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Unveiling customer engagement dynamics in the metaverse: A retrospective bibliometric and topic modelling investigation

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ABSTRACT

This study is a comprehensive retrospective bibliometric and topic modelling analysis of customer engagement within the metaverse. We carefully investigated a sample of 409 articles extracted from the Scopus database and used in this analysis. The aim was to explore the evolution, current state, and emerging trends in this rapidly evolving field. Utilizing advanced bibliometric tools including Biblioshiny and ScientoPy, alongside network visualisation software VOSviewer, we systematically mapped the intellectual landscape, identifying key publications, authors, and institutions that have significantly contributed to the discourse. Furthermore, through machine learning-based Latent Dirichlet Allocation (LDA) analysis, we dissected the thematic structure of the literature, revealing the predominant topics and their interrelations. Our findings highlighted the dynamic nature of customer engagement strategies in the metaverse, emphasizing Design of Immersive Platforms, Personalisation & Customization, and the Interaction & Participation implications of virtual interactions. This study not only synthesizes existing knowledge but also uncovers gaps in the literature, suggesting directions for future research. By providing a holistic view of the domain, this research serves as a valuable resource for academics, practitioners, and policymakers interested in the intersection of customer engagement and virtual environments.

1. Introduction

The advent of metaverse technologies have disrupted and transformed the marketing landscape. It has paved innovative ways for the brands to connect and create impactful relationship. The concept of metaverse can be looked as a 3D internet which offers virtual shared platforms created by fusion of physical and virtual worlds. It enables consumers to interact with other users with the help of their digital human or avatar (Dwivedi et al., 2022). Broadly, the metaverse is "a massively scaled and interoperable network of real-time rendered 3D virtual worlds which can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments" (Ball, 2022). If we begin to draw a timeline of some major events to evaluate the evolution of the metaverse, we start with 1980s when the Internet started

developing, followed by 1992, when the term 'metaverse' was first coined; 2002, when the 'digital twins' concept was introduced; 2009, when blockchain was implemented in the marketplace. Currently, various large technology firms are taking initiatives for further development and contributing in the evolution process of the metaverse (Giang Barrera & Shah, 2023).

The primary objective of consumer engagement is to improve retention and maintain long-term brand loyalty (Cowan et al., 2023). Consumer engagement, briefly defined as an "individual-specific, motivational, and context-dependent variable emerging from two-way interactions between relevant engagement subject(s) and object(s)" (Hollebeek, 2011). In order to achieve this engagement, the marketers need to remain connected with customers and prospective buyers to build brand affinity (Scholz & Smith, 2016). The disruptive digital technologies have enabled the customer engagement process to be more smooth and seamless (Simoni et al., 2022). In the traditional

ecommerce, consumers largely order goods online and consume them offline. Metaverse provides opportunities for the combination of virtual and physical items simultaneously (Nasr & El-Deeb, 2023). The virtual world provides consumers immersive experience (Grupac & Roiu, 2022), to engage them digitally, with an interaction as if they were dwelling in real world (Cheong et al., 2023). It is because of the fact that the metaverse is the combination of multiple interconnected technologies or platform involving VR/AR, social media, gaming platforms, etc. (Ali, M. et al., 2023).

The core business objective of the metaverse is to develop immersive experiences (Dahane et al., 2022) and the technological tools employed to achieve this objective are VR, AR, blockchain, and AI (Tayal & Rajagopal, 2023). VR and AR technologies help to engage the users with digital content vis-à-vis foster a deeper connection with brands and products (Grupac & Roiu, 2022). On the other hand, blockchain helps in ensuring security and integrity of transactions and digital assets within the Metaverse (Deepa et al., 2023). AI-driven algorithms help in enhancement of user interactions and creation of personalized experiences (Rosário et al., 2023). All these technologies combined – the metaverse ecosystem – resonates with users and creates memorable brand experiences (Kliestik et al., 2022). This ecosystem encompasses a diverse array of platforms catering to various user preferences and interests (Bashar et al., 2021). Social platforms like Facebook Horizon, VRChat, and Decentraland facilitate socialization, while gaming platforms like Fortnite and Roblox offer interactive gaming experiences within the Metaverse (Dwivedi et al., 2022; Park & Kim, 2022). Additionally, decentralized platforms built on blockchain technology empower users to create and monetize their digital assets (Boudreau et al., 2023). The integration of these platforms presents a unique challenge and opportunity for marketers. Understanding the nuances of each platform and devising cross-platform strategies are crucial for businesses aiming to establish a cohesive and engaging presence in the Metaverse (Dwivedi et al., 2022). So, the scope of the metaverse has three broad dimensions: (i) interconnecting multiple virtual worlds, (ii) blended reality perspective and convergence of many other technologies, and (iii) immersive and socially interactive aspects of environment (Giang Barrera & Shah, 2023).

There are various previous researches that employed systematic literature review in the context of Metaverse& marketing such as Metaverse & electronic word of mouth (Srivastava et al., 2023), Metaverse and fashion industry (Rabbani et al., 2021, pp. 1087–1091), Metaverse for sustainable development using bibliometric analysis (Johri et al., 2024), Metaverse as immersive technology and consumer behaviour (Anupama Ambika et al., 2023), Metaverse in business research (Firmansyah & Umar, 2023), Metaverse and education (De Felice et al., 2023) and defining metaverse (Ritterbusch & Teichmann, 2023).

While considerable number of qualitative research studies conducted in the context of metaverse and marketing, only a few have explored the effects of virtual technologies on customer engagement. Therefore, further research studies needed to investigate and understand factors influencing consumer engagement on metaverse. The metaverse and consumer engagement research is in its infant stage and required to be explored to understand the most significant antecedents effecting consumer engagement on metaverse. There is no existing research study found that specifically examined the metaverse and consumer engagement. This field of research is well recognized by the brands & marketers as a new business concept, and continuously attracting the attention of brands communities, researchers, and marketing scholars. This study will explore metaverse and consumer engagement in the context of immersive experience, personalisation & customization, interaction and participation, seamless integration and security & privacy. The current research would also explore the existing gap in the literature. This study has employed SLR along with state-of-the-art bibliometric analysis and topic modelling technique to discover insight about current and prospects of research in metaverse and consumer engagement. Citation trends reveal the evolution of research focus in metaverse marketing,

indicating emerging areas related to customer engagement. Identifying influential authors and sources helps pinpoint key contributors and foundational works, guiding the development of effective marketing strategies. Co-citation analysis uncovers thematic clusters and intellectual connections, showing how different aspects of metaverse marketing are interconnected. Together, these analyses provide a comprehensive understanding of the field, supporting the development of targeted strategies to enhance customer engagement in the metaverse.

This research will help the brands, practitioners, business, and enterpriser to gain better understanding of metaverse and consumer engagement. The outcome of this research will also contribute the theoretical concept in this area.

This article contributes to the literature related to adoption and application of metaverse for virtual customer engagement. It attempts to present bibliometric analysis, network analysis and topic modeling for the research landscape of customer engagement on metaverse. Also, we have identified five important characteristics of metaverse application, viz. immersive experience, personalisation and customization, interactivity and participation, seamless integration, security and privacy; that scholars can use in order to develop research premises. Researchers can utilize the outcomes to define variables in these five characteristics in their studies.

Further, the article describes data strategy and methodology in Section 2, Section 3 presents the results and discussion. This is followed by section 4 which describes the networks analysis and topic modelling. Thereafter, Section 5, 6 and 7 present the future research directions, implications and limitations respectively.

2. Data strategy & research methodology

Systematic review method as shown in Fig. 1, has been adopted in this study. The systematic steps comprise of data search & extraction, Data screening and exclusion, Final sampling, bibliometric analysis, network analysis and finally topic modelling.

2.1. Data characteristics

The data set used in this study is published between years 2006–2024 (till February 5). There are total 409 articles included in this study. These articles are written by 823 authors and published by 204 sources. Only 49 documents were found single authored, rest of the documents are written by multiple authors. This indicates collaborations among international authors and suggests that the studies offer a global perspective on customer engagement strategies within the metaverse.

2.2. Data extraction

The Scopus database is selected for searching and extraction of quality records on the subject of customer engagement through metaverse as the Scopus database is widely used by social science scholars to extract large volume of articles for systematic review and bibliographic analyses studies (Naeem et al., 2023; Rabbani et al., 2022). The records were searched in the TIT-ABS-KEY field of Scopus database using unique combinations of keywords for customer engagement on metaverse. The following Boolean combinations were used to extract the data:"- Customer Engagement AND Metaverse", "Virtual Engagement AND Metaverse", "Virtual Customer Engagement", "Customer AND Metaverse", "Brand Engagement AND Metaverse", "Virtual Customer Engagement", "Consumer Engagement AND Metaverse", "Metaverse Retail Engagement". This step returns 687 articles; these articles were downloaded in.CSV format.

