



See you on the Metaverse: A bibliometric expedition through the Metaverse landscape

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ABSTRACT

The Metaverse is a rapidly developing technology that has attracted interest from various companies. Experts predict exponential growth in profits from the Metaverse market in the coming years. However, early stages of innovation often bring uncertain and speculative impressions, making its direction, timing, and future unclear. The viability of the Metaverse as either an innovation that fails or as the next technological revolution is questionable in its own right. Academically, the Metaverse has generated interest across various disciplines, including psychology, marketing, and legal studies. The aim of this study is to systematically consolidate the growing literature to understand the intricate dynamics of consumer behavior and marketing practices in this evolving sphere. To achieve this, a comprehensive bibliometric analysis was carried considering 284 contributions from the Web of Science on the Metaverse in business, management, marketing, and communication using quantitative analysis tools such as VOSviewer and SciMAT. The study provides insight into pioneering contributions, prominent authors, central themes, and emerging research challenges related to the Metaverse. The results contribute towards better understanding of the Metaverse, enabling well-informed decisions for efficient marketing strategies and future advancements in this ever-evolving realm for both practitioners and researchers.

1. Introduction and research objectives

The digital landscape is currently undergoing a significant transformation with technologies such as artificial intelligence (AI), augmented reality (AR), virtual reality (VR), mixed reality (MR) and cryptocurrencies at the forefront of this change, that are heavily influencing marketing and management. The Metaverse is the latest technological breakthroughs and it is bound to have a strong impact on the field of digital marketing.

Among the various definitions of the Metaverse that have emerged in literature parallel to its advancement, the one proposed by Ball (2022) states that it is: “a massively scaled and interoperable network of real-time 3D virtual worlds in which users can experience synchronously and persistently with unlimited numbers of other users, and with continuity of data such as identity, entitlements, objects, communications and payments”.

The Metaverse is commonly understood as a 3D digital virtual world that surpasses the physical universe. It is populated by digital human replicas, known as avatars, which allow users to explore and interact within 3D spaces. In this new world, individuals can engage in various activities such as working, shopping, meeting with friends, establishing

social and emotional connections, attending concerts, and events, among others.

Although the Metaverse remains an ongoing project, early features are starting to emerge (Bratu and Sabău, 2022; Hwang and Chien, 2022; Ng, 2022; Reyes, 2020). These include: a) digital nature, which encompasses any persistent, immersive, 3D digital experience on the Internet, resulting in a virtual world accessible to anyone via VR/AR or video game platforms; b) global and decentralized environment with data and information without geographical or jurisdictional boundaries and a structure based on space-time; c) high level of immersion and interactivity achieved combining physical reality and VR that allow users to interface and collaborate with others through the utilization of sophisticated technologies facilitating a dynamic and autonomous learning environment; d) sense of corporeity due to the presence of avatars through which users are able to move freely in 3D spaces, participate in virtual experiences and interact with others in realistic scenarios using verbal and non-verbal interactions; e) continuous connection and interoperability that let the Metaverse operate as a virtual realm that emulates real-world settings, enabling digital content to be saved and retrieved even when reconnecting to the virtual world; f)

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collaborative technical infrastructure, not owned by any particular company, wherein virtual environments are created by users themselves, who then share them with other users; g) digital ownership established by leveraging Non-Fungible Tokens (NFTs) defined as digital property certificates of digital ownership of non-fungible digital goods and commodities such as images, videos, music, and various other objects (Nadini et al., 2021). NFTs are registered on the blockchain, a decentralized digital ledger that allows users to authenticate transactions made (Bodkhe et al., 2020).

From a managerial perspective, it is predicted that the global Metaverse market will grow to reach 678.8 billion US dollars by 2030 (Statista, 2022a), reflecting growing business interest in the digital future. More companies are investing, with 67 % expecting complete success in five years (Statista, 2022b). Early investors in the Metaverse included big global brands such as Coca-Cola, Nike, and Heineken, as well as those targeting younger demographics and gaming culture. According to research by Osservatori.Net (2023), Metaverse investments are led by retail (30 %) and entertainment (30 %), followed by IT (17 %), finance/insurtech (9 %), and food & beverage (5 %). Fashion and luxury brands, such as Gucci, Balenciaga, Louis Vuitton, Moncler, Dolce&Gabbana, and Vans, are at the forefront of virtual world retail. Carrefour has invested €300,000 in a 36-ha space in 'Sandbox', which demonstrates retailers' emphasis on communication and advertising (Mark-up.it, 2022). About 141 virtual worlds have been identified, each populated by millions of avatars, all operating under differing business models, rules, and characteristics. Out of these, only 62 (44 %) are 'Metaverse ready': freely accessible, persistent, featuring 3D graphics, economically active and interoperable. These platforms are equipped with components enabling digital assets to be used across them. It is noteworthy that 84 % of the initiatives were created on popular platforms such as 'The Sandbox' (43 %), 'Decentraland' (23 %), and 'Roblox' (15 %), suggesting that companies typically launch their projects on established and familiar platforms (Osservatori.Net, 2023). This pattern is reflected in the increase of people seeking entertainment and curiosity within virtual worlds during the Covid-19 pandemic, particularly in popular games such as 'Fortnite' and 'Roblox'.

The future of the Metaverse is uncertain despite brand investments. Its potential success or failure, that can be called '*metacrash*', is questionable. The impact of the Metaverse on lives and work is undeniable. The technology enables the creation of 3D worlds, fostering creativity, but not all companies share this enthusiasm. According to Statista (2022c), 38 % of invested firms have cybersecurity concerns, and 25 % doubt its lasting impact. According to Google Trends, there was a peak in interest in the Metaverse in 2021 (refer to Figure WA1 in Web Appendix), but there has been a recent decline. Searches have suggested negative sentiments, such as "*the Metaverse is dead*" or "*Metaverse cancelled*".

From an academic perspective, the Metaverse is a rapidly expanding field of research that has attracted the attention of various disciplines. These include economic and business studies, psychological studies, marketing and advertising, and legal studies. The theoretical basis of the Metaverse draws on a range of disciplines, including computer science, psychology, and sociology (Kraus et al., 2023). Scholars have started to conceptualize and define the Metaverse and its features in order to explore how it may revolutionize marketing and business activities. To date, scholars have analyzed different perspectives within this novel landscape to stimulate further interdisciplinary research and development. This has involved exploring a new phenomenon that has the potential to enhance the literature across multiple disciplines due to the interaction of technology with the social, behavioral and environmental aspects (Bourlakis et al., 2009; Dwivedi et al., 2023; Kraus et al., 2023). Furthermore, the emergence of new marketing and consumer behavior, as well as societal opportunities and challenges, has been observed (Dwivedi et al., 2022).

