

Immersion, Value and Identity: Mapping the Structure and Evolution of Consumer Behaviour in the Metaverse

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Abstract

The rapid growth of metaverse technologies has increased interest from researchers and managers in understanding consumer behaviour in immersive virtual environments. Despite a rising number of studies, existing evidence is still scattered, and there is little clarity on the key ideas, major trends, and new behavioural themes in this area. This study aims to fill that gap by providing a detailed overview of 551 Scopus-indexed publications through bibliometric analysis and adding to these results with BERTopic modelling of a refined set of 62 studies focused on consumer behaviour in the metaverse. By examining performance metrics, co-authorship patterns, co-citation structures, and bibliographic connections, the study maps how metaverse research has evolved across marketing, information systems, psychology, and human–computer interaction. The topic modelling results show two main theme clusters: consumer experience and virtual value formation. These clusters highlight how elements like immersion, identity, virtual socialisation, and technology-driven engagement influence behaviour in metaverse environments. Trends over time show a shift from conceptual discussions of virtual reality to practical studies on virtual commerce, AI-enhanced experiences, and immersive decision-making. Overall, this research provides a solid foundation for understanding theoretical concepts, identifies new areas of knowledge, and points out opportunities for future research on consumer behaviour in the metaverse. The findings also give useful insights for those creating immersive platforms and digital strategies that meet changing consumer expectations.

Keywords: *Metaverse, Consumer Behaviour, Bibliometric Mapping, BERTopic Modelling*

Introduction

The concept of the "Metaverse" has quickly gained global attention and has become a popular topic on digital and social media. Although the term was made famous by Neal Stephenson's 1992 novel *Snow Crash*, the idea of virtual worlds has been around for years, with several of its elements already found in everyday technologies (Buhalis et al., 2023b). The term comes from the Greek word "meta," meaning "beyond." The metaverse offers great potential for innovation, discovery, and immersive engagement (Li et al., 2025). It merges physical and digital environments using ambient intelligence and technologies like virtual reality (VR), augmented reality (AR) headsets, and haptic interfaces. These technologies create highly immersive and interactive user experiences (Paul et al., 2024; Dwivedi et al., 2022). These advancements help users engage in various social and commercial activities, such as exploring virtual spaces and interacting with simulated products. This contributes to the slow merging of physical and digital experiences (Buhalis et al., 2023a). The rapid rise of the Metaverse has drawn significant attention from academics and industry experts because of its potential effects on business practices and marketing strategies (Chen, 2024; Fan et al., 2022; Monaco & Sacchi, 2023). Metaverse platforms allow consumers to participate in virtual product experiences and interactive previews. This helps them make more informed buying decisions and improves the quality of their experiences with physical products after purchase (Rauschnabel et al., 2022; Yin et al., 2023).

The metaverse continues to capture interest from both marketers and consumers. Much of the current discussion about its potential comes from Mark Zuckerberg's early vision with Meta Platforms. This vision emphasises the possibility of transforming key aspects of interaction and communication in virtual and mixed reality settings (Dick 2021; Fernandez & Hui, 2022; Dwivedi et al., 2022). Worldwide, metaverse technology is expected to grow at an annual rate of 48% by 2030, with a projected market size of about \$1303.4 billion (Markets and Markets, 2023). In India, growth is expected to be at a rate of 40.3%, reaching a market value of \$16.2 billion by 2030 (Statista, 2023; Pillai et al., 2025). Current literature shows that widespread adoption of the metaverse could reshape how users engage in leisure and professional activities in virtual settings (Dwivedi, Hughes, Baabdullah, et al., 2022). It goes beyond traditional e-commerce by offering immersive and personalized experiences that create enjoyment and psychological engagement (Jafar et al., 2023). The retail sector is also embracing the metaverse, with many retailers using this technology to enhance both virtual and physical shopping environments (Bourlakis et al., 2009). Several well-known retailers, such as Zara, Crate and Barrel, Lowe's, Forever 21, Pacsun,

Taco Bell, H&M, and Walmart, have included metaverse technologies in their retail strategies (Pillai et al., 2025). Features like customizable avatars improve personalisation and engagement, leading to unforgettable shopping experiences that cater to consumers' needs for individuality (Zhu & Yi, 2023).

The metaverse is quickly becoming a unique digital space for consumer engagement (Chakraborty et al., 2024). It is also changing the modern business environment by enabling skill development and training through artificial intelligence and gamified systems. At the same time, it is altering the dynamics of sourcing ideas, data, products, and services (Saridakis et al., 2024). Researchers are increasingly looking into how consumer interactions and experiences in the metaverse influence their intentions and lifestyle choices (Yin & Do, 2025). However, the research in this area is still in the early stages. This study aims to fill existing knowledge gaps by using SPAR-4-SLR, bibliometric analysis, and BERTopic modelling. It will explore the following research questions:

RQ1: Who are the top authors contributing to understanding consumer behaviour in the metaverse?

RQ2: What are the key research areas and structures influencing consumer behaviour studies in the metaverse?