The extracted records were carefully investigated to align with the scope of this research. Multiple exclusion and inclusion criteria were applied to screen the extracted dataset. Papers published in non-English languages including books, short notes, editorials, articles, etc. are excluded. A total of 131 papers were excluded. The inclusion criteria
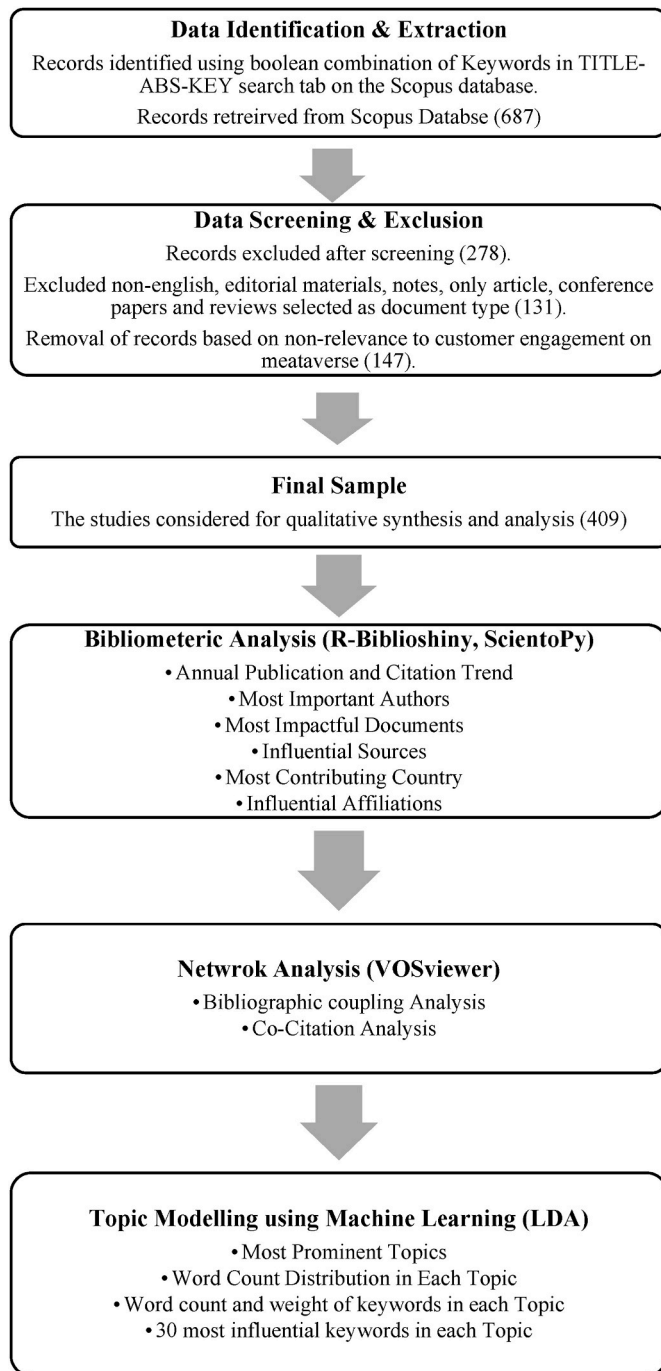
Data Identification & Extraction

Records identified using boolean combination of Keywords in TITLE-ABS-KEY search tab on the Scopus database.

Records retreirved from Scopus Databse (687)

Data Screening & Exclusion

Records excluded after screening (278).

Excluded non-english, editorial materials, notes, only article, conference papers and reviews selected as document type (131).

Removal of records based on non-relevance to customer engagement on meataverse (147).

Final Sample

The studies considered for qualitative synthesis and analysis (409)

Bibliometeric Analysis (R-Biblioshiny, ScientoPy)

• Annual Publication and Citation Trend
• Most Important Authors
• Most Impactful Documents
• Influential Sources
• Most Contributing Country
• Influential Affiliations

Netwrok Analysis (VOSviewer)

• Bibliographic coupling Analysis
• Co-Citation Analysis

Topic Modelling using Machine Learning (LDA)

• Most Prominent Topics
• Word Count Distribution in Each Topic
• Word count and weight of keywords in each Topic
• 30 most influential keywords in each Topic

Fig. 1. – Data extraction & research methodology.

were limited to articles, book reviews, book chapters, and conference papers.

One of the most important criteria was to assure that the documents could match with the core objectives and research questions of the study. The authors investigated each article by careful look at title & abstract and made sure that the central core of the studies is on the customer engagement on metaverse. In this step of screening another 147 articles were excluded from the dataset. Therefore, 409 articles were remaining as the final data set for further synthesis and analysis.

The bibliometric analysis is conducted based on the final dataset to explore the past and current trends of the state of research on the subject of consumer engagement on metaverse. Bibliometric analysis is a qualitative technique to explore and determine the trends of publications,

citations, best authors, best journals, affiliations, keywords etc. (Hassan, et al., 2023; Wasiq et al., 2023). The graphic interface of R application Biblioshiny was used for the bibliometric analysis to explore and interpret the scholarly dataset. This software is capable of analysing large set of bibliographic data and creating results and visualisation to suit the scope of bibliometric analysis (Bashar, 2021a; Hassan, et al., 2023).

2.3. Network analysis and topic modelling

The network analysis is performed using VOSviewer application to explore and understand the developments and trends in a specific field of study that helps in gaining insight about the overall landscape of the scientific research (Wang et al., 2021). Keyword Co-occurrence, bibliographic coupling and Citations Analyses are performed to analyze the dynamics and underpin the major trends in the research area of customer engagement.

Finally, topic modelling was performed using Latent Dirichlet Allocation (LDA). This is one of the powerful tools widely used for exploring and gaining insight about the thematic structure of the scientific dataset. The coding for LDA is done in python language. There are various steps which are being followed for LDA topic modelling. The data is needed to be pre-processed from raw text to a format suitable for Natural Language Processing (NLP). This process involves tokenisation, lowercasing, removing punctuations, removing stop words, stemming of words, vectorisation etc. LDA analysis is done to explore and present most prominent topics, word count distribution in each topic, word cloud of each topic, word count and weight of keywords in each topic, t-SNE Clustering of LDA Topics with 30 most influential keywords in each Topic.

3. Results & discussion

3.1. Annual publications & citations trend

The annual publication and citations trend are shown in Fig. 2. The first article on the subject of research in customer engagement on metaverse was found in the year 2006. However, the first article "Avatar-based marketing" has been cited 221 times since then. The citations trend is also depicting a promising expansion of the research in customer engagement on metaverse. The development in this research field was slow and steady for almost one decade. The attention of researchers in studying & understanding immersive customer engagement saw increasing growth for 6–7 years and then increased exponentially from 2021 onwards. The trend shows that the field is going to see new heights as more companies are investing in and adopting to metaverse strategies for engaging their customers and transacting with them.
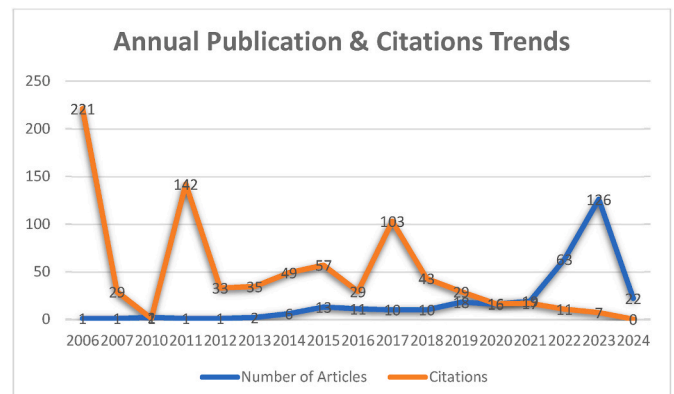

Fig. 2. Annual publication and citations trend.

3.2. Influential documents

Top 15 documents based on their total citations are presented in Table 1. The most prolific document is authored by Grewal D and published by Journal of retailing in the year 2017. The article titled "Customer experience management in retailing: An organizing framework" has attracted 625 citations over the period. This article has defined the various aspects of customer engagement in retailing. The article further elaborated the various strategies that can be adopted by the retailers to attract, engage and transact on metaverse. The customer experience shall be an organisational strategy and must be designed to tap each customer touch-point from exploration to payment and advocacy (Bashar et al., 2022, pp. 634–638).

The second document in this table is titled "The impact of online brand community characteristics on customer engagement: An application of Stimulus-Organism-Response paradigm", authored by Islam J, published by Telematics and Informatics in 2017 and have been cited 315 times. This research study focussed on the importance of online community components such as information quality, system quality, virtual interactivity, virtual rewards etc. The results of this empirical study emphasises that the success of online community for the businesses depends on carefully crafted and designed customer experience strategies that can positively engage the customers online (Jaziri et al., 2023).

The third most influential document in the current dataset is published by Harvard Business Review in the year 2006. The articles titled "Avatar-based marketing" is written by Hemp P and has attracted 221 citations over the period. This is one of the seminal articlesabout metaverse marketing strategies. This article emphasised on the possibilities of advertising to avatars in virtual world. Moreover, this article revolves around the strategies for segmentation, targeting and positioning using digital tools for virtual worlds.

The other articles in the list are reflecting the important aspects of customer engagement virtually, few of the focussed area of investigation are "brand loyalty through user engagement", "gamification and customer engagements", "branding on social media" etc. and metaverse as a driver of customer experience. The marketers need to create unique and memorable customer experience to engage and positively instigate them to transact on virtual immersive platforms.

3.3. Influential authors

The 15 most Influential Authors (based on h-indices, total citations and number of papers) are presented in the following Table 2. These authors have substantially contributed in the development of understanding of the phenomenon of customer engagement on metaverse.

As far as h-index is concerned, the best author is LEE J with h-index of 4. LEE majority of the work is about fashion & beauty industry in metaverse such as "Future value and direction of cosmetics in the era of metaverse", "The significant transformation of life into health and beauty in metaverse era" etc. The author has deliberated on the present and probable future landscape of beauty industry in metaverse era. The second author is ZVARIKOVA K having h-index of 3, who has worked on the various tools and procedures for immersive virtual environments such as "Retail Data Measurement Tools, Cognitive Artificial Intelligence Algorithms, and Metaverse Live Shopping Analytics in Immersive Hyper-Connected Virtual Spaces", "Cognitive Artificial Intelligence Algorithms, Movement and Behavior Tracking Tools, and Customer Identification Technology in the Metaverse Commerce" etc. The third author as per h-index is RAHMAN Z with h-index of 3, whose work is revolving around online brand communities, online services such as "The impact of online brand community characteristics on customer engagement: An application of Stimulus-Organism-Response paradigm", "The role of consumer engagement in recovering online service failures: An application of service-dominant logic" etc.