Given the imminent introduction of innovative Metaverse applications and the potential for Metaverse usage to transform virtual world

interactions, alter supply chain dynamics and revolutionize human-computer interactions, it is vital to gain an understanding of previous research in academic literature. As research in this field progresses, the complexities of the Metaverse require urgent and systematic organization of the myriad theories, concepts and research directions that have emerged over time to understand the intricate dynamics of marketing, consumer behavior and social changes in the new digital world (Dwivedi et al., 2023; Kraus et al., 2023). Specifically, a systematic and rigorous approach is necessary for consolidating the fragmented academic research on the Metaverse from its creation to the present day (Abbate et al., 2022). Such an approach is essential to establish a comprehensive framework that understands the complex dynamics of the Metaverse, provides direction for future research and creates a coherent roadmap for its practical implementations. Therefore, the following research questions are posed: What bibliometric information can be derived from the literature? What are the primary trends observed in the literature? What can be learned from the literature regarding possible future research directions?

To our knowledge, current reviews do not offer a comprehensive overview of the main research topics and emerging research themes that provide clarity to the field of Metaverse (Abbate et al., 2022; Piñero-Chousa et al., 2024; Yadav et al., 2024). To address the gap in existing literature, this study performs a bibliometric analysis through quantitative techniques to evaluate the field's status, identify the primary academic contributions that constantly advance the field, recognize the central themes of current research, and establish the future research challenges, shaping effective marketing strategies for future development.

The paper is organized as follows. Firstly, the methodological approach is presented, with a focus on the two phases in which it is divided: the identification of the relevant scientific contributions and the bibliometric analysis. Secondly, the data analysis is presented. This section is divided into three subsections, each pertaining to a different aspect of the research findings. The first subsection concerns the descriptive findings relating to the scientific production, while the second and third subsections address the content-related findings, which emerged first from VOSviewer and then with SciMAT. Finally, the last section presents the conclusions, implications, future directions and limitations.

2. Methodology

The current study is divided into two phases: (1) identification of the relevant scientific contributions, and (2) bibliometric analysis. The bibliometric analysis was further divided into two macro-areas: performance analysis and scientific mapping (Noyons et al., 1999). The aim of the performance analysis is to assess the qualities of the contributions from a descriptive perspective using bibliometric indexes (e.g., typology, journal, citations, country, authors) established by Narin and Hamilton (1996). The aim of the SMA is to define the structural and evolutionary aspects of the research areas under consideration (Noyons et al., 1999) through content analysis, and to create a bibliometric map, which is a spatial representation of how scientific production, contributions, or authors are related to each other (Cobo et al., 2012). Small (1999) argued that a comprehensive understanding of the interrelations among documents, authors, keywords, disciplines, or fields could only be achieved through the complementary capacity of both techniques.

To ensure methodological consistency with previous literature (Capobianco-Uriarte et al., 2019; Zerbinì et al., 2022), this research followed the five-step approach outlined in Fig. 1.

2.1. Phase 1 – documents selection

In order to define the parameters of the study (step 1), it was necessary to determine the focus of the investigation. This was defined as an examination of the phenomenon of the Metaverse in the context of

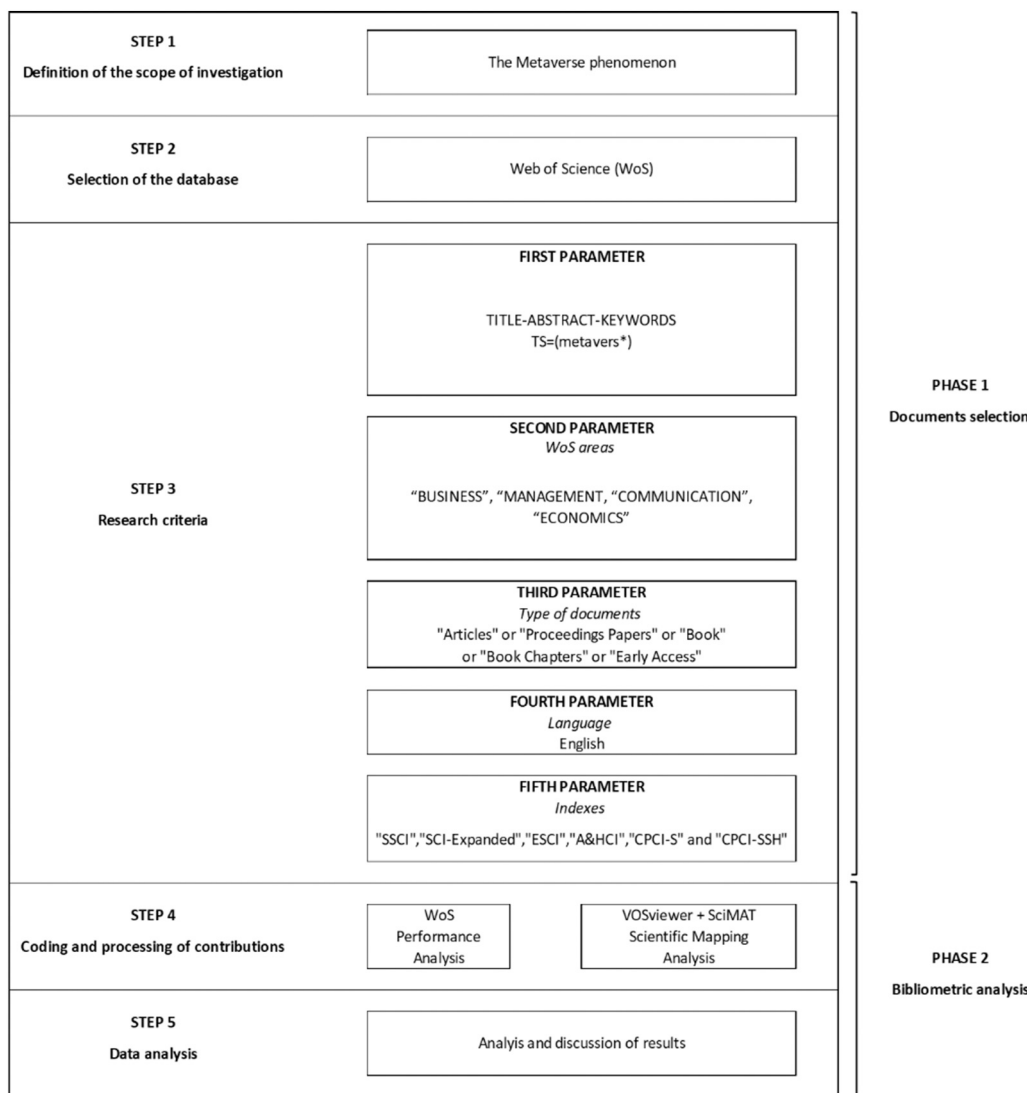


Fig. 1. Five steps in bibliometric analysis.