RQ3: What emerging themes define consumer behaviour within the metaverse?

Background of the study

The concept of the metaverse is increasingly invoked in marketing, psychology, information systems, and consumer research. Yang & Chattopadhyay (2024) define the metaverse as comprising “3D virtual, augmented, and mixed realities in which individuals can socialise, entertain, learn, work, consume, and engage in other life activities”. Different marketing experts defined metaverse as “an online collaborative shared space built of 3D environments that leverage high consumer immersion techniques to reduce the perception of technological mediation alongside transferrable and unique digital assets while allowing user-generated digital personas to interact with each other” (Yoo et al., 2023, p. 5). In its earliest conception, the metaverse referred to a virtual domain where individuals, appearing as avatars, participated in daily life activities within a simulated environment (Akour et al., 2022). It represents an emerging evolution of the internet, characterised by the convergence of virtual and physical environments

through the use of immersive technologies such as virtual reality headsets, blockchain systems, and digital avatars (Lee et al., 2021). The origin of the metaverse can be dated back to the Web 2.0 era, when early virtual environments were designed to deliver immersive digital experiences, primarily within the gaming domain. With the advent of Web 3.0 technologies, metaverse platforms have evolved to extend these earlier frameworks, integrating augmented reality to enable more authentic, reality-based user interactions. Earlier virtual platforms offered users the ability to create avatars, engage in social roles, and simulate real-world activities within digital spaces. In contrast, the contemporary metaverse has progressed through the inclusion of advanced technologies such as artificial intelligence (AI) and extended reality (XR). It also captures content-oriented services featuring immersive, interactive experiences, as well as diverse payment mechanisms including digital and cryptocurrency systems (Ball, 2021), thereby enhancing its overall immersive potential (Dwivedi et al., 2022).

Prior research has been conducted on the applicability of the metaverse across diverse domains, including e-commerce, transportation, tourism and hospitality, healthcare, and education (Shahzad et al., 2024). The metaverse has rapidly surpassed its origins in gaming to become an applied platform across multiple sectors, each leveraging immersive technologies (VR/AR/XR), AI, and distributed ledger systems to deliver novel experiences, services, and business models (Yoo et al., 2023; Akour et al., 2022). In retail, firms are using metaverse platforms to create immersive shopping environments, enable virtual try-ons and product previews, and design branded virtual spaces that enhance consumer engagement and co-creation. These interventions aim to increase purchase confidence and experiential value by combining avatar-based interactions with virtual product demonstrations and NFT/digital-asset strategies (Yoo et al., 2023). Researchers such as Raman and Paul (2025) employed BERTopic modelling and thematic mapping to uncover underlying areas specifically in the metaverse and online retail. It illustrated how VR and AR technologies improve consumer engagement, personalisation, and decision-making, thereby deepening insights into their influence on customer interactions and satisfaction. Not only is the metaverse reshaping the retail landscape, but it is also extending its influence over spatial economies. Hajipour and Fadaei (2025) found that the metaverse could significantly contribute to the growth of the space economy in developing nations. Their study emphasised that metaverse platforms can democratize participation in space activities, reduce the high costs associated with physical infrastructure, and foster innovation ecosystems through virtual experimentation. However, it also identified major structural constraints such as inadequate digital infrastructure, limited technological readiness, regulatory gaps, and financial barriers,

which delay the effective integration of metaverse technologies into the space sector. The tourism sector, too, has derived many-sided benefits from metaverse technologies, which have notably transformed destination experiences by enabling

The growing scholarly and managerial interest in the metaverse is driven by its potential to fundamentally reshape how individuals interact, consume, work and experience digital environments. As immersive technologies unite with advanced data-driven infrastructures, the metaverse is increasingly viewed as the next major evolution of the internet and often described as a transition from two-dimensional, screen-based interactions to embodied, experiential, and multisensory virtual engagement (Lee et al., 2021). Kaur et al. (2023) conducted a quantitative study on Gen Z and their interactions with the metaverse. Similarly, Ladeira et al. (2025) also examined a metaverse behaviour model using SEM and found that higher levels of interactivity and vividness significantly enhance users' sense of telepresence within the metaverse. Metaverse's rising prominence is also tied to the rapid maturation of Web 3.0 capabilities, particularly blockchain, decentralised ownership, interoperable digital assets, and AI-based content generation, all of which enhance user autonomy and allow more personalised and persistent virtual experiences (Dwivedi et al., 2022). This growing attention can further be attributed to the metaverse's transformative commercial potential. Firms across sectors increasingly view it as a strategic space for value creation, experiential marketing, customer co-creation, and data-rich behavioural insights.