The important authors in terms of total number of citations are

Table 1

Top 15 documents on customer engagement on metaverse.

Author	Year	Journal	Document Title	Total Citations
Grewal D	2017	Journal of Retailing	Customer experience management in retailing: An organizing framework	625
Islam J	2017	Telematics and Informatics	The impact of online brand community characteristics on customer engagement: An application of Stimulus-Organism-Response paradigm	315
Hemp P	2006	Harvard Business Review	Avatar-based marketing	221
Zheng X	2015	Information Technology and People	Building brand loyalty through user engagement in online brand communities in social networking sites	219
Breidbach CF	2014	Managing Service Quality	Beyond virtuality: from engagement platforms to engagement ecosystems	217
Harwood T	2015	Journal of Services Marketing	An investigation into gamification as a customer engagement experience environment	196
Simon F	2018	Journal of Business Research	Does brand-consumer social sharing matter? A relational framework of customer engagement to brand-hosted social media	169
Cheung Cmk	2015	Electronic Commerce Research and Applications	Promoting sales of online games through customer engagement	151
Fernandes T	2016	Journal of Strategic Marketing	How to engage customers in co-creation: customers' motivations for collaborative innovation	150
Porter Ce	2011	California Management Review	How to foster and sustain engagement in virtual communities	142
Hollensen S	2023	Journal of Business Strategy	Metaverse–the new marketing universe	135
Akrout H	2018	Information & Management	Trust and commitment within a virtual brand community: The mediating role of brand relationship quality	118
Buhalis D	2023	International Journal of Contemporary Hospitality Management	Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing	114
Giang Barrera K	2023	Journal of Business Research	Marketing in the Metaverse: Conceptual understanding, framework, and research agenda	114
Buhalis D	2023	Tourism Management	Metaverse as a disruptive technology revolutionising tourism management and marketing	113

Table 2
Most Influential Authors (Based on h-indices, total citations and no. of papers).

Most Influential Authors					
Based on h-index		Based on Total Citations		Based on no. of Papers	
LEE J	4	ROGGEVEEN AL	670	SINGH A	5
ZVARIKOVA K	3	NORDFÄLT J	670	LEE J	4
RAHMAN Z	3	GREWAL D	670	RAHMAN Z	3
POPESCU GH	3	RAHMAN Z	421	BUHALIS D	3
NICA E	3	CHEUNG CMK	370	FERNANDES T	3
KWON KH	3	ISLAM J	315	HOLLEBEEK LD	3
HORAK J	3	BUHALIS D	280	BRENGMAN M	3
HOLLEBEEK LD	3	FERNANDES T	261	NICA E	3
BUHALIS D	3	LEUNG D	227	POPESCU GH	3
BRENGMAN M	3	BREIDBACH CF	227	ZVARIKOVA K	3
BALICA R-Ș	3	HEMP P	221	HORAK J	3
ZHANG L	2	ZHENG X	219	GRUPAC M	3
WILLEMS K	2	LIANG L	219	KWON KH	3
WEI W	2	LEE MKO	219	BALICA R-Ș	3
WANG Y	2	HOLLEBEEK L	217	ZHANG L	3

ROGGEVEEN AL, NORDFÄLT J and GREWAL D having total citations of 670 each. These authors' work reflects the important considerations for virtualisation of marketing activities on metaverse specially customer engagement. Their work mark & underline critical virtualisation components and their importance in terms of creating immersive customer experience. They have also highlighted the challenges these technologies are posing in terms of data privacy and ethical considerations.

The authors SINGH A, LEE J and RAHMAN Z are in the top three authors in terms of total number of articles contribution. It is obvious to note that both LEE J and RAHMAN Z are among top three authors based on h-indices, total citations and number of papers published. SINGH A has published significant articles adding substantially to the overall knowledge of marketing in metaverse in general and customer engagement in particular and few of the important works are "Optimizing augmented reality and virtual reality for customer engagement", "Cultural Marketing and Metaverse for Consumer Engagement", etc.

3.4. Most contributing country

The most productive countries are depicted in Fig. 3. The United States of America, India and United Kingdom are top three countries which have contributed considerably in the understanding and development of customer engagement on metaverse. It is quite interesting to note that these countries are actively publishing from 2022 onwards. For instance, USA has published 81% (38) of their total contribution (47) between 2022 and 2023 so as other top contributing countries. The right side of Fig. 1 shows the evolution of countries in terms of their contribution on the subject of customer engagement on metaverse. The
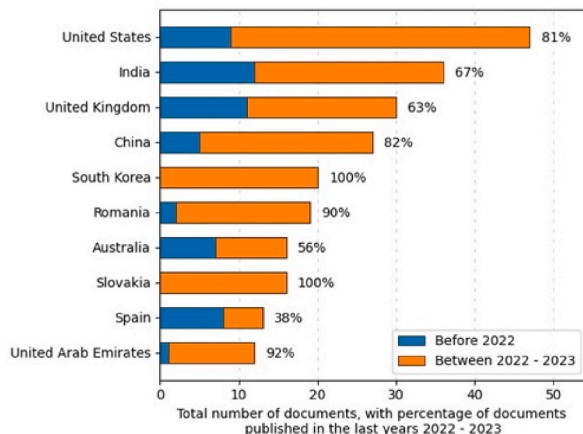
countries such as Australia, India and UK are contributing from last one and one & half decades, while other nations have started publishing in the recent past.

This trend shows that all these nations are adopting metaverse as a faster rate compared with other nations. The scholars are getting attracted towards this phenomenon because of heavy government spending that build required infrastructure for the virtualisation & digitalisation to prosper at a never before rate. The researchers in these countries are deliberating and determining the ways these technologies can be exploited for business applications and growth. Especially, it has entirely changed the marketing landscape with the convergence of virtual and real world.

3.5. Keywords evolution

The evolution of author's and Index keywords is presented in Fig. 4. These keywords reflect the direction of the research trends in the customer engagements on metaverse. A careful look at the below figure is showing that keywords like "virtual reality", "Metaverse", "customer engagement", "Augmented reality" are top keywords which have been re-occurring in majority of the research published between 2010 and 2024 (see Fig. 4).

The keyword metaverse has evolved mainly after 2020 and started appearing exponentially in the documents from then. The research on metaverse regarding the application of technologies such as virtual reality, augmented reality, artificial intelligence and integration of social media, social networking platforms are the most found research themes based on the following keywords. The right figure of Fig. 1 is depicting that very few numbers of articles have been written on other aspects of visualisation etc. the focus is now on the application of metaverse platform for marketing activities. The scholars are deliberating on frameworks and procedures to be adopted for a successful customer engagement on the metaverse platform.

3.6. Top 15 influential sources

Most Influential Sources (based on h-indices, total citations and no. of papers) are presented in Table 3, which have contributed substantially by publishing quality articles in the development of customer engagement in metaverse research. The most prolific source in terms of h-index is "Linguistic and Philosophical Investigations". It is having h-index of 11 and published important articles for exploring the metaverse for customer engagement. The research topics covered by this journal are virtual marketplace dynamics, spatial analytics, decentralized metaverse, blockchain-based metaverse platforms, multisensory immersion etc. The second influential journal in terms of h-index is "Review of
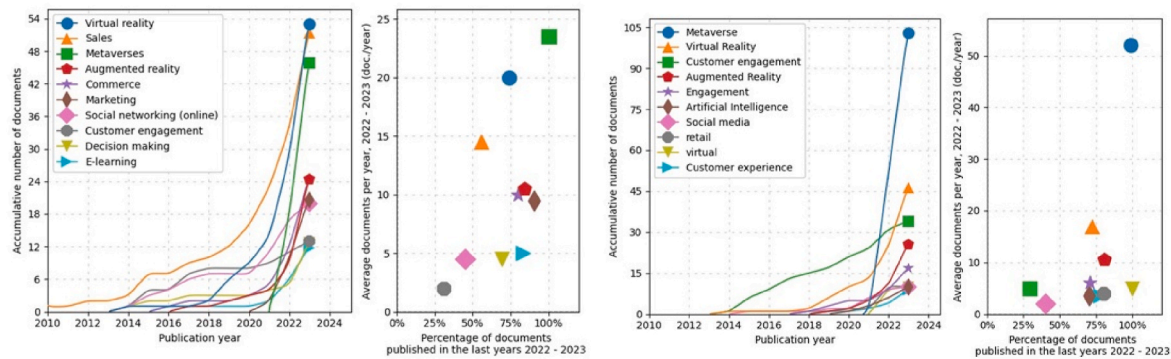

Fig. 3. Most productive country.
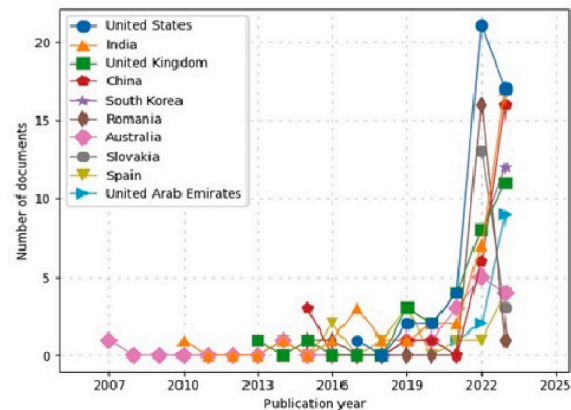
Fig. 4. Author's & index keywords dynamics.