business and management. Consistent with previous literature (Norris and Oppenheim, 2007; Waltman, 2016; Zerbini et al., 2022), the Web of Science™ (WoS) was identified as the bibliographic research platform, an online scientific citation indexing service provided by Clarivate Analytics (step 2). Notably, WoS provides easy-to-use bibliometric analysis tools, a range of citation indexes, and summarized data on authorship and other publication characteristics, such as publication source and year (Norris and Oppenheim, 2007; Waltman, 2016; Zerbini et al., 2022). While its size is comparable to Scopus, WoS distinguishes itself with its standardized format, which results in minimal data cleaning requirements (Zupic and Čater, 2015).

To guarantee methodical planning, consistency, and clearness the SPAR-4-SLR protocol (Paul et al., 2021) was followed for the analysis (Fig. 2).

The search for scientific contributions was conducted by establishing particular search and eligibility criteria (step 3). Specifically, targeted keywords were defined to identify pertinent documents, the desired contribution types (Article or Proceeding, Paper or Book, Chapters or Early Access) and the language of the contributions (English). To achieve comprehensive coverage, multiple databases were consulted, namely the Social Science Citation Index (SSCI), the Science Citation Index Expanded (SCI-Expanded), the Emerging Sources Citation Index (ESCI), A&HCI, CPCI-S, and CPCI-SSH. Abbreviations were explained

when first used. The final Web of Science™ (WoS) query used was as follows: (metavers*) (Topic) and English (Language) and Article or Proceeding Paper or Book Chapters or Early Access (Document Types). To enhance the analysis of published research, supplementary contributions were sought from alternative sources including Google Scholar and Scopus.

The search was conducted in May 2024, and the study period was limited from 1995 to May 2024. Initially, 1018 publications were retrieved. To increase specificity, the results were categorized according to specific WoS categories. Given the goals of our research, papers were refined to the ‘BUSINESS’, ‘MANAGEMENT’, ‘COMMUNICATION’, and ‘ECONOMICS’ categories.

Following the cross-check mechanism proposed by Zupic and Čater (2015), duplicate entries were eliminated. Additionally, two researchers conducted independent reviews of all abstracts to exclude papers that were not relevant to the research topic. Disagreements were resolved via consultations with a third researcher in joint sessions, ultimately resulting in a consensus. The comprehensive screening process identified 284 contributions from 2008 (the year of the initial publication on the subject of interest in the present research) to May 2024 and deemed relevant for the final analysis (all the contributions are shown in Table WA1 in Web Appendix). The information was collected in csv and ris formats and later analyzed using Microsoft Excel, VOSviewer, and

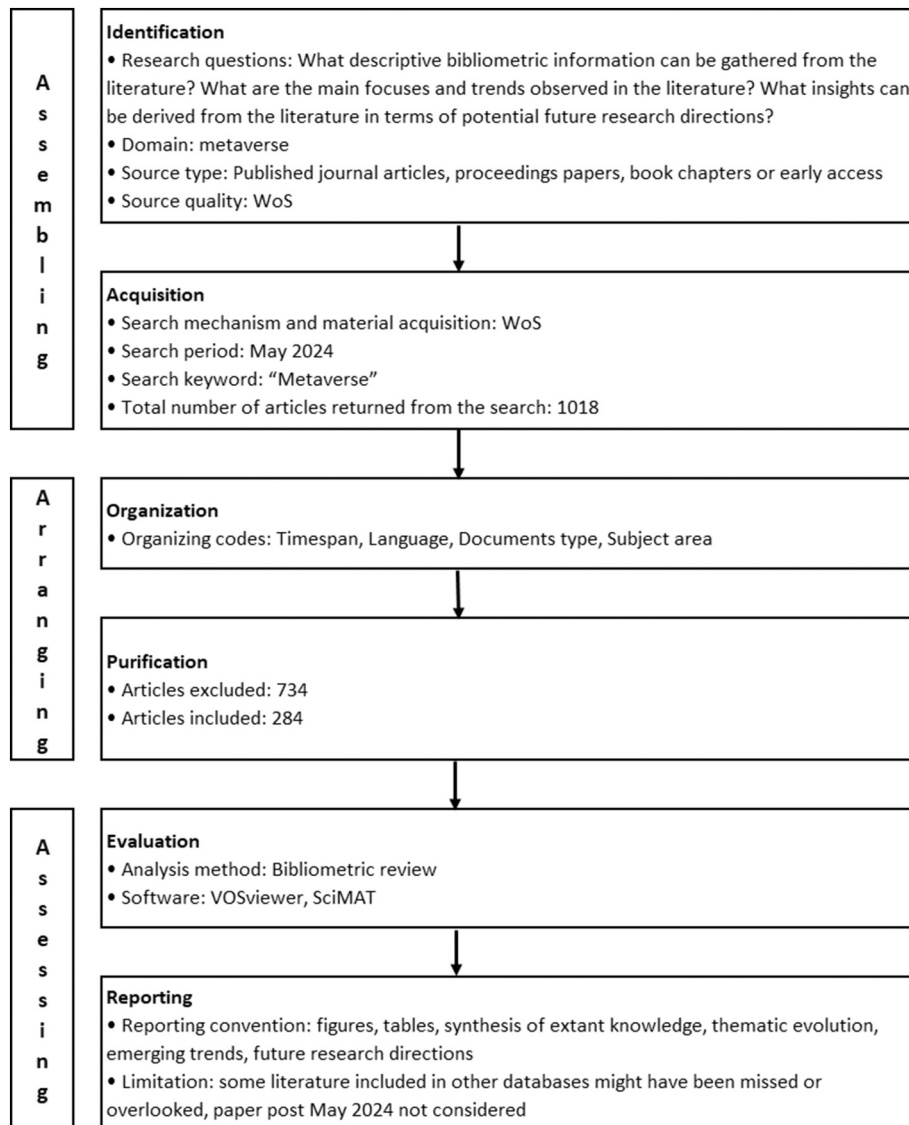


Fig. 2. Protocol for the analysis.

SciMAT for additional examination.