Research Methodology

A rigorous methodological approach is always essential for strengthening the credibility and academic contribution of review studies. Systematic Literature Reviews (SLR) play a pivotal role in advancing knowledge by offering structured, transparent, and replicable syntheses of existing research. Unlike narrative reviews, SLR follows rigorous protocols that minimise selection bias, enhance conceptual clarity, and facilitate theory building by uncovering patterns, contradictions, and gaps within a field (Snyder, 2019). High-quality bibliometric reviews rely on carefully defined search strategies, consistent inclusion–exclusion criteria, and validated performance and science-mapping indicators to accurately capture the intellectual structure of a field (Zupic & Čater, 2014). Integrating BERT-based topic modelling techniques into a systematic review confers several methodological advantages. By leveraging contextual sentence embeddings derived from pretrained transformer models, BERTopic captures nuanced semantic relationships, thereby enabling the extraction of more coherent, semantically rich, and human-interpretable



themes (Mishra, 2024; Gupta et al., 2024). The present study, therefore, integrates SPAR-4-SLR, bibliometric analysis, and BERTopic-based topic modelling to provide a comprehensive and methodologically robust examination of the metaverse research landscape. The adoption of the SPAR-4-SLR protocol is particularly suitable for this study, as it provides a structured, transparent, and decision-oriented framework specifically developed for management and social-science reviews (Paul et al., 2021). Unlike PRISMA, which is predominantly oriented toward medical and clinical evidence synthesis (Page et al., 2021), SPAR-4-SLR is better suited for reviews that involve conceptual mapping, bibliometric analysis, and theory-building objectives commonly followed in business research (Snyder, 2019).

To enhance methodological consistency and analytical accuracy, this study relies on the Scopus database, which is widely known for its broad coverage of peer-reviewed articles and its suitability for rigorous bibliometric research (Mohanani & Rangaswamy, 2025). Scopus provides comprehensive metadata, well-curated author and institution profiles, and superior recall and precision compared to other databases, particularly for business, management and social-science publications (Baas et al., 2020). The initial search was conducted on 21st August 2025 and retrieved 6984 documents by using the search string “(extended reality OR immersive technology OR metaverse) AND (gamification OR haptics)”. These results were subsequently refined by limiting the scope to publications within the Business, Management and Accounting subject areas as outlined in Table 1. Finally, a manual screening process was undertaken to eliminate studies that did not align closely with the objectives of the review, resulting in a focused and conceptually relevant dataset of 551 documents. This approach aligns with best practices for bibliometric study design, as described in recent methodological frameworks (Öztürk et al., 2024).

Table 1: Inclusion and exclusion criteria in Scopus database

Filtering Criteria	Reject	Accept
Search engine: Scopus		6984
Search term: (extended reality OR immersive technology OR metaverse) AND (gamification OR haptics)		
Subject area: Business, management and accounting	6008	976

Document type: Articles	309	667
Publication stage: Final	71	596
Source type: Journal	9	587
Language screening: English only	19	568
Manual screening: Documents exclusively on the metaverse and consumer behaviour	17	551

The current study also employs bibliometric analyses to explore the intellectual structure and thematic evolution of consumer-behaviour studies in the metaverse. It uses Biblioshiny (R) and VOSviewer to produce robust and interpretable visualisations of the bibliographic landscape. When they are used together, Biblioshiny and VOSviewer provide complementary analytical strengths. Biblioshiny has an added advantage for systematic reviews in management and social-science domains because it supports transparent workflows, reproducible analysis, and a wide range of performance indicators, including author-level metrics, source impact, thematic evolution, and collaboration structures (Aria & Cuccurullo, 2017; Donthu et al., 2021). VOSviewer, on the other hand, is widely recognised for its ability to generate high-quality network visualisations based on co-authorship, co-occurrence, bibliographic coupling, and co-citation structures (Van Eck & Waltman, 2017).

To extract latent thematic structures from the final corpus of 62 documents, this study employed BERTopic, a transformer-based topic modelling technique that integrates contextual embeddings with density-based clustering (Grootendorst, 2022). The analysis was carried out in a controlled computational environment using Anaconda, where a dedicated environment was created with Python 3.10 to ensure dependency stability. Within this environment, essential packages such as BERTopic 0.17.3, Sentence-Transformers 5.1.2, UMAP, HDBSCAN, NLTK, and openpyxl were installed via Anaconda Prompt. A JupyterLab kernel was linked to the same environment and then configured to ensure consistent execution of all modelling steps.

The filtered Scopus dataset was pre-processed in JupyterLab by merging the Title, Abstract, and Author Keywords fields into a unified text column. Using the lightweight transformer all-MiniLM-L6-v2 as the embedding model, documents were converted into high-dimensional

vectors. BERTopic subsequently reduced these embeddings through UMAP and clustered them using HDBSCAN, allowing topic discovery without pre-specifying topic numbers. Outlier clusters (topic -1) were removed based on the document-topic distribution, and BERTopic was rerun on the cleaned corpus to enhance coherence. Finally, topic word scores and temporal patterns were generated to support the interpretation of consumer-behaviour themes within the metaverse.

Findings & Interpretations:

By performing an analysis of authors' performance metrics (see Table 2), which includes H-index, G-index, M-index, total citations, number of publications, and start year, our study reveals a clear picture of the top influential and emerging contributors to metaverse-related consumer behaviour research.