Contemporary Philosophy", it has published articles focusing on "Visual Imagery and Geospatial Mapping Tools", "Virtual Simulation Algorithms", and "Deep Learning-based Sensing Technologies in the Metaverse Interactive Environment". These articles have highlighted the technological aspects of metaverse to address the issue of real-time behavioural analytics and intelligence to alter marketing offerings virtually.

Third important journal is "Journal of Business Research", the virtual brand management, marketing in metaverse; virtual reality marketing, brand engagement etc. are few of the areas of metaverse marketing it has published.

As far as total citations are concerned, "Journal of Retailing", "Journal of Business Research", and "Journal of Services Marketing" are three top sources publishing on the customer engagement research on metaverse. These sources have attracted 712, 406 and 316 citations respectively. These journals have published substantially on virtual brand engagement, physical Vs virtual customer engagement, digital sports viewing behaviour, gamifications etc. The future of retailing in metaverse has been investigated thoroughly. The concept of digital human or artificial intelligence powered chatbots which are interacting with metaverse users in virtual environments are being investigated to adopt and apply for business purposes.

The top three sources in terms of number of papers published are "Linguistic and Philosophical Investigations", "Review of Contemporary Philosophy", and "Analysis and Metaphysics". These sources have contributed 16, 11 and 7 articles respectively. These sources have explored the customer engagement on virtual platform from various angles such as tools & techniques, implementations and ethical considerations.

3.7. Top contributing affiliations

The top affiliations contributing in the research of customer engagement on metaverse are presented in Fig. 5. The top affiliation is "The Hong Kong Polytechnic University", it has contributed 23 articles mainly focussed on the understanding of interplay between consumers and virtual immersive platforms. The second top affiliation is "University of Zilina" is one of the top universities in Slovakia. 16 articles exploring the customer engagement are published by this university. The "University of Zaragoza" is ranked third most contributing affiliation with the publication of 11 articles. The other affiliations "Manchester Metropolitan University", "Murdoch University", "Symbiosis International (Deemed University)", "University of Craiova" have also contributed extensively in the development of research on customer engagement on virtual platforms especially metaverse.

3.8. Network analysis

3.8.1. Bibliographic coupling analysis

The bibliographic coupling analysis was performed using VOSviewer application to visualise the research clusters and streams. Two documents are said to be coupled bibliographically if both have cited at least one or more common document(s) in their reference, it shows the probability of similar works in both documents (Bashar, Singh, & Pathak, 2024). The bibliographic cluster network obtained by applying a threshold criterion that required each document to be cited at least five times. The network is made up of four clusters as represented in Fig. 6.

The largest cluster consists of 47 documents and is represented by green colour. A careful investigation of this cluster shows that this cluster is about immersive experience to the customer. Some of the important documents in this cluster are "The impact of online brand community characteristics on customer engagement: An application of Stimulus-Organism-Response paradigm", "An investigation into gamification as a customer engagement experience environment", "Building brand loyalty through user engagement in online brand communities in social networking sites" etc. The research sub streams in this cluster are about creating a parallel virtual world (Bashar, Singh, & Pathak, 2024), creating engaging simulations (Rohit et al., 2023), introduction of digital human (Hassan et al., 2021), engaging virtual games (Bansal et al., 2022), digital collectibles (Zheng et al., 2015), digital wallet and hyper fusion of real and virtual worlds (Singla et al., 2023).

The second largest cluster in this network is represented in red colour and made up of 33 documents. This cluster is about the application of digital technologies and virtualisation tools for creating highly personalized & customised spaces for the customers on metaverse. The most important articles found in this cluster are "Metaverse – the new marketing universe", "Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing", "Metaverse as a disruptive technology revolutionising tourism management and marketing". All of these articles are exploring about the possibilities of user-based customization of their virtual identity i.e. avatar (Singla et al., 2023), virtual possessions (Bashar, 2012) and virtual interactions (Mengalli et al., 2023) that can foster virtual value co-creation and improve overall customer engagements on metaverse.

The third largest cluster comprises of 22 documents and presented by blue colour. The theme is this cluster is revolving around interaction & participation on metaverse platforms. "Navigating the Aisles: An Augmented Reality Solution for Gamified Indoor Grocery Store Navigation", "Decision Intelligence and Modelling, Multisensory Customer Experiences, and Socially Interconnected Virtual Services across the Metaverse Ecosystem", "Cognitive Artificial Intelligence Algorithms, Movement and Behavior Tracking Tools, and Customer Identification Technology in the Metaverse Commerce". The research on the topics such as the design of platforms that instigate interactions, design of

Table 3

Most Influential Sources (Based on h-indices, total citations and no. of papers).

Based on h-index		Based on Total Citations		Based on no. of Papers	
Linguistic and Philosophical Investigations	11	Journal of Retailing	712	Linguistic and Philosophical Investigations	16
Review of Contemporary Philosophy	7	Journal of Business Research	406	Review of Contemporary Philosophy	11
Journal of Business Research	5	Journal of Services Marketing	316	Analysis and Metaphysics	7
Journal of Services Marketing	5	Telematics and Informatics	315	Developments in Marketing Science: Proceedings of The Academy of Marketing Science	7
Analysis and Metaphysics	4	Linguistic and Philosophical Investigations	260	Journal of Business Research	5
Frontiers in Psychology	4	Harvard Business Review	221	Journal of Services Marketing	5
IEEE Access	3	Information Technology and People	219	IEEE Access	4
International Journal of Contemporary Hospitality Management	3	Managing Service Quality	217	Frontiers In Psychology	4
Journal of Marketing Management	3	Electronic Commerce Research and Applications	168	Sustainability (Switzerland)	4
Journal of Retailing	3	California Management Review	167	Lecture Notes in Computer Science (Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics)	4
Psychology and Marketing	3	Journal of Strategic Marketing	150	Journal of Retailing	3
Sustainability (Switzerland)	3	International Journal of Contemporary Hospitality Management	148	Electronic Commerce Research and Applications	3
ACM International Conference Proceeding Series	2	Review of Contemporary Philosophy	141	International Journal of Contemporary Hospitality Management	3
California Management Review	2	Journal of Business Strategy	135	Journal of Marketing Management	3
Computers in Human Behavior	2	Information and Management	118	Internet Research	3

virtual events, participation in events (Bashar et al., 2013) and collaborations for virtual projects are the core of this cluster (Atshan et al., 2023; Lee et al., 2020).

The smallest cluster is having 14 documents and presented in pink colour. The influential documents found in this cluster are "Metaverse-retail service quality: A future framework for retail service quality in the 3D internet", "Critical questions for Facebook's virtual reality: data, power and the metaverse" etc. This cluster is about creating retail space on metaverse i.e. metaverse retailing (Bashar, 2021b) and various critical aspects in terms of challenges such as availability of high-speed internet with related telecom infrastructure, making people to adopt and engage in metaverse and opportunities such as to cater market by grabbing ever increasing investment on metaverse platform as a

marketing tool (Jafar et al., 2023; Rohit et al., 2023).

3.8.2. Co-citation analysis

The co-citation analysis was conducted to explore the emerging trend in a given area of research. When a research article is citing two documents together then it is termed as co-cited, it shows the semantic coherence about the research in various documents that eventually forms a cluster (Bashar et al., 2023).

The co-citation analysis of cited authors is conducted using VOS-viewer application by keeping citations of an author as 20. The co-citation network obtained is having four clusters and is presented in Fig. 7.

The largest cluster of the network is represented in green colour have made of 146 authors. The result of this analysis is in line with the results of bibliographic coupling. The authors "Buhalis D″, "Kim J″, "Wang Y″, "Zhang X″, "Hollensen S″ etc. in this cluster have investigated the immersiveness on metaverse. The theme of this cluster is creation of immersive experience on metaverse and have centred around the exploration of strategies for immersiveness. These strategies are related to technological factors such as IT infrastructure, visualisation & quality acoustics and latency (Bashar & Rabbani, 2021, pp. 23–28). Other important aspects related to immersiveness is about relevant content, personalisation, emotional engagements, ease of use, social interactions and state of flow that make the users forget about time and fully indulged virtually (Deriu et al., 2021; Dhamore & Balaji, 2016; Kumar, 2019). This research stream reflects the fact that gaining customer loyalty as a result of their satisfaction can only be achieved by exploring, understanding and optimizing various factors which are instrumental in creation of unique and memorable customer experience online.

The cluster represented in red is second largest cluster of this network, it is made up of 139 authors. The prominent authors in this cluster are "Brodie R.J″, "Hollebeek L.D″, "Sarstedt M″, "Grewal D″, "Bagozzi R.P″, "Vargo S.I″ who have explored about the concepts and framework of interactions and participation. The scholars have deliberated about creation of a digital world where users can interact virtually with the help of AI based bots labelled as digital human, they can socialize with other users as per their interest that allows them to communicate and virtually collaborate (Bashar & Saraswat, 2020). In addition, the users shall be given a positive and creative environment to create their own virtual contents such as graphic based artworks, games, events and unique experiences that foster better customer engagement on the metaverse platform. The marketers need to deduce framework and create virtual environments where users can have fun and earn virtual credits that can be redeemed in real world, it eventually converges the real and virtual goods. The metaverse platform allows users to have their digital wallet where they can collect their digital rewards and use them on wide-ranging occasions & platforms.

The next cluster represented in blue contains 96 authors who have published about consumer engagement on metaverse. The most prominent authors of this cluster are "Lazaroiu G″, "Yang Y″, "Gao W″, "Chen J″. This cluster is centred around the concept of virtual engagement of customer on the metaverse platform using marketing strategies. Basically, this cluster explores the intersection and fusion of various marketing strategies than can be aligned with and applied in virtual world. The traditional marketing practices are not fit for the hyper immersive virtual platforms where customers are interacting in real-time environment and they wish that information about products they explore shall also be readily available in real-time. The marketers also need framework that can enable them to ascertain that the customers are getting what they are looking for as a result of real-time behavioural intelligence (Bashar, Singh, & Pathak, 2024).