2.2. Phase 2 – bibliometric analysis

Regarding bibliometric analysis (Step 4), this study presents a descriptive overview of contributions, including citations and country of origin. Bibliometric indexes based on citation and publication data are used to examine publication trends in 2008–2024, publication distribution by country, and the most frequently cited literature on the Metaverse in the business and management domains. Through the SMA process prominent research themes and emerging trends were identified while maintaining objectivity. It is important to note that in bibliometric literature, bibliometric maps have received more attention than their graphical representations. Most studies have used basic graphical representations provided by SPSS or Pajek, with little emphasis on their visual interpretation (Van Eck and Waltman, 2010). To conduct a thorough analysis, two established and complementary tools were used: VOSviewer and SciMAT. These tools have been widely used in various bibliometric studies (Cobo et al., 2012; Van Eck and Waltman, 2010).

VOSviewer, which was developed by Van Eck and Waltman (2010), enables graphical mapping of bibliographic material. Using bibliographic data, it produces graphical maps that rely on bibliographic

coupling, co-citations, co-authorship, and co-occurrence of author keywords. This facilitates the comprehension and interpretation of interactions and connections between countries, institutions, journals, authors, and keywords (Cobo et al., 2011; Terán-Yépez et al., 2020). This research specifically examines the co-occurrence of author keywords extracted from WoS. Furthermore, the use of SciMAT 1.1.04, an open-source bibliometric software, allowed for a longitudinal evaluation of scientific mapping through specific bibliometric performance indicators and co-word analysis, as discussed by Batagelj and Cerinšek (2013), Callon et al. (1991), Cobo et al. (2012), and Zerbini et al. (2022). Distinguished from other scientific mapping software, SciMAT enables longitudinal studies and the creation of enriched scientific maps using bibliometric indicators (e.g., sum or average number of citations) as well as more robust analyses and indices such as the H index (Hirsch, 2005) and co-word analysis (Callon et al., 1991). Additionally, SciMAT utilized a content analysis approach to examine the co-occurrence of keywords, generating diagrams that are advantageous for examining data (Zerbini et al., 2022). Marketing discipline scholars have acknowledged the usefulness of SciMAT in identifying associations and interactions among previously researched topics, as well as mature and emerging research trends. The tool can also trace their temporal evolution through strategic diagrams, as evidenced by research from Callon et al. (1991) and Terán-

Yépez et al. (2020). In this particular investigation, the use of SciMAT analyses, in combination with performance analysis and scientific mapping tools, enabled the recognition and depiction of conceptual topics or common themes pertaining to the Metaverse, along with their thematic progression (Cobo et al., 2012; Zerbini et al., 2022).

3. Results

Data analysis (step 5) is subdivided into three subsections to facilitate the explanatory process. The first subsection details descriptive findings relating to the scientific production of published papers and citations, scholarly output distribution across different subject areas and journals, as well as the most prolific authors and countries. Additionally, frequently cited papers concerning the Metaverse in business and management are analyzed. The subsequent two subsections analyze content-related findings, with the goal of identifying the most significant trends associated with the Metaverse first with VOSviewer and then with SciMAT. The objective of this study is to identify current trends, areas that require further development, and emerging trends in the field.

3.1. Descriptive analysis

Beginning with the descriptive analysis of scientific productivity, after analyzing the 284 contributions obtained from WoS and filtered according to the aforementioned inclusion criteria, we found that the first relevant contribution was published in 2008, while a significant surge in contributions was evident in the last three years, with more than 79 % of the articles published from 2021 to May 2024 (Fig. 3). This underscores the growing significance of the Metaverse in business and management in recent years. Additionally, the research within the considered dataset predominantly falls under the field of business (53.5 %) followed by management (22.2 %), communication (16.9 %), and economics (7.4 %). Table 1 illustrates the distribution of document types, their corresponding percentages based on the total record count and the type of documents. Notably, the majority of the documents (93.3 %) consist of journal articles, among which 24.3 % (69 in total) are classified as ‘Early Access’. This indicates that some documents have been made available prior to their official publication, providing users with access in advance. Proceeding papers represent 4.9 % of the total (6 conferences before 2021 and 8 after 2021), encompassing conference proceedings and presentations on specific research or topics. Specifically, 56 % of the proceedings refer to conferences about business, followed by conference about computer science (33 %), information systems (22 %), management (11 %), engineering (11 %) and economics (6 %). Finally, book chapters constitute a smaller proportion, comprising only 1.8 % with 5 chapters recorded.

Table 2 presents the top 10 journals based on the number of publications and the AJG Journal Ranking 2021. The highest-ranking journals are ‘Internet Research’ and ‘Technological Forecasting and Social

Table 1
Research area and type of documents.

	Record Count	%
Research Areas		
Business	152	53.5
Management	63	22.2
Communication	48	16.9
Economics	21	7.4
Document Types		
Article*	265	93.3 %
*Early Access	69	24.3 %
Proceeding Paper	14	4.9 %
Book Chapters	5	1.8 %
Total	284	100 %

Table 2
Top 10 journals.

Journal	N° publications	AJG Journal Ranking 2021
Internet Research	15	3
Technological Forecasting and Social Change	13	3
Journal of Retailing and Consumer Services	11	2
International Journal of Contemporary Hospitality Management	9	3
Journal of Global Fashion Marketing	8	1
Psychology & Marketing	7	3
Electronic Commerce Research	6	2
Journal of Business Research	6	3
Business Horizons	5	2
Journal of Consumer Psychology	4	4*

Change’, which feature a total of 15 and 13 articles, respectively. This emphasizes researchers’ exploration of the interplay between technological advancements and their impact on social dynamics and change.

A shift in focus to countries’ productivity reveals that the United States (USA) is the most prolific country, with 78 publications, representing 27.5 % of the total contributions. England follows closely behind with 46 publications (16.2 % of the total), thus securing the second position. India occupies the third position with 40 publications, equivalent to 14.1 % of the total. The collective contributions from these three nations account for more than half of the total publications during the period under review. China is the fourth-ranked country with 38 publications, while South Korea and Spain are tied in fifth and sixth place with 25 and 24 publications, respectively. Among other European countries, Germany, Italy and France are also notable contributors. Australia is the final contributor to the top 10, with 17 publications (Table 3).