Dwivedi Y. K. stands out as the most influential contributor, with the highest H-index (8) and G-index (9), coupled with an exceptionally high citation count (2,651). His consistency of nine publications since 2021 indicates sustained scholarly engagement, making him a central intellectual figure in this domain. His works revolve around digital transformation, innovative technology adoption, and emerging consumer interfaces such as AI and the metaverse. Eventually, his body of work consistently bridges technology acceptance, digital marketing, and societal implications, positioning him as a central intellectual figure shaping contemporary discourse on technology-enabled consumer behaviour. Buhalis D., although with a lower number of publications (4), records the second-highest citations (3,146) and demonstrates an early entry (2019), suggesting foundational contributions to digital consumer research that later intersect with metaverse themes. Rana N. P., Behl A., and Ooi K.-B. exhibit moderate H- and G-indices (5–6) with notable citation counts. Their balanced metrics reflect both productivity and citation influence, indicating their role in reinforcing the conceptual and methodological landscape of metaverse consumer studies. Ooi K.-B., in particular, combines high citations (1,940) with only five publications, highlighting strong per-article impact, likely tied to high-quality or widely adopted theoretical contributions. Emerging authors such as Chakraborty D. and Paul J. present high M-index values (1.667), signalling rapid research momentum relative to their recent academic entry (2023). Their works depict that they are fast-growing contributors whose work is gaining momentum at an early stage. Lim W. M., with an M-index of 2 despite a very recent entry (2024), stands out as an accelerating academic influence, potentially due to conceptual or perspective papers that attract immediate citations. Flavián C. and Liu Y. also demonstrate

consistent scholarly output with good citation counts. Their contributions reflect strong thematic alignment with metaverse consumer behaviour, reinforcing their roles within the developing intellectual structure.

Table 2: Top ten influential contributors in the field of metaverse

Author	H-Index	G-Index	M-Index	Total Citations	Number of Publications	Start Year
Dwivedi YK	8	9	1.6	2651	9	2021
Rana NP	6	7	1.2	747	7	2021
Behl A	5	5	1	183	5	2021
Chakraborty D	5	5	1.667	276	5	2023
Ooi K-B	5	5	1	1940	5	2021
Paul J	5	6	1.667	283	6	2023
Buhalis D	4	4	0.571	3146	4	2019
Flavián C	4	4	0.8	776	4	2021
Lim WM	4	5	2	209	5	2024
Liu Y	4	5	0.8	115	5	2021

The co-citation analysis (see Figure 1) revealed six distinct intellectual clusters that collectively structure scholarship on consumer behaviour in the metaverse. Cluster 1 (Red) represents the methodological foundation of the field, tied to important works such as Fornell & Larcker (1981), Anderson & Gerbing (1988), and Venkatesh et al. (2003), indicating that metaverse-related consumer studies heavily rely on psychometrics, structural equation modelling, and technology-adoption theories. Cluster 2 (Green) comprises experiential and interactive technology research led by works from Tussyadiah, Jung, Kim, and Steuer, highlighting the importance of immersion, presence, and virtual experience design in shaping consumer responses within 3D environments.

Cluster 3 (Blue) shows online consumer behaviour and digital marketing perspectives, featuring authors such as Flavián, Ibáñez-Sánchez, and Ooi, who focus on usability, consumer engagement, social interaction, and digital service interfaces. Cluster 4 (Yellow) centres on gamification and motivational psychology, emphasising how rewards, playfulness, motivation, and engagement mechanics influence metaverse consumer behaviour. Cluster 5 (Purple) reflects innovation-diffusion and emotion-based behavioural theories, highlighting the role of affect, environmental stimuli, and perceived innovativeness in shaping metaverse technology adoption. Finally, Cluster 6 (Pink) consists of emerging metaverse-specific scholarship that focuses on digital transformation, AI-enabled systems, and future-oriented virtual consumer ecosystems. Together, these six clusters demonstrate that metaverse-related consumer research is theoretically grounded in technology adoption, experiential interaction, gamification, emotional psychology, and digital marketing, while simultaneously evolving into a distinct interdisciplinary domain integrating virtual environments with behavioural science.