The smallest cluster of the co-citation network is depicted in pink and made of 55 authors. The influential authors in this cluster are "Flavian C″, "Lee H″, "Heller J″, "Law R". The core theme of this cluster is technological aspects of metaverse i.e. technologies being used for virtualisation and immersiveness. The metaverse platform is a combination of
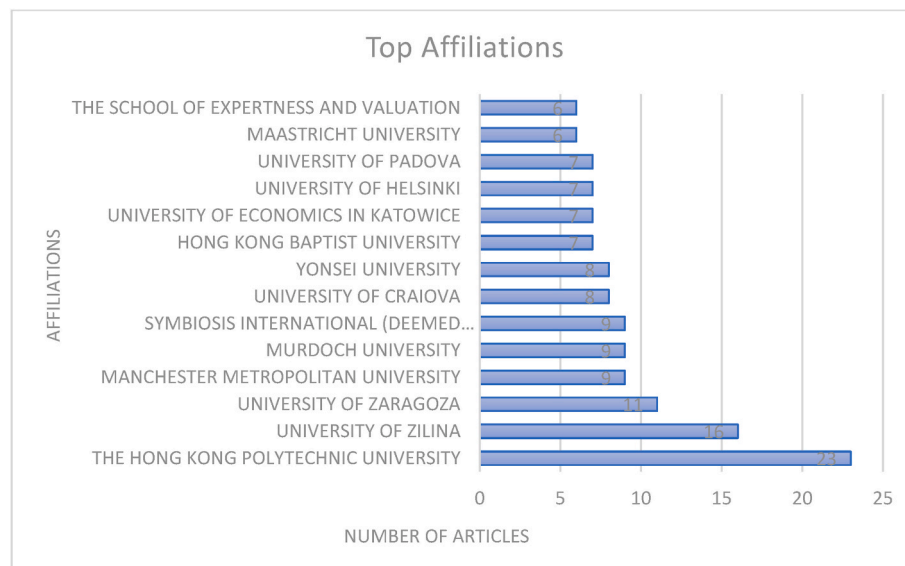
Fig. 5. Affiliations Contributing to research in Consumer Engagement on Metaverse.
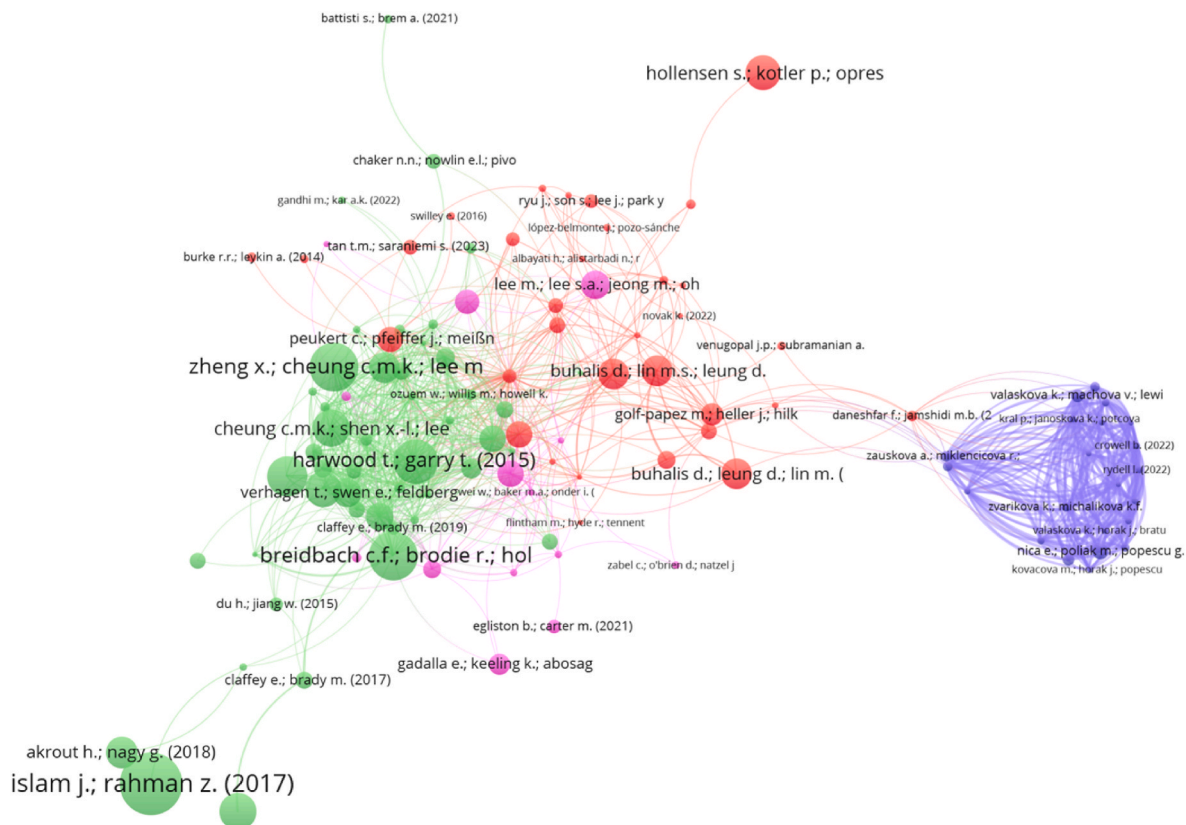

Fig. 6. Bibliographic coupling analysis.

technologies such as virtual reality, augmented reality, mixed reality, extended reality, blockchain & cryptography, artificial intelligence, cloud computing etc. (Bashar, 2020). These technologies are enabling the developers to design immersive virtual platform where users can interact, collaborate and hang out virtually through their simulation in virtual world (Rohit et al., 2023). Therefore, it is the fundamental need of the virtual platform to enable users to have their digital twin or digital human that they can customise and recreate as their presence across various virtual platforms (Samad et al., 2023).

3.9. Topic modelling

Topic modelling technique is a group of highly sophisticated algorithms used for exploration and discovery of hidden patterns and thematic structure in a certain area of research (Jung & Kim, 2023). It employs machine learning algorithms that counts the frequencies of the appearances of sentences or re-occurrences of words in a given set of documents to reveal emerging research streams (Jung & Kim, 2023).

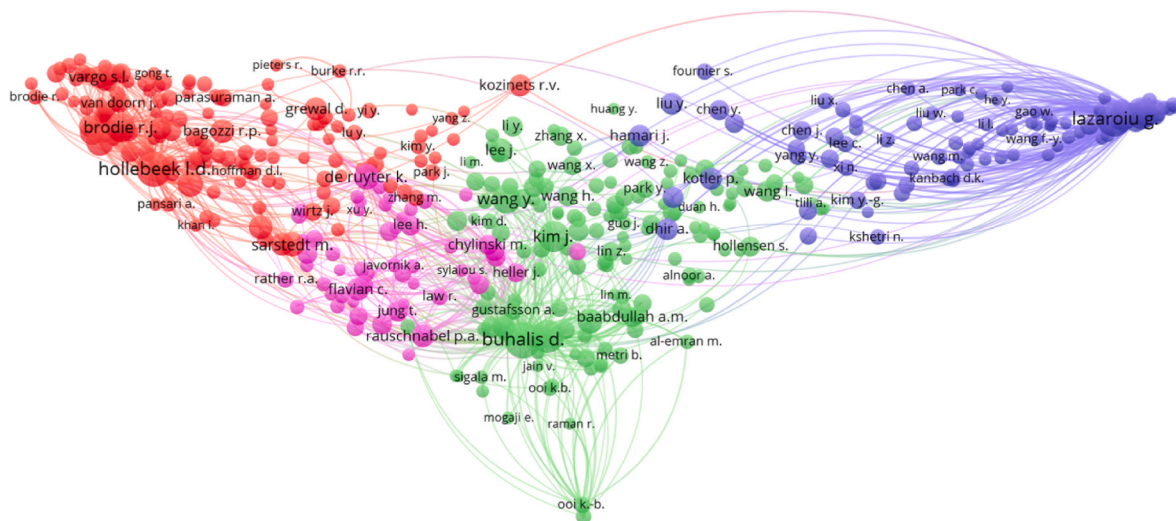The Latent Dirichlet Allocation (LDA) algorithm is employed in this

Fig. 7. Co-citation analysis.

study. It is a statistical technique based on a generative probabilistic method that helps in discovering topics that occurs in a pool of documents (Mušanović & Dorčić, 2022).

The coding for this algorithm has been done in the python. The LDA modelling was performed in different stages, first stage was to initialise the modelling by randomly assigning a unique topic to each individual document in the collection of documents. This stage was followed by updating the allocation of topics based on conditional probabilities of topics in documents and word in topics. It was then followed by repeating the previous step based on Dirichlet distribution. Finally, re-iterations were done unless the words are assigned along with their most suitable topics.

The decision about the number of topics was not straightforward; it was decided by looking at the coherence score. Coherence score is basically is the degree of semantic likeness between words having high score, the high the coherence the better the fitness of LDA mode. For determining we need to fine tune the LDA model. The coherence score and the number of topics has been plotted and presented in Fig. 8. Fig. 8 shows that the maximum coherence score of 0.57 is achieved when the number of topics is 7. Therefore, the model is proceeded with 7 LDA topics for further analysis and modelling.