Table 4 presents the ten most frequently cited articles published from 2008 to May 2024. This analysis provides valuable insights into the

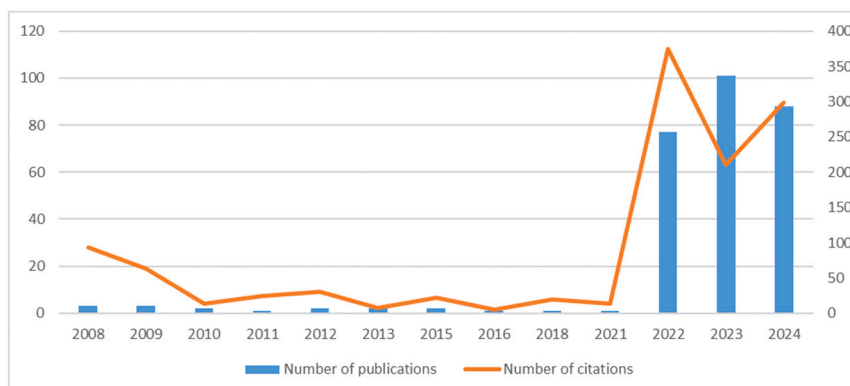


Fig. 3. Number of publications and citations 2008–May 2024.

Table 3
Top 10 of the most productive countries.

Country	N° Publications	%
USA	78	27.5
England	46	16.2
India	40	14.1
China	38	13.4
South Korea	25	8.8
Spain	24	8.5
Germany	20	7
Italy	20	7
France	19	6.7
Australia	17	6

impact of publications on the scientific community. Despite their recent publication, Dwivedi et al. (2023) and Gursoy et al. (2022) are the most cited authors in this period. However, Buhalis et al. (2023) are the most cited authors on an annual average of citations. The most cited papers pertain to the post-2021 period. The significant number of yearly highly-cited papers that reference the period after 2021 indicates a recent growth in interest in this topic, perhaps due in part to the launch of Meta on 28 October 2021, when Mark Zuckerberg declared the Metaverse to be a reality.

The most frequently cited works prior to 2021 pertain to Second Life. Specifically, Papagiannidis et al. (2008) delve into the developing business prospects, obstacles, and moral considerations in virtual realities comparable to Second Life. The research studies the impact of information technology on social and human ethics, as well as the potential social, economic, ethical, and policy outcomes of virtual marketplaces. Furthermore, it discusses the ethical issues that arise for users and businesses in virtual worlds. Bourlakis et al. (2009) highlight significant challenges and opportunities faced by retailers and provide insights into Second Life. The authors explore the progression of retailing from conventional to electronic to Metaverse retailing, and examine the influence of the Metaverse on retailing, proposing future research directions.

After the 2021 boom, the focus of the issues is on exploring potential marketing implications and future research directions of the Metaverse. In particular, Dwivedi et al. (2023) focused on the capacity of the metaverse to transform customer experiences, service quality, and

Table 4
Citation analysis: top 10 of the most cited articles (2008–May 2024).

Title	Authors	Journal	Year of Publication	N° citations 2008–May 2024	Average annual citations
Metaverse marketing: How the metaverse will shape the future of consumer research and practice	Dwivedi et al.	Psychology & Marketing	2023	162	54
The metaverse in the hospitality and tourism industry: An overview of current trends and future research directions	Gursoy et al.	Journal of Hospitality Marketing & Management	2022	143	47.67
Metaverse as a disruptive technology revolutionizing tourism management and marketing	Buhalis et al.	Tourism Management	2023	127	63.5
Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing	Buhalis et al.	International Journal of Contemporary Hospitality Management	2022	116	38.67
Making real money in virtual worlds: MMORPGs and emerging business opportunities, challenges and ethical implications in metaverses	Papagiannidis et al.	Technological Forecasting and Social Change	2008	115	6.76
What is augmented reality marketing? Its definition, complexity, and future	Rauschnabel et al.	Journal of Business Research	2022	105	35
Facebook and the creation of the metaverse: radical business model innovation or incremental transformation?	Kraus et al.	International Journal of Entrepreneurial Behavior & Research	2022	98	32.67
Money, possessions, and ownership in the Metaverse: NFTs, cryptocurrencies, Web3 and Wild Markets	Belk et al.	Journal of Business Research	2022	97	32.33
Retail spatial evolution: paving the way from traditional to metaverse retailing	Bourlakis et al.	Electronic Commerce Research	2009	94	5.88
A metaverse assessment model for sustainable transportation using ordinal priority approach and Aczel-Alsina norms	Pamucar et al.	Technological Forecasting and Social Change	2022	78	26

productivity. They also addressed challenges such as dehumanization, social isolation, and ethical concerns, as well as consumer privacy and wellbeing in the metaverse. Furthermore, Gursoy et al. (2022) highlighted the potential impact of the Metaverse on the hospitality and tourism industry. Specifically, the authors presented a conceptual framework for the creation of Metaverse experiences and provided directions for further investigation into the role of the Metaverse in the hospitality and tourism sector.

3.2. VOSviewer scientific mapping analysis

A co-occurrence analysis was conducted on keywords extracted from the titles, abstracts, and keywords of the 284 included articles. The software VOSviewer generated outputs that aided researchers in characterizing the relationships between elements and making connections. This study using VOSviewer enhances the investigation of research trends conducted with SciMAT by analyzing the top 50 frequently employed keywords among the 1068 keywords extracted from WoS. A keyword must appear nine or more times to be included. The analysis was executed by utilizing a network visualization map, a density visualization map and an overlay visualization map.

3.2.1. VOSviewer cluster networks

To comprehend the interrelations among different topics, it is necessary to first create network visualizations and density maps using VOSviewer. These maps exhibit the latest findings in the field of Metaverse research. The network visualization portrays items as multi-colored dots that vary in size to reflect the frequency of each topic's appearance in the documents. The larger the dot, the more frequent the corresponding item. Additionally, each dot's color indicates its thematic or social cluster membership. The analysis demonstrates that the most frequent words are 'Metaverse', 'virtual reality', and 'virtual worlds'. Furthermore, Fig. 4 illustrates six central clusters that pertain to the hard and soft dimensions of the Metaverse.

