, particularly those between customer engagement, trust, and satisfaction in digitally immersive settings, suggesting that the psychological mechanisms of experience differ in virtual realms when compared to traditional digital platforms.

Broader academic significance

The findings shift scholarly understanding by foregrounding virtuality as a core dimension of customer experience. Where previous literature treated digital environments as auxiliary or transactional, this study frames them as primary experience spaces. This theoretical repositioning suggests that future customer experience frameworks should fully integrate virtual characteristics, such as embodiment, multisensory interactivity, and persistent environments if they are to remain relevant. The gaps identified also call for the development of new or hybrid theories that bridge marketing, psychology, and human-computer interaction (HCI) in virtual contexts. This study therefore provides a roadmap for future scholars to advance customer experience theory by (1) adapting established models to immersive technologies, (2) exploring under-theorized constructs within virtual environments, and (3) proposing interdisciplinary theoretical integrations to reflect the complexity of future customer experiences.

Social and practical implications

This bibliometric and TCCM-guided study revealed that customer experience research in virtual realms focuses increasingly on immersion, interactivity, trust-building, and emotional engagement. These factors significantly influence customer satisfaction, brand loyalty, and digital

behavior across emerging platforms, such as the metaverse, augmented reality (AR), and virtual reality (VR).

Social implications

One key social implication is digital inclusion and exclusion. As virtual experiences become more advanced, disparities in digital access (due to cost, connectivity, or digital literacy) risk leaving behind marginalized populations, deepening the digital divide). Addressing this aligns with Sustainable Development Goal 10 (Reduced Inequalities), which calls for promoting inclusive access to technology. Moreover, identity construction and social interaction in virtual spaces are evolving. Virtual avatars and hyper-personalized experiences reshape how individuals present themselves and engage with others and brands. These dynamics not only impact marketing strategies but also societal norms relating to authenticity and emotional connection in digital environments. The psychological and behavioral effects of immersive CX are another area of concern. Although VR could enhance emotional engagement, it may also lead to overstimulation, addiction, or detachment from physical reality for some users. Addressing this resonates with SDG 3 (Good Health and Well-being), particularly as regards the mental health impacts of prolonged or intense virtual interactions.

Practical implications

The current study on customer experience in virtual realms, such as virtual reality (VR), metaverses, and immersive digital platforms, offers some important insights to stakeholders, such as policymakers, user interface (UI) and user experience (UX) designers, as well as digital marketers.

Practical implications for policy makers

The dominance of Chinese institutions in CX and metaverse research present some noteworthy implications from a practical perspective. Firstly, it shows national-level priorities and innovation policies supported by China's state-backed investment in AI, virtual reality, and digital infrastructure. This is shaping the global discussion on immersive customer experience. Furthermore, Chinese metaverse platforms could be unique in that they prioritize super-app integration, gamified commerce, and government-compliant digital identities, which distinguish them from CX in Western or African virtual platforms. The current research has an important role to play in influencing policy development where consumer protection and privacy are concerned. This is because virtual environments populate data in different forms, which may raise some privacy concerns. There is therefore a need to develop clear regulations relating to data collection, consent, and proper ethical usage, especially for vulnerable populations, such as minors. Another important implication is inclusion and digital accessibility, because customer experience (CX) in virtual realms always overlooks people with physical challenges, and/or with limited tech access. To address this issue, there is need to enforce accessibility standards, such as Web Content Accessibility Guidelines (WCAG) for VR or AR as developed by World Wide Web Consortium (W3C) and to institutionalize policies that support digital equity. The current research also has implications for the economic and social set-ups of different countries. Predictively, Customer experience development and innovation have a great impact on economic growth but may reduce conventional job creation. Governments may therefore need to create human development frameworks, such as upskilling and responsible employment transitions relating to virtual environments.

Practical implications for user interface (UI) and user experience (UX) designers

For UX designers, there is an implication for Human-Centered-Design (HCD) for immersive environments, because Customer experience relies on sensory, emotional, and spatial design elements. Therefore, integrating personalized avatars, multi-sensory feedback, and methods of natural interaction, such as voice and gesture can help enhance engagement and reduce friction. There is also need for continuity across touchpoints, where the users interact with

different or various brands in VR, web, and physical environments. Accordingly, the design should be seamless and consistent Customer experience across all platforms, ensuring that everyone has access to easy transitions and recognizable brand cues. UX/UI designers are therefore encouraged to adopt inclusive and emotionally intelligent design principles that cater to diverse user needs while fostering trust and ease of navigation in virtual environments (Sahu & Ranganathan, 2025). Ethical experience design is required because virtual realms manipulate attention and perception. Therefore, it is needed to prioritize transparency and avoid exploitative practices such as, among others, persuasive design targeting minors, dark patterns. Soft skills, such as empathy, emotional intelligence, and cross-platform communication, are increasingly critical. Ethical design must become a priority, especially in handling user data, consent, and behavioral nudges in virtual realms. Transparency and ethical foresight in immersive marketing and brand experiences uphold SDG 12 (Responsible Consumption and Production), ensuring that engagement does not exploit psychological vulnerabilities.