The LDA model with seven distinct topics is presented in Fig. 9, the left panel shows the concentration and strength of each topic while right panel presents 30 most frequent words in each topic. The size of the topic circle is indicating the strength of each topic in the LDA model; it is evident that topics strength is decreasing from 1st to 7th.
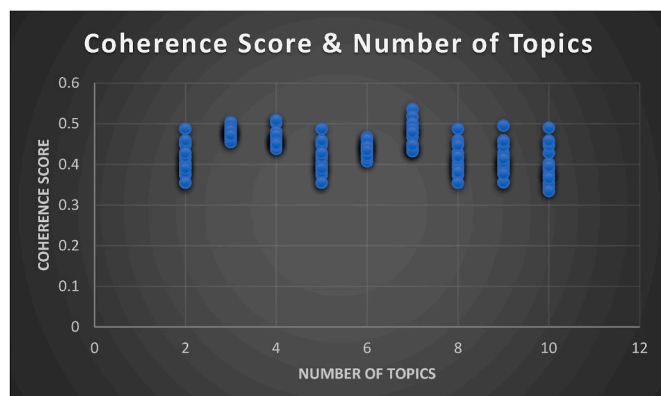

Fig. 8. Coherence score &number of LDA topics.

3.9.1. Most prominent topics

We extracted the most prominent topics along with 20 words in each topic in the research landscape of customer engagement on metaverse is presented in Table 4.

The 7 distinct classified topics have enhanced the exploration and understanding of customer engagements on metaverse platforms. By diving deep and analysing each topic outputs, the topics can be interpreted and named in the context of customer engagement on metaverse. The following 7 topics are the primary focus of the research in the area of customer engagement virtually.

Topic 1: Virtual Marketing & Digital Engagement
Topic 2: Consumer Engagement in Virtual Spaces
Topic 3: Metaverse Brand Engagement
Topic 4: Social Marketing in Virtual Customer Engagement
Topic 5: Marketing Design and Metaverse Engagement
Topic 6: Brand Reality and Engagement on Metaverse
Topic 7: Data Driven Virtual Customer Engagement

The research landscape of metaverse customer engagement topics can be grouped together into three distinct components viz. Design of Immersive Platforms (Topic 4, Topic 6), Personalisation & Customization (Topic 3, Topic 5) and Interaction & Participation (Topic 0, Topic 1, Topic 2). These topics are consistent with the previous results that the marketers must design strategies that can help in creating super immersive experience with utmost customization and personalisation that can allow them to interact and recreate on metaverse.

3.9.1.1. Pillars of customer engagement on metaverse. Each pillars of customer engagement research based on the outcome of the LDA modelling and the corresponding research topics are discussed below.

3.9.1.2. Design of immersive platforms (Topic 4, Topic 6). A careful investigation of the topics 5 & 6 can help in understanding the underlying research landscape in the design and development of immersive platforms. The word count distribution of each topic and their weights are presented in Fig. 10.

The five most influential words from each topic was considered for better visualisation and interpretation. In both topics 4&6 the words "Virtual", "Engagement", "Customer" are the prominent words that indicates that it is essential for the firms to consider the design of immersive environment with utmost priority that can lead to better customer experience and engagement.

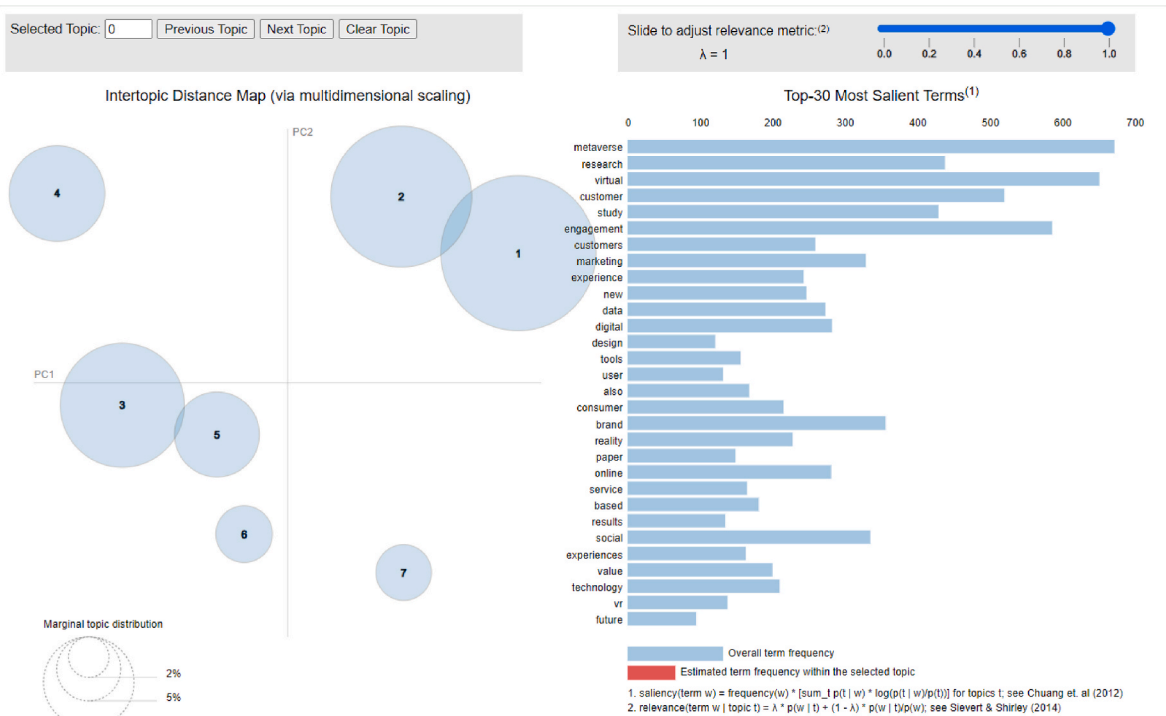Similarly, the word count and number of documents are presented in

Fig. 9. LDA model output with 7 topics.

Table 4
Top 20 most frequent words in each topics.

Topic 0:	Topic 1:	Topic 2:	Topic 3:	Topic 4:	Topic 5:	Topic 6:
engagement	metaverse	social	metaverse	metaverse	content	engagement
virtual	virtual	engagement	virtual	tools	clutch	customer
study	marketing	online	engagement	data	marketing	virtual
research	digital	research	service	virtual	virtual	study
online	study	consumers	research	research	social	metaverse
customers	social	study	learning	algorithms	vehicle	brand
customer	new	virtual	Ai	customer	engagement	research
social	brand	brand	industry	immersive	brand	experience
value	consumers	metaverse	reality	findings	model	marketing
sales	engagement	new	digital	quality	media	customers
development	brands	customers	fitness	assessment	paper	reality
data	research	consumers	education	literature	value	online
use	online	marketing	customer	analytics	brands	social
community	customer	media	experience	digital	customer	vr
service	experience	customer	new	marketing	marketers	results
metaverse	customers	digital	users	experiences	simulation	also
interaction	content	game	technology	visualization	also	technology
digital	use	shopping	tourism	technologies	torque	new
design	consumer	also	framework	shopping	posts	technologies
new	using	theory	system	review	museum	findings

Fig. 11. This figure signifies the number of words that have been occurred in a set of documents. The distribution of words occurrence and number of documents are skewed left for topic 4and contains only few documents where more than 150 words have occurred. While in topic 6 the frequency of occurrence is quite low which signifies that the words are gravitated properly.

There are organisations such as Microsoft, Amazon, Coca-Cola, IKEA etc. who have implemented immersive technologies to design virtual immersive platforms. There are various types of technologies such as virtual reality (Bodenbenner & Neumann, 2012; Flavián & Barta, 2023), augmented reality (Lee, 2023), mixed reality (Yawised et al., 2022), digital twin (Islam & Rahman, 2017), extended reality (Cho et al., 2023) and 360-degree reality (Beck et al., 2019), implemented by the organization to engage their customers with highest level of immersiveness.

The metaverse is providing digital platform to create communities, to engage customer and encourage them to share content online (Rossanty et al., 2023).

Immersive experience is referred to as creating engaging lifelike simulation and environment that captive the users, offering them experiences that they cannot get in the physical world (Sharma et al., 2023). These immersive technologies provide digital environment to the brands to sell their products to their customer. The luxury brands create virtual worlds to engage, interact, and entertain within brand community to enhance the brand affinity (Simon & Tossan, 2018).