The hard dimension pertains to the technological aspects and can be divided into two clusters. (a) The light blue cluster focuses on the connection between the Metaverse and technology. It encompasses topics such as blockchain, cryptocurrency, NFT, and Web 3. This cluster encompasses a number of technological elements that facilitate the

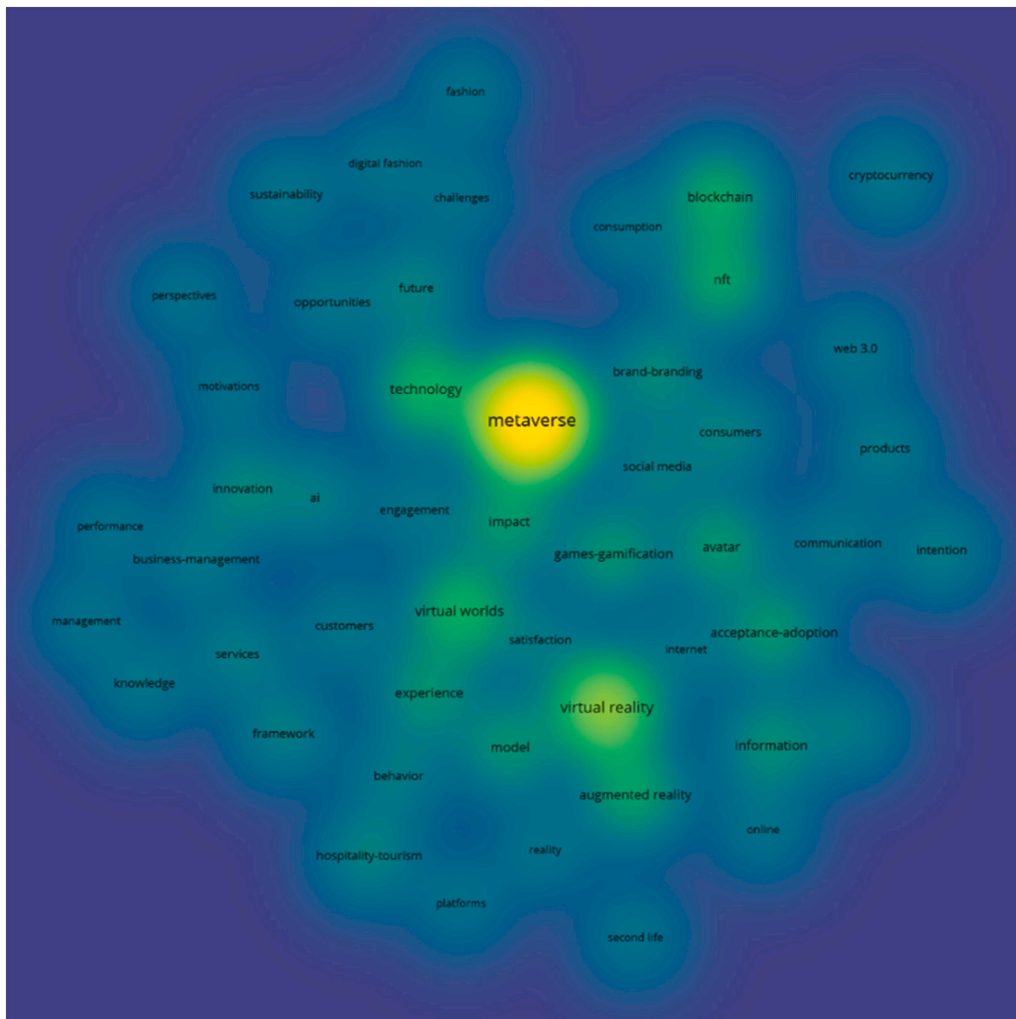


Fig. 5. Items density visualization map – VOSviewer output.

experience, augmented reality and gaming; fourth focusing on the Metaverse and its related technologies and lastly addressing the challenges and perspectives regarding the future of the Metaverse.

During the earliest stage, research concentrated on virtual environments instead of the Metaverse itself. Publications primarily explored virtual environments and Second Life, both as an abstract concept and as the online world made by Linden Lab. Subsequently, publications started using the term Metaverse because of Facebook company's interest in it with the launch of Meta in October 2021. The majority of articles at this point focused on the development of VR and related areas. In recent times, there has been a concentrated research effort aimed at examining both the potentials and threats of the Metaverse, as well as the elements that both characterize it and can determine a richer experience for its users: AR, games-gamification, blockchain, cryptocurrency and NFT. Furthermore, the overlay visualization indicates the increasing relevance of intention themes in recent years. Researchers and practitioners examine user perceptions of the adoption of this new technology to identify the primary barriers and facilitators of the Metaverse as perceived by potential users. Lastly, recent trends on the Metaverse focus on its transformative potential, emphasizing technology, opportunities, sustainability, challenges, perspectives, future trends, and consumption patterns.

3.3. SciMAT scientific mapping analysis

For a more accurate SciMAT analysis, the contributions were divided

into three time periods: 2008–2021, 2022–2023 and 2024–May2024. This division was motivated by a significant increase in scientific contributions related to the Metaverse in 2021 (as shown in Fig. 3), marking a notable turning point with a substantial rise in academic interest and scientific output related to the Metaverse. The longer period preceding 2021 allows us to gather a sufficient number of publications for comprehensive analysis, while the shorter period after 2021 helps us identify emerging research directions, following the recommendations of Cobo et al. (2011) for co-occurrence analysis in longitudinal studies. The end of 2021 coincides with Meta's launch on October 28, 2021, as Mark Zuckerberg declared Facebook's old mission to build the Metaverse. Meta's launch has piqued widespread interest in the technology sector and beyond, as it marks a clear direction for the future of digital interaction and virtual experiences. Furthermore, in consideration of the fact that the majority of the contributions were published in the last two years, the post-2021 period was divided into two sub-periods: 2022–2023 and 2024–May2024. This was done in order to place greater emphasis on the last few years and to discuss changes in trends around the metaverse in depth.

In line with previous research (Zerbini et al., 2022), this study utilized SciMAT to examine bibliometric indexes and phases of analysis. The co-occurrences of 'Authors' Word', 'Source's Words', and 'Added Words' (determined by the authors, journal, and WoS, respectively) were analyzed. The equivalence index (Callon et al., 1991) was used as the measure of similarity for normalization, and the simple centers algorithm was chosen as the aggregation algorithm for extracting clusters.