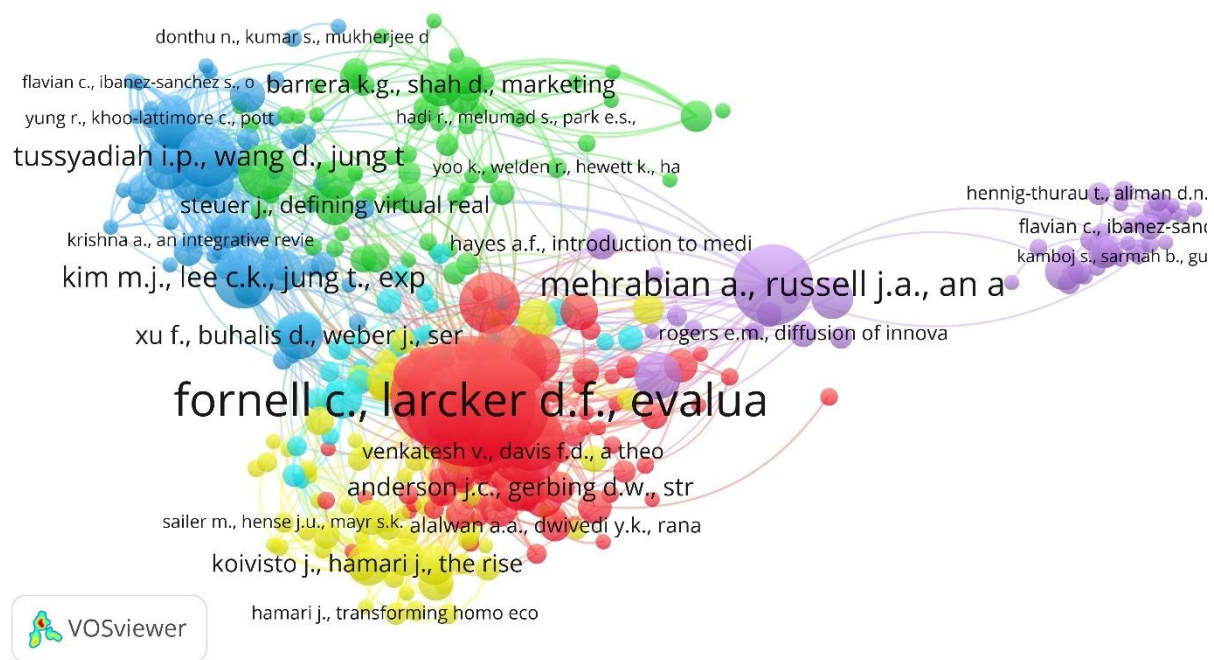


Figure 1: Co-citation analysis on cited references

To delve deeper into understanding the key research streams and intellectual structures, the authors also conducted bibliographic coupling analysis (see Figure 2). It revealed four thematically coherent clusters, each representing a distinct intellectual stream within metaverse-related consumer behaviour research.

Cluster 1 – Theoretical Foundations of Metaverse Adoption (Yellow Cluster)

The yellow cluster reflects works that establish the conceptual and theoretical bases for understanding consumer decision-making in virtual environments. Studies in this cluster typically draw on established behavioural frameworks such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and stimulus–organism–response (S-O-R) models to explain psychological antecedents of metaverse engagement. This cluster provides the fundamental explanatory mechanisms (e.g., perceived usefulness, presence, enjoyment, trust) that shape consumer attitudes towards immersive platforms. It represents the core theoretical backbone of the field.

Cluster 2 – Metaverse Marketing, Branding, and Consumer Experience (Blue Cluster)

The blue cluster concentrates on studies examining how organisations use metaverse platforms for marketing, branding, experiential engagement, and digital consumption. Research here focuses on virtual brand interactions, immersive customer journeys, social presence, and the experiential value created through gamification, VR/AR environments, and 3D virtual stores. This cluster highlights how the metaverse reshapes consumer experience design and brand–consumer relationships.

Cluster 3 – Technological Enablers and Business Applications (Red Cluster)

The red cluster consists of research exploring the technological architecture and operational applications of metaverse systems. These studies investigate topics such as blockchain integration, NFTs, extended reality infrastructure, data governance, interoperability, and platform-level innovations. The emphasis is on how technological capabilities, system quality, and infrastructure readiness influence adoption and value creation. This cluster positions the metaverse as an evolving socio-technical ecosystem.

Cluster 4 – Social Interaction, Identity and Virtual Community Behaviour (Green Cluster)

The green cluster includes studies centred on social, psychological, and community-driven aspects of metaverse participation. The articles examine identity construction, avatar-based expression, virtual communities, social influence, and peer dynamics that shape behavioural intentions. It also captures how consumers develop social belonging, self-presentation, and interaction patterns within immersive environments.