3.9.1.3. Personalisation & customization (Topic 3, Topic 5). Another important aspect of customer engagement on metaverse is allowing users to customise their environment, avatar, digital assets etc. and
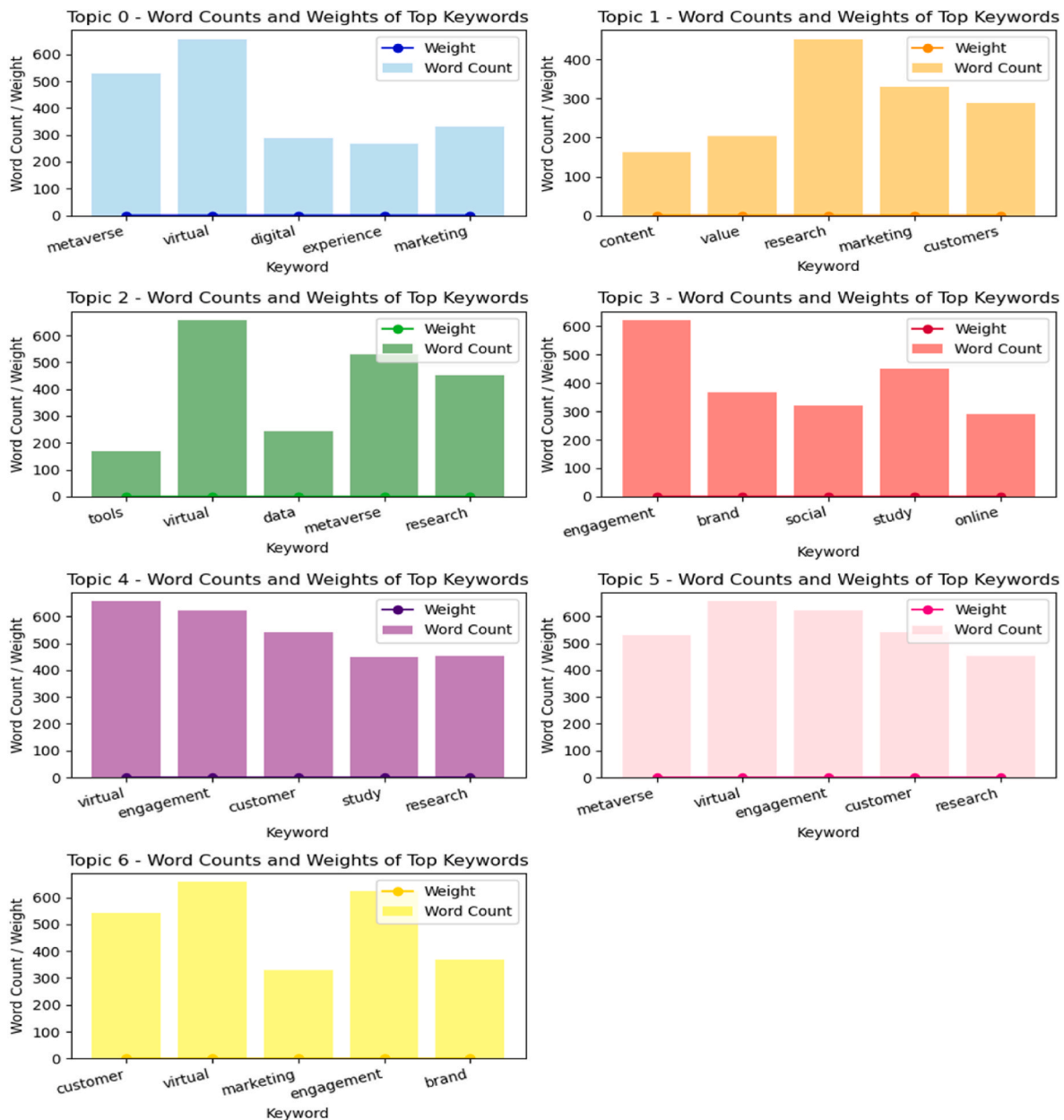
Fig. 10. Word count and weights of top 5 keywords in each topic.

hyper personalisation as per their unique needs and wants. Personalisation and customization make the base for the users to have their virtual identity, expression that enable them to interact, engaged and become loyal for a given brand. Fig. 10 shows that the most prominent words under Topic 3 and Topic 5 are "Engagement", "Virtual", "Metaverse" and "Customer". The investigation of all the words in these topics suggests that personalisation and customization are key to the customer engagement on metaverse. There are very few documents where top words of the topics are repeated more than 150 times, topic 5 is having greater concentration of words occurrence in the documents as compared to topic 3 that forms the essence of personalisation and customization.

The brands and retailers are using emerging technologies such as metaverse, web 3.0 and other specialised virtual technologies that enable the participants to engage on virtual environments & platforms with hyper personalisation and customization (Boudreau et al., 2023; Jeong et al., 2022; Simon, 2023). The customization is a methodology that allows the brands to create customized products (Garcia et al.,

2023) and services based on customers preferences and needs (Kolkur et al., 2021, pp. 753–758). The disruptive and advanced technologies allow the smart companies to react creatively and innovatively to enhance the strength of brands (Barrientos-Báez et al., 2023; Davis & Aslam, 2024; Pengnate et al., 2020).

The primary objective of metaverse marketing is to provide unique experiences to the customers (Giang Barrera & Shah, 2023). By implementing the data analysis tools companies can understand consumer preferences and their unique needs that will help them to customise the offerings accordingly (Trujillo & Bacciu, 2023, pp. 653–657) and to create online shopping experience immersive & memorable for each customer (Mohamed Jahir Hussain & Bee Hwa, 2023). Luxury brands are creating metaverse stores where consumers can tailor offerings as per their needs and preferences (Kim et al., 2022). Customers can increase their online shopping experience by integrating the augmented reality and artificial intelligence technologies (Broll & Herling, 2015). Augmented reality (AR) provides realistic view of products while artificial intelligence technology provides personalized recommendation

based on previous purchase. The metaverse technology facilitate the brands to retain their customer through unified marketing communication strategy and enhance customer experience through virtual co-innovation (Tung & Lin, 2020) with mass customization. Online shopping experience enables customers to discover their interests and purchase favourite products and services (A Ambika et al., 2022).

3.9.1.4. Interaction &participation (Topic 0, Topic 1, Topic 2). The second important pillar of customer engagement on metaverse is interaction and participation that has been found with the fusion of Topic 0, Topic 1, Topic 2. The careful investigation of Fig. 10, reveals that "metaverse", "virtual" and "customers" are the most prominent words of all these three topics that points towards the next important component of metaverse after creating the immersive environment is fostering interaction and participation on the virtual platforms. Fig. 11 shows that there are very few documents that have seen word count of more than 150 or above which indicates that the research in this area is concentrated and not diverged across.

The interaction on the metaverse via their digital twin or avatar has made it quite attractive for the users to indulge, immerse and participate. The proliferation of web3.0 (Morales et al., 2023), advancement of technology (Garcia et al., 2023), and internet has given new edge to metaverse platform to interact and participate (Lee et al., 2023) with the brands in virtual environment. The metaverse virtual store allows brands, customers, suppliers, and competitors to participate virtually (González et al., 2018). This metaverse virtual platform encourages all users to interact and invite for collaboration on variety of exciting projects. The remote collaboration in metaverse platform enables users to work together in virtual environment by making use of avatars to represent themselves (Mittal & Bansal, 2023).

The Big tech such as NVIDIA (Lledo et al., 2014), ERNST & YOUNG, ACCENTURE and MICROSOFT (Sekhar et al., 2018) provide virtual space for customers, suppliers, and partners to connect and collaborate or co-creation in online environment (Zabel et al., 2023). The big tech companies provide virtual office for demonstration of product, virtual events, and virtual meetings to all participants to engage online to enhance their business (Göppert, 2021). There are numerous metaverse online store such as GUCCI, L'Oréal, Sephora, and Disney (Fernandes & Remelhe, 2016) invite the customers participate and interact in virtual or online events (Punyatoya & Saini, 2023; Ramachandran et al., 2023, pp. 1009–1014). The big brands such as Nike, Gucci and Ralph Lauren have created new marketspace to interact and participate to their brand community through virtual world to sell the digital-only clothes and accessories (Bodhani, 2012; Ruan et al., 2023). Metaverse also transforming the education industry where student can collaborate for the group assignment on shared documents and received feedback all in one virtual environment (Dash et al., 2021; Lee, 2023).

4. The future research directions

The advent of metaverse technologies and immersive virtual platforms offers myriad opportunities for firms to engage with their target audience. To cater customer's unique preferences of engagements it is imperative to understand its dynamics from different angles. These deliberations paved ways for future research directions in customer engagement within metaverse. The following are few probable research directions.

1) **The Changing Behavioural Dynamics of Engagement:** Exploration of factors that significantly impact the customer engagement on virtual platforms as compared to traditional online and brick & mortar physical settings. The scholars can also investigate the antecedents of loyalty, purchase intentions and purchasing behaviour on the metaverse.

2) **Examining the Impact of Customization & Personalisation on Engagement**: There are studies available on the importance of customization & personalisation which effects customer experience in an online setting. It can be further extended by investigating the impact of customised avatar, content, games etc. in creating excellent user experience and retention on metaverse platform.

3) **Communities & Social Interactions:** The understanding of communities and its impact on consumer behaviour is of enormous importance for the organisations and marketers. Studies can be conducted to determine the role of social interactions and communities building on customer engagement within metaverse.

4) **Seamless Integration with Other Platforms:** The realm of cross-integration with other platforms such as e-commerce, m-commerce, and social media shall be investigated to understand the continuity of user experience and their impact on overall engagement.

5) **Economic Models:** Future studies can focus on the study of economic model development and its overall impact on consumer engagement and purchasing behaviour. The virtual assets such as cryptocurrencies, NFTs, virtual goods etc. can be studied to understand its effect on consumer engagement.

6) **Access & Inclusiveness:** Research is required to explore & understand that how metaverse can be made more accessible & inclusive for larger audiences and their overall impact on customer engagement.

7) **Cross-cultural Perspective:** The impact of cultural differences is needed to be understood to devise and develop strategies to suit various cultural groups on metaverse.

8) **Measurement of Engagement:** Scholars can develop measurement framework for measuring the customer engagement on metaverse that can provide vital insights about tracking & enhancing customer engagement landscape.

9) **Privacy & Security**: There is a need of study that can outline the concerns of users about privacy, security and trust that effects the customer engagement. These studies can help the organisations to design safe and secure metaverse environment that can positively impact customer engagement.

10) **Ethical Consideration:** The ethical implications of metaverse marketing shall be investigated to understand its impact on customer engagement. This research will help organisations in creating responsible content and positive virtual environment for the users.

5. Discussion & implications

Metaverse presents exciting opportunities for brands to engage with customers in innovative and immersive ways by creating deeper connections leading to long-term loyalty. Recognizing the vast potential of the Metaverse, businesses are now focusing on developing effective customer engagement strategies and exploring the possibilities to enhance virtual shopping experience like virtual browsing, purchasing without leaving homes, virtual trial of clothes, makeup, visualizing furniture in homes, etc. VR and AR form the foundation, allowing users to perceive and interact with digital objects and spaces in real-time (Li et al., 2023). Technologies like haptic feedback (Bashar et al., 2024) systems that simulate an object or interaction from the virtual system to produce the feeling its real; and motion tracking devices that enhance user engagement by enabling tactile sensations and natural movements; are creating a sense of presence and immersion (McLean & Alyahya, 2022).