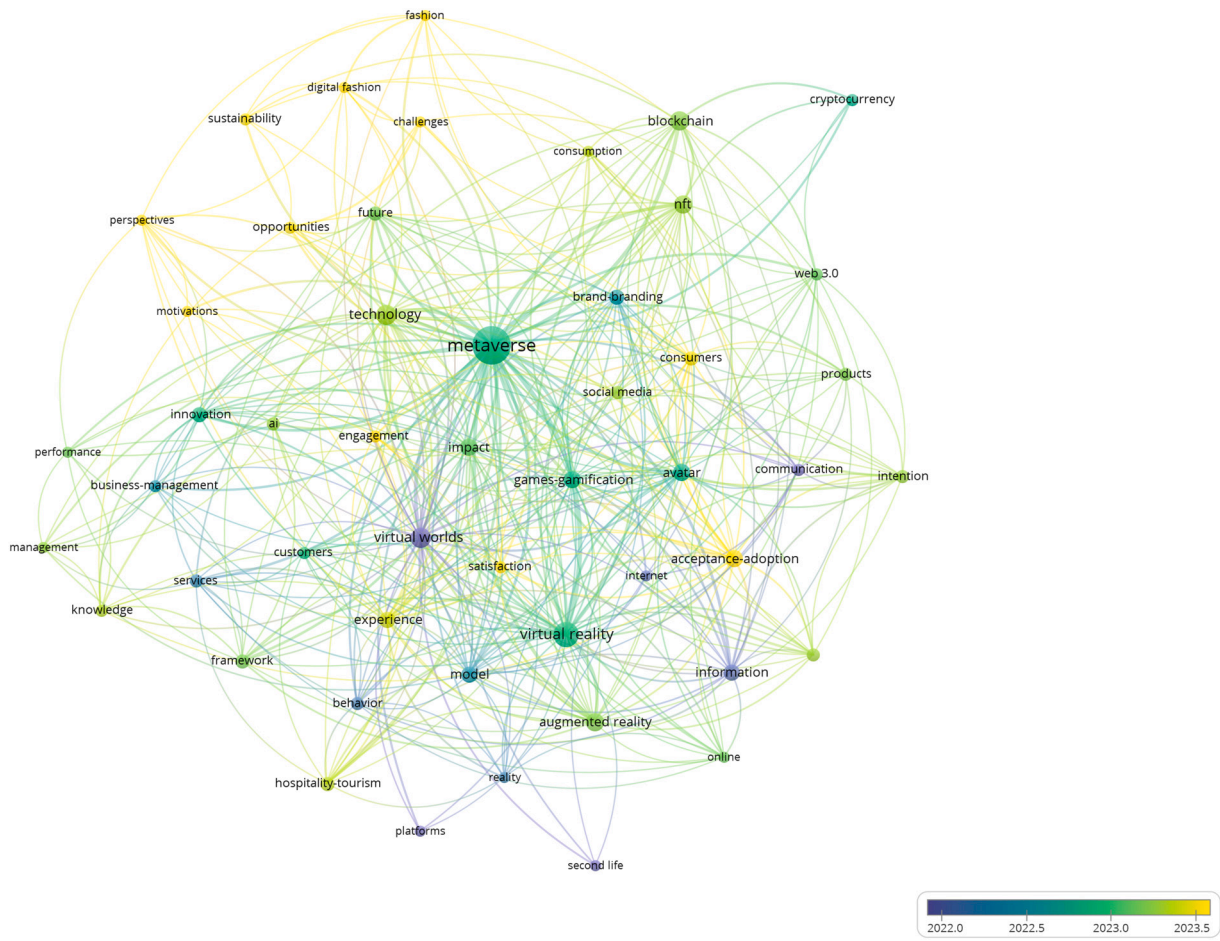


Fig. 6. Overlay visualization map – VOSviewer output.

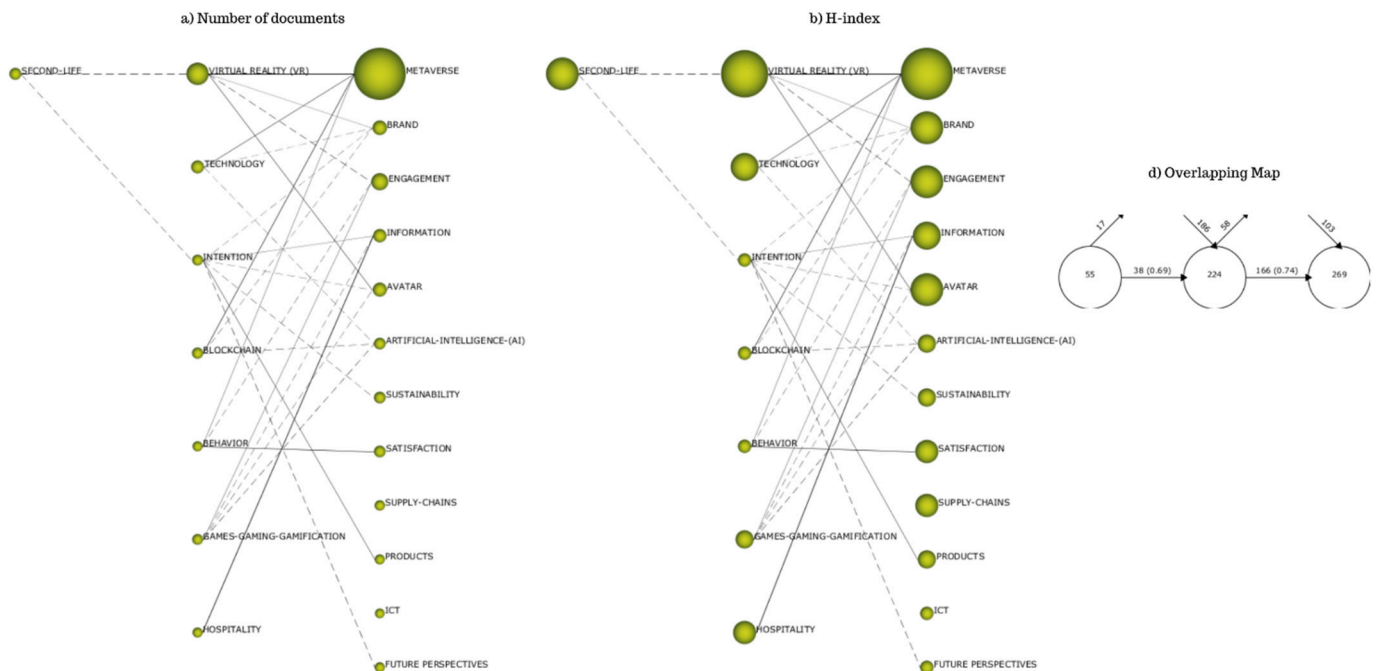


Fig. 7. Evolution and overlapping map.

The relevance of words within ‘Core documents’ was determined based on the number of citations and the H-index (Alonso et al., 2009; Hirsch, 2005). Finally, the Jaccard index (Peters and Van Raan, 1993) and the inclusion index were considered to measure the development and overlap of topics, respectively.