Practical implications for digital marketing professionals

Digital marketing professionals could leverage the study findings to tailor campaigns that prioritize experiential engagement, such as branded virtual events or gamified interactions. These strategies not only improve customer retention but also foster long-term brand relationships in sustainable and value-driven ways (Patel, 2024). Additionally, digital marketing professionals could use the findings to enhance their immersive brand storytelling efforts to enhance customer experience (CX), since the virtual realms offer novel opportunities for deep brand immersion. As far as these professionals are concerned, the study's insights offer numerous actionable pathways. They may need to create immersion in interactive experiences, such as product demos, branded VR spaces, fostering emotional connections and memory retention. Real-time personalization enhances the value of personalized-content-aware interactions. To improve this, digital marketing professionals need to enhance behavioral data and artificial intelligence (AI) to dynamically adapt content, promotions, and individual user preferences environments. The current study has implications for customer journey innovation, since the virtual journey is exploratory and non-linear in nature. There is a need to rethink the traditional funnel, therefore, by designing gamified open-ended or co-creative customer journeys that promote discovery and engagement. Customer experience professionals should be trained to manage customer interactions in immersive platforms, including voice, gesture, and haptic feedback mechanisms that differ from traditional screen-based interactions.

Cross-functionally, the integration of policy, technology, and design in virtual realms demands collaboration among stakeholders to ensure that customer experience (CX) is inclusive, safe, ethical, and environmentally engaging. A decision tree, shown in Figure 7, depicts the framework for marketers to develop their metaverse strategies to ensure excellent customer experience on metaverse.

Conclusion and strategic direction for future research

In conclusion, to evolve with the ever-changing, fast-paced global technological landscape, research on CX in virtual realms needs to be expanded conceptually, theoretically, and methodologically. This study makes numerous fundamental contributions to the ever-evolving field of customer experience in virtual environments, particularly the metaverse. Firstly, it offers one of the most comprehensive bibliometric reviews of CX literature within immersive VR and AR contexts. Secondly, this study applies the TCCM (Theories-Contexts-Characteristics-Methodologies) framework in both a unique and novel approach to systematically organize and evaluate relevant VR, AR, and metaverse literature, highlighting emerging trends and underexplored areas. While much existing research on customer experience in the metaverse relies on traditional surveys and experiments, some of the least used methods could be used to gain deeper insights and broaden contextual applications.

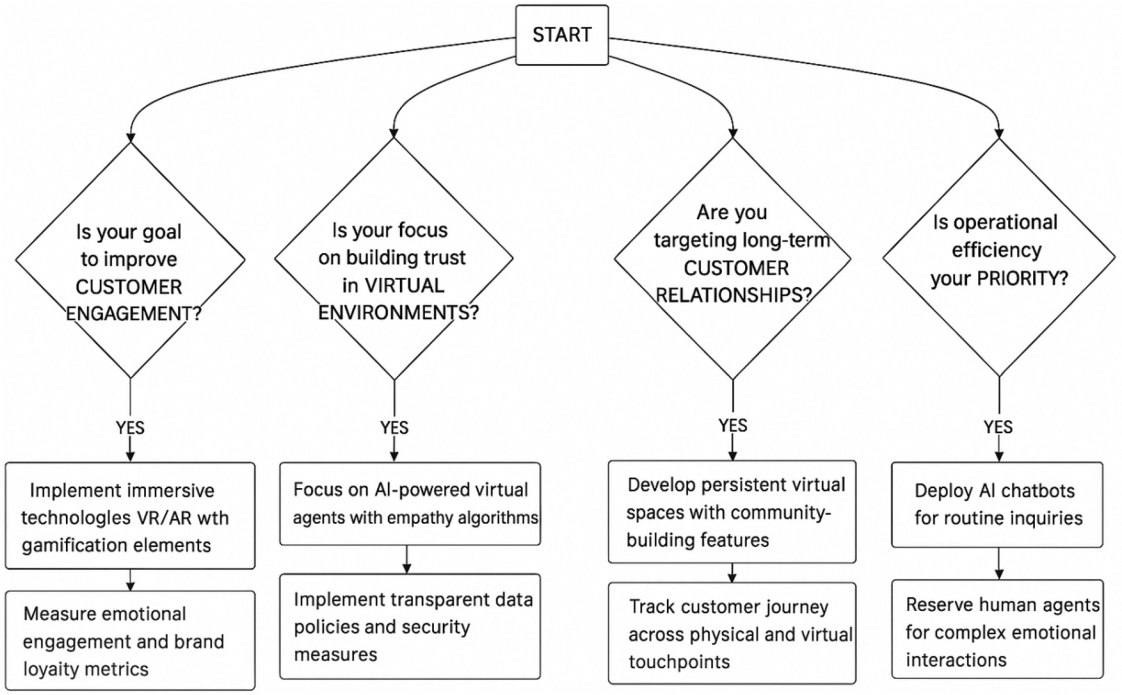

Figure 7. Decision tree for marketers of CX in metaverse.
Source: Authors' conception (2025).