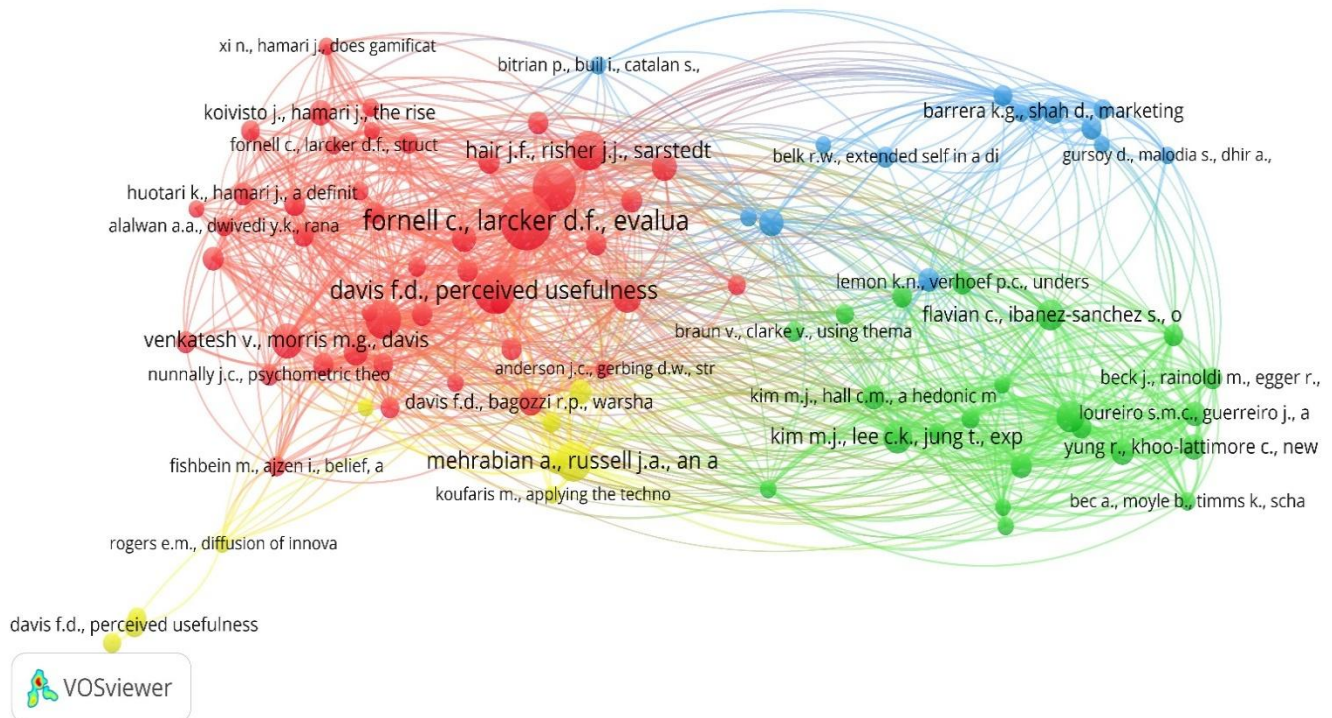


Figure 2: Bibliographic coupling

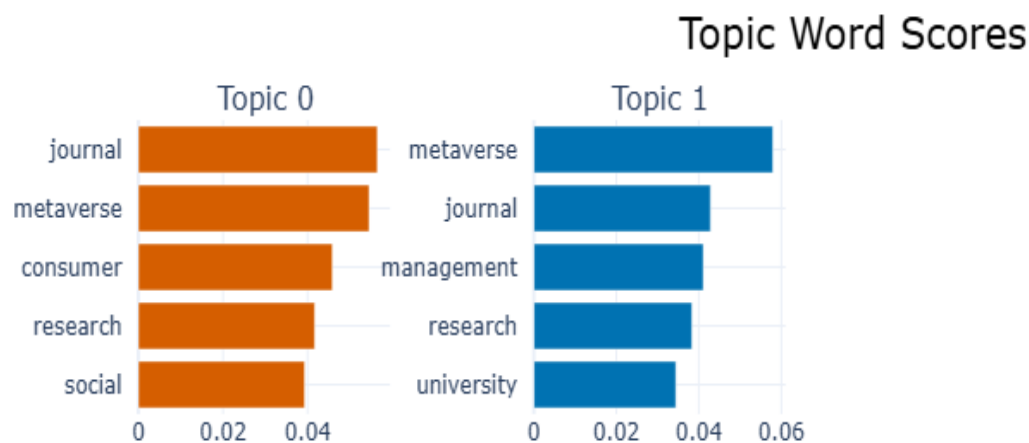
The BERTopic analysis (see Figure 3) revealed two dominant and conceptually coherent themes that characterise contemporary research on consumer behaviour within the metaverse. The model identified stable clusters of semantically aligned documents, thereby enabling a structured understanding of the intellectual patterns shaping this emerging domain.

Theme 1: “Metaverse–Journal–Consumer–Research” Nexus:

This theme, represented by keywords such as “*journal*”, “*metaverse*”, “*consumer*”, “*research*”, and “*social*”, reflects a stream of literature focused on consumer interaction with immersive virtual environments. The prominence of these terms suggests that contemporary research emphasises understanding how consumers navigate, adopt, and evaluate metaverse platforms. The presence of “*consumer*” and “*research*” indicates substantial academic interest in conceptualising behavioural models, particularly in relation to the construction of identity, virtual social presence, and experiential value. This topic also captures broader sociotechnical concerns, such as the role of digital communities and the influence of peers in shaping metaverse engagement. Overall, this theme illustrates a research direction centred on behavioural determinants, adoption mechanisms, and experiential drivers within immersive digital ecosystems.