Metaverse platforms seamlessly integrate with social media networks, enabling businesses to expand existing user bases. While, Facebook's integration with Oculus VR devices allows reach to users through targeted advertisements and sponsored events; Facebook Horizon and
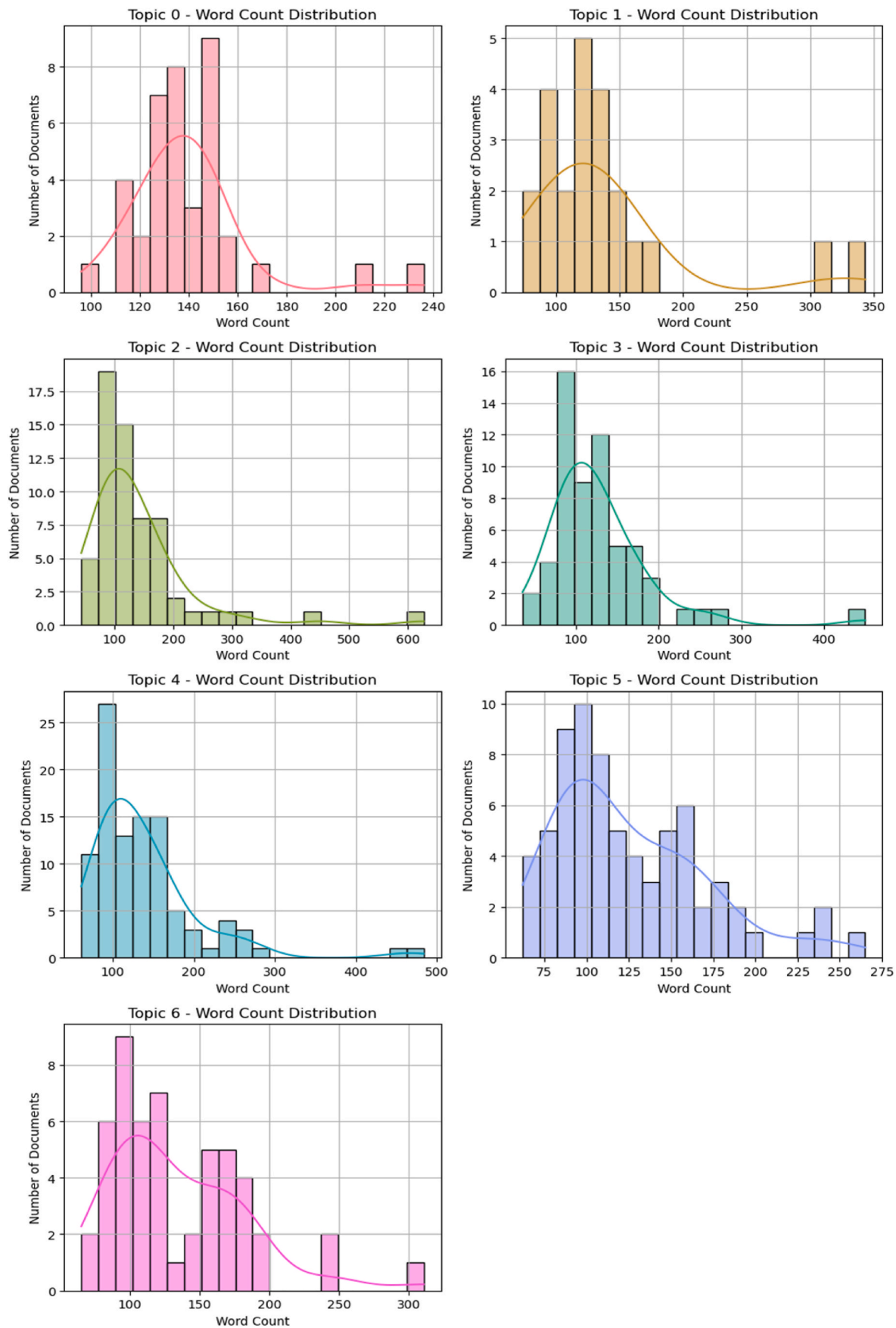
Fig. 11. Word count Vs number of documents.

VRChat are focusing on social interactions and communities building, where users can socialize, participate in events, and engage with friends and strangers (Dwivedi et al., 2022). Businesses are gradually adopting this model by hosting virtual events, creating branded spaces, and building online communities to enhance customer engagement through shared experiences. Gaming platforms like Roblox and Fortnite are merging the gaming, social interaction, and user-generated content (Park & Kim, 2022). Now the players are able to create, play, and monetize their games, developing a vibrant ecosystem (Vasilogamvros & Kasapakis, 2022). Such businesses are also able to engage customers through in-game advertisements, branded merchandise, and immersive gaming experiences to tap into the vast user base of gamers within the Metaverse. Similarly, the enterprise metaverse platforms like Spatial and Microsoft Mesh focus on professional collaboration in virtual workspaces and allow remote teams to collaborate in immersive environments resulting in enhanced productivity and creativity (Remondino, 2017).

The decentralized platforms like Decentral and Sandbox are powered by blockchain technology providing users a control over their digital assets and identities (Neves et al., 2024). These are also able to engage customers through unique immersive experiences, such as limited-edition virtual products, art exhibitions, and interactive storytelling, all secured by blockchain technology. Metaverse platforms integrated with e-commerce capabilities, for example Shopify's integration with Roblox, enabling virtual sales (Park & Kim, 2022). The integration streamlines the customer journey, allowing users to explore, interact with, and purchase products seamlessly. By offering exclusive virtual items, limited-time discounts, and interactive shopping experiences, businesses can create a unique blend of entertainment and retail therapy within the Metaverse (Kaushal & Yadav, 2021).

Creating effective customer engagement strategies in the Metaverse demands a deep understanding of user behavior, preferences, and expectations. Businesses must prioritize the strategies to engage customers successfully in this dynamic digital landscape. Personalisation is central to engaging customers in the Metaverse (Ibrahim & Juhari, 2019). By leveraging data analytics and AI algorithms, businesses can analyze user preferences, behaviors, and interactions, tailoring virtual experiences to individual users. Personalized avatars, recommendations, and interactive storytelling that adapts based on user choices enhance engagement, creating a sense of individuality and relevance within the virtual world (Park & Lim, 2023). Incorporating interactive storytelling techniques create immersive narratives that captivate users. The techniques used are interactive quests, branching storylines, and user-driven narratives empowering users to become active participants in the story. By crafting engaging narratives around products or services users are invited to explore and shape the storyline, leading to a deeper emotional connection and sustained engagement (Song & Wu, 2023). Gamified experiences can be created, encouraging users to participate in virtual events, complete quests, solve puzzles, etc by incentivizing them through rewards, exclusive items, and social recognition (Dieter et al., 2023).

However, the challenges relating to user privacy, accessibility, content moderation, and technological barriers need navigation by ensuring a safe, inclusive, and seamless experience for all users (Mehra et al., 2024). The continuous innovative and adaptation within the Metaverse, the key to successful customer engagement lies in a dynamic and user-centric approach (Davis & Aslam, 2024).

6. Limitations

Since this bibliometric analysis is based on the citation databases, we acknowledge some limitations. Firstly, all the precautions have been taken to ensure adequate counts of citation, yet the quality of the content may not be scientifically rigorous or influential. The probable reason may be that the data were searched in the "TIT-ABS-KEY" field of Scopus search engine with deliberate combinations of keywords syntax using logical operators 'AND' and 'OR' to retrieve all the possible

literature in the subject area and therefore the base literature may or may not cover all scholarly outputs with another lexicon. Secondly, results of topic modelling algorithms application largely depend on pre-processing of text data, the choice of algorithm, and the coherence of topics. In order to achieve relevance and quality in our search, we applied stringent filtering criteria. Nevertheless, we are confident that our search results were able to capture the relevant topics for our study without losing context and nuance in the analysis. Finally, in some cases, topics may be labelled based on the most frequent terms, which may not capture the essence of the topic accurately; therefore, at times manual efforts were made to assign meaningful labels to topics.

7. Conclusion

The metaverse is new and dynamic concept that has been contributing a lot in the field of marketing. It is difficult to predict the development of metaverse marketing in the context of customer engagement at present. This study aimed to cultivate the opportunity of metaverse in the context of customer engagement in virtual world. The findings of this research disclose the best authors, best journals, best publications, citations, keywords, and affiliation etc. It has been uncovered that the research around metaverse marketing increasing with exponential rate. The finding of this research disclosed the metaverse marketing play an important role to engage customers through new innovative technologies. The study found most significant topics in the research domain of customer engagement as virtual marketing & digital engagement, consumer engagement in virtual spaces, metaverse brand engagement, social marketing in virtual customer engagement, marketing design and metaverse engagement, brand reality and engagement on metaverse and data driven virtual customer engagement. Moreover, the results found design of immersive platforms, personalisation & customization, and the interaction & participation as three main pillars of customer engagement on metaverse. The study offered ten distinct important areas for further expansion of research. This research will add significantly to extant literature of consumer engagement within metaverse. The results may guide marketing practitioners to develop attractive strategies to attract, engage and transact profitably in virtual world.

CRediT authorship contribution statement

Mohammad Wasiq: Methodology, Funding acquisition, Conceptualization. **Abu Bashar:** Resources, Formal analysis. **Irfanullah Khan:** Software, Resources, Conceptualization. **Brighton Nyagadza:** Supervision, Project administration.

Declaration of competing interest

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

Data availability

No data was used for the research described in the article.

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