By fundamentally addressing the research gaps identified in the current study, future research studies could contribute to a more enhanced inclusive, immersive, and insightful understanding of CX in the digital future. Following are suggestions for future research endeavors:

Theoretical advancement

Given the fast-paced technological landscape, research on CX in virtual landscape should be expanded theoretically and methodologically. Previous literature on digital marketing, grounded mainly in the theory of planned behavior, has established that consumers ultimately engage in action through precursors, which include perceived behavioral control and attitude (Sharma, 2024). This study is markedly distinct, departing from this traditional narrative. By way of example, it provides new perspectives on interactivity, immersion, and the dynamic nature of metaverse experiences in relation to virtual environments that influence customer experience. Virtual realms, such as the metaverse, incorporating avatars, 3D environments, emotional engagement, and real-time co-creation not only introduce new technologies but entirely unique experiential dynamics. Unlike prior literature on VR/AR technologies, which focused predominantly on Presence Theory, Flow Theory, and Media Richness Theory to explore user experiences in entertainment and education, the current study reveals underutilized frameworks, such as the Assemblage Theory and Perceived Value Theory that could provide more insightful understanding into multi-actor, socio-technical environments. The Assemblage Theory provides an understanding of how different parts—people, technologies, spaces, emotions, tools, and even rules—come together to create an experience or system (Hoffman & Novak, 2018). Perceived Value Theory, meanwhile, explains why consumers choose, remain loyal to, and recommend a product or service based on what they see as value, not necessarily product price or features.

Future researchers could also investigate under-explored theories (such as Embodied Cognition theory, Flow theory, and TAM3 in the metaverse), integrating frameworks combining consumer psychology and digital marketing to explain CX in immersive environments, and contextualizing theories to multi-sensory and gamified nature of virtual realms. This study also reveals a significant underutilization of theories, such as

Assemblage Theory and Perceived Value Theory in the context of customer experience in virtual realms. These frameworks offer numerous possibilities for future research. By way of example, researchers could deploy Assemblage Theory to model immersive CX using human and non-human elements (e.g., avatars, AI agents, haptic feedback devices, and branded virtual spaces). Similarly, Perceived Value Theory could be used in studying economic and psychological aspects of metaverse experiences. This may include the role of perceived experiential value in predicting customer loyalty across different types of virtual environments or modeling of immersive personalization features to study the users' value perceptions and co-creation behavior.

Contextual expansion

Future researchers may need to expand contextual application by exploring further underrepresented sectors, such as healthcare, education, tourism, and financial services, where virtualization is increasing. Contextual expansion could investigate the CX dimensions in virtual realms in underrepresented regions, such as Africa, Latin America, and South-East Asia to enhance the generalization of results.

Characteristic exploration

There may also be the need for cross-channel customer experience (CX) investigation where "*phygital*" (physical and digital) channels are virtually interconnected. Additionally, future researchers may need to investigate characteristic exploration, for example how affective computing, emotion AI and digital empathy may shape virtual CXs, how digital identities, avatars and sense of presence affect trust, satisfaction and loyalty, and why, even though CX has temporal dynamics, there is paucity of research tracking customer journeys over time in virtual spaces.

Methodological development

Rapid technological development, in line with virtual realms research, requires future researchers to apply long-term or longitudinal research methodologies and real-time data collection so as to gain an in-depth understanding of the phenomena. They may consider integrating multiple methodological approaches, such as qualitative (digital ethnography and netnography) and quantitative (behavioral analytics, eye-tracking, and biometrics). In addition, future researchers could consider setting up VR based experimental designs in virtual labs, leveraging machine learning, sentiment analysis, and Natural Language Processing (NLP) to analyze large-scale virtual interactions and unstructured customer data. The Action Research approach, for example, may be used for continuous feedback and iteration, which is ideal for improving virtual environments in which user needs and expectations evolve quickly. On the other hand, the Bibliometric Analysis approach could help to map out the growth of the research area, showing which topics, theories, and authors are shaping the field and to explore new avenues in this domain. Techniques like Fuzzy Delphi, DEMATEL, and DANP are suitable for dealing with the complexity and uncertainty of decision-making in immersive digital settings. These techniques allow researchers to identify key influencing factors and draw significant insights, understanding model customer perceptions more accurately.

Emerging technologies and themes

Future research could also focus on how metaverse platforms potentially shape community, co-creation, and gamification in CX. In addition, due to increasing data surveillance in virtual realms, research could examine ethics and privacy issues (ethical boundaries, trust building, and data transparency). Research could also direct attention on how CX in virtual realms strategies potentially enhance sustainability, diversity, and inclusivity, particularly for people with physical challenges with limited access to high-end technology.

Ethical approval

This article does not involve any studies with human participants or animals performed by any of the authors. Therefore, ethical approval was not required. All data and

materials used in this work are publicly available or obtained through legal and ethical means.

Consent for publication

All authors consent to the publication of the article.

Authors contributions

All authors contributed, read, and approved the final manuscript.

Disclaimer

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