Theme 2: “Metaverse–Management–Research–University” Nexus:

This theme is characterised by terms such as “*metaverse*,” “*journal*,” “*management*,” “*research*,” and “*university*.” These reflect a parallel research cluster focusing on organisational, managerial, and institutional dimensions of the metaverse. Studies in this area explore how academic institutions, businesses, and managerial bodies conceptualise the metaverse as a strategic innovation space. The inclusion of “management” and “university” indicates that much of the scholarly discourse addresses capability development, pedagogical integration, and strategic foresight. This theme represents a structural view of the metaverse as an ecosystem requiring



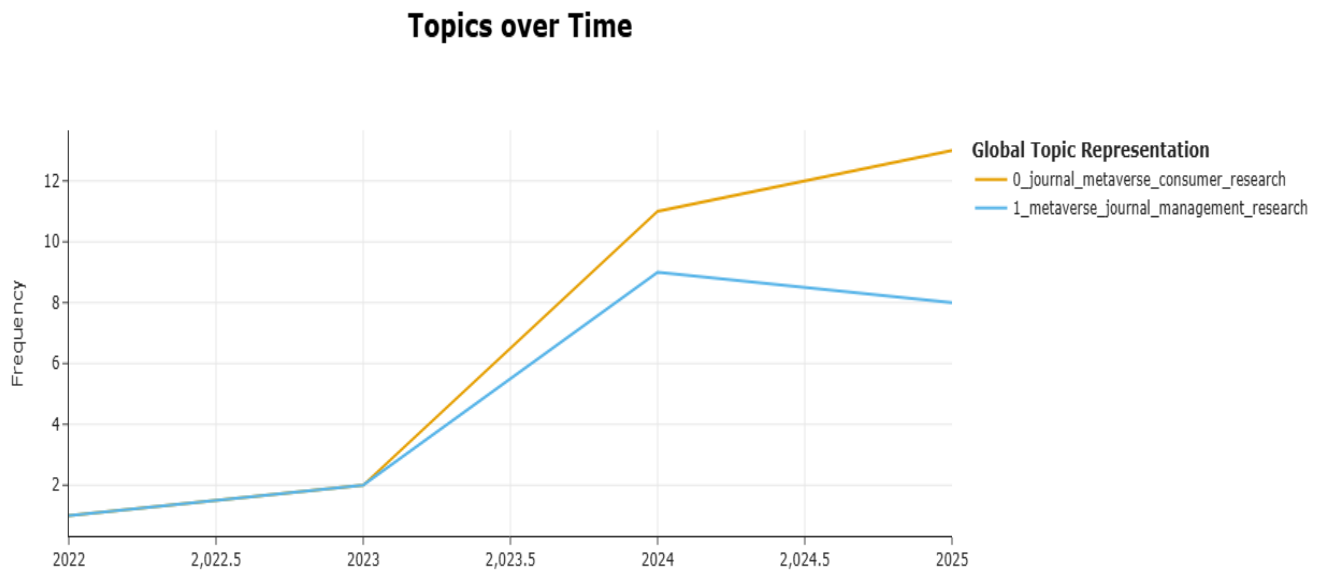
governance frameworks, technological readiness, and institutional support.

Source(s): Author’s own creation

Figure 3: Keyword Distributions for the Two Extracted BERT Topics

Temporal Evolution of Research Topics

The Topics-over-Time graph (see Figure 4) demonstrates a clear upward trajectory for both themes from 2022 to 2024. Theme 1 depicts a dramatic rise in publication frequency in 2024, signalling increasing interest in consumer-centric metaverse studies as virtual worlds gained mainstream traction. Theme 2 also grew substantially, though with a slight decline in 2024–2025, suggesting that managerial and academic discussions reached early maturity while behavioural research expanded rapidly. This indicates a shift from institutional conceptualisation toward consumer-focused empirical studies, reflecting the increasing real-world adoption of immersive technologies.



Source(s): Author's own creation

Figure 4: Frequency of topics over time

Term Score Decline and Topic Coherence:

The term-score decline curves (see Figure 5) provide further insight into how strongly key concepts define each topic and how consistently these themes appear across the document set. In both identified topics, the highest-ranked terms display stronger c-TF-IDF scores, suggesting that a small set of keywords, such as metaverse, journal, consumer, management, and research, carry substantial weight in shaping topic boundaries. The gradual downward slope observed across lower-ranked terms indicates that the themes are well-structured, with little distortion from noise words or weakly related concepts. This pattern reflects good topic coherence, viz., the most important terms dominate clearly, while subsequent terms decrease predictably without inconsistent fluctuation. Conceptually, the thematic structure in the literature is relatively mature, with stable clusters of meanings consistently used by authors. In Topic 0, terms related to consumer engagement and social research discourse show a smooth decline, indicating a cohesive stream of work around how users interact with metaverse environments. Topic 1 displays a similar pattern for managerial and institutional perspectives, revealing that discussions on governance, academic contribution, and organisational implications are also systematically developed across publications. Ultimately, the gradual decline of term importance confirms that each topic is underpinned by a well-defined set of vocabulary, reinforcing the reliability of the

themes derived

through BERT and strengthening confidence in the conceptual distinctions identified within metaverse-related consumer behaviour research.

Term score decline per Topic



Source(s): Author's own creation

Figure 5: Decline in Topic Term Importance Based on c-TF-IDF Scores

Future Research Directions:

Several promising approaches emerge for future scholarly inquiry into consumer behaviour within the metaverse. First, future research should undertake theory-building studies that integrate fragmented explanatory lenses such as telepresence, immersive experience, technology acceptance, social identity, and experiential value into more comprehensive behavioural models suited for dynamic virtual environments. The multidimensional nature of metaverse interactions, as revealed in the topic clusters, indicates the need for hybrid, cross-disciplinary theoretical frameworks that explain behaviour across stages of immersion, identity enactment, virtual co-creation, and AI-mediated interaction. Second, more empirical, context-sensitive investigations are needed across sectors such as education, retail, tourism and healthcare to validate and extend the conceptual themes identified in this review. Experimental and field studies can also shed light on causal mechanisms underpinning avatar identification, immersive persuasion, and decision-

making in hyper-real environments.

Finally, methodological advancements also represent another important direction. While BERTopic allowed the identification of latent, nuanced thematic structures, future studies could combine multimodal data sources (e.g., text, behavioural logs, in-world interactions) and advanced analytical techniques such as LLM-augmented topic modelling, neural network-based clustering and multimodal sentiment analysis) to derive richer insights. Researchers may also validate and triangulate machine-generated themes with expert coding to strengthen the interpretative robustness of metaverse scholarship.

Theoretical Implications:

The present study advances theoretical understanding of consumer behaviour in the metaverse by highlighting how multiple foundational perspectives, viz., telepresence, technology acceptance, immersion, social identity, and experiential value, have evolved to jointly explain user responses within virtual environments. The intellectual structure revealed through bibliometric mapping indicates that existing theories remain fragmented across disciplines, yet increasingly converge as researchers attempt to conceptualise behaviour within highly immersive socio-technical settings. Complementary evidence from BERTopic further reinforces that metaverse-related behaviour cannot be fully captured through any single theoretical lens. Instead, the thematic patterns highlight the need for integrative models combining consumer psychology, information systems, marketing science, human–computer interaction, and virtual environment theories to explain how individuals perceive, interact with, and derive value from metaverse experiences.

Temporal analysis also illustrates a theoretical progression from early emphasis on virtual reality, presence, and identity formation toward deeper examinations of virtual commerce, co-creation, social influence, and AI-enabled consumer experiences. This progression suggests that metaverse behaviour is shaped by continuous technological evolution, thereby calling for adaptive and context-sensitive theories that capture shifts across stages of immersion, interaction, decision-making, and value realisation.

Methodologically, this study contributes by demonstrating how BERTopic uncovers latent behavioural constructs that are not easily identifiable through conventional reviews or manual coding. Because BERTopic leverages contextual embeddings rather than frequency counts, it reveals nuanced themes such as avatar-based identity extension, immersive persuasion mechanisms, virtual socialisation, and digitally mediated trust formation. These constructs

require systematic theorisation and offer new foundations for developing metaverse-specific behavioural models. The findings thus position advanced topic modelling as a theoretically complementary tool that enhances conceptual clarity, supports theory expansion, and guides the formulation of future metaverse consumer behaviour frameworks.

Limitations to the study:

Despite employing a rigorous multi-method design integrating SPAR-4-SLR, bibliometric techniques, and BERTopic modelling, this study is subject to several limitations that should be acknowledged for the appropriate interpretation of its findings. First, the analysis draws only from the Scopus database, which, although widely recognised for its comprehensive coverage of management and social-science research, may still omit relevant publications indexed elsewhere. This may limit the breadth of the intellectual landscape captured in the review (Baas et al., 2020). Secondly, the bibliometric dataset ($n = 551$) and the corpus used for BERTopic ($n = 61$) differ in size due to the necessity of filtering incomplete or non-textual records for topic modelling. While this approach enhances semantic quality, it also introduces a degree of dataset asymmetry that future studies could address by combining full-text sources or applying large-scale transformer-based summarisation techniques to larger corpora.

Although BERTopic offers advanced semantic extraction through contextual embeddings, its outputs remain sensitive to document length, noise in abstracts, and the stochastic nature of UMAP and HDBSCAN. As a result, a relatively small number of stable topics emerged, suggesting that the current state of metaverse-related consumer behaviour research is still conceptually fragmented. Fourth, bibliometric techniques such as co-citation analysis and bibliographic coupling provide structural insights but cannot fully account for the interpretive depth or theoretical nuance contained within individual publications. Therefore, the intellectual clusters identified should be considered indicative rather than definitive representations of the field.

Finally, this review is time-bound. Given the fast-evolving nature of the metaverse and its associated technologies, the intellectual structures and thematic patterns identified may shift rapidly as new empirical evidence and theoretical perspectives emerge. Future research would benefit from longitudinal bibliometric analyses, integration of multi-database retrieval, and expanded topic modelling using full-text semantic analysis to enhance the comprehensiveness and robustness of findings.

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