3.3.1. Evolutionary analysis with SciMAT

Fig. 7 shows the evolution map divided into the three identified time periods. It is a graphical representation of the main themes and their interaction over time (Xie et al., 2020). In particular, different evolution regions can be defined and the connections between the nodes indicate that the research has continuity. The dashed lines indicate that the two clusters do not share the main analysis unit and the thickness of the line indicate the degree of relationship between the two cluster themes. Whereas ‘Second Life’ was the sole keyword in the initial phase, the latest phase covers seven significant themes. The absence of the initial period’s sole keyword indicates an evolution of the phenomenon over time. This evolution has resulted in a proliferation of related topics in recent years, reflecting increased scientific interest and sustained attention over time.

Fig. 7 displays also the overlapping-items graph that illustrates the number of keywords related to the topic, providing insight into the new and old research trends (Cobo et al., 2011; Xie et al., 2020). The number of keywords related to the Metaverse in the 2008–2021 period was 55 while the number of keywords in 2022–2023 period was 224 showing a rapid growth trend that is confirmed in 2024–May2024 with a number of keywords equal to 269. The stability index between the first and second research periods was 0.69 and in the 2022–2023 study period, 38 keywords were used from the 2008–2021 study period. The increase in the number of new themes after 2021 reflects the strengthening of research power in the Metaverse. The number of newly generated keywords in 2022–2023 was 186 while the number of missing keywords was only 17. In 2024–May2024 the number of newly generated keywords was 103 while the number of missing keywords was 58 with a stability index of 0.74 with 166 keywords used from the 2022–2023 study period. The increase in the number of new themes after 2021 reflects the strengthening of research power in the Metaverse showing that

scholars actively carried out exploration and research from new perspectives and disciplines with a continuous and in-depth research.

3.3.2. SciMAT strategic mapping and cluster networks

The analyses presented below are based on the discussion of the outputs from SciMAT: the strategic diagram and the cluster network map. The strategic diagrams make it possible to deepen the analysis by period and to identify the weight and relevance of the individual themes. The four quadrants in Figs. 8 and 9 can be identified based on the centrality and density indexes (Cobo et al., 2011). The centrality index measures the level of connection between a cluster and other clusters and thus the higher the centrality, the more important it will be for the research field and its evolution. The density index describes the strength of ties between clusters and it can be interpreted as a measure of theme development: the higher the density, the better developed the theme (Kipper et al., 2020). In addition, the nodes represent clusters, and the larger the size of the spheres, the greater the number of documents in the cluster (Cobo et al., 2011).

Following Cobo et al. (2011) and Xie et al. (2020), the topics in the upper right quadrant (Quadrant 1) are the motor themes that are considered to be the most contemporary and driving topics of the research field due to their high centrality and high density, meaning that a lot of literature is focused around those topics. Motor themes, characterized by strong evolution, represent well-developed and important topics around which the field of research is organized. Quadrant 2, located in the bottom right corner of the diagram, highlights basic and transversal themes that constitute crucial theoretical contributions in the field. As a result of their high centrality, they are of significant interest to researchers and exert a considerable influence on the field. However, their low density indicates a lack of development, suggesting considerable potential for further exploration. The upper left corner shows the highly developed and isolated themes (Quadrant 3) with high density values and low centrality. Those topics are highly developed and mature in the field but isolated from the rest of the cluster of the research. Therefore, these themes are marginal to the research topic and do not hold significance for present development opportunities. Finally, Quadrant 4, in the lower left quadrant, shows the emerging or declining

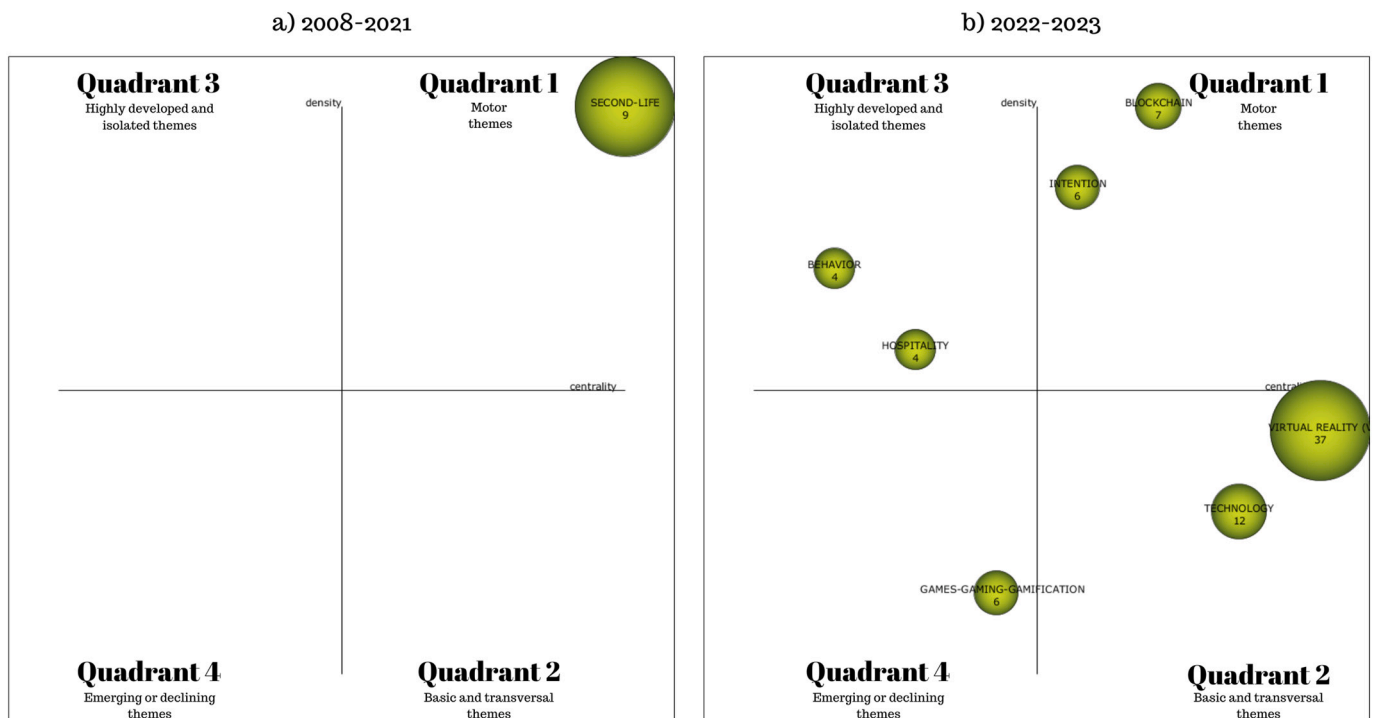


Fig. 8. Strategic diagram 2008–2021 and 2022–2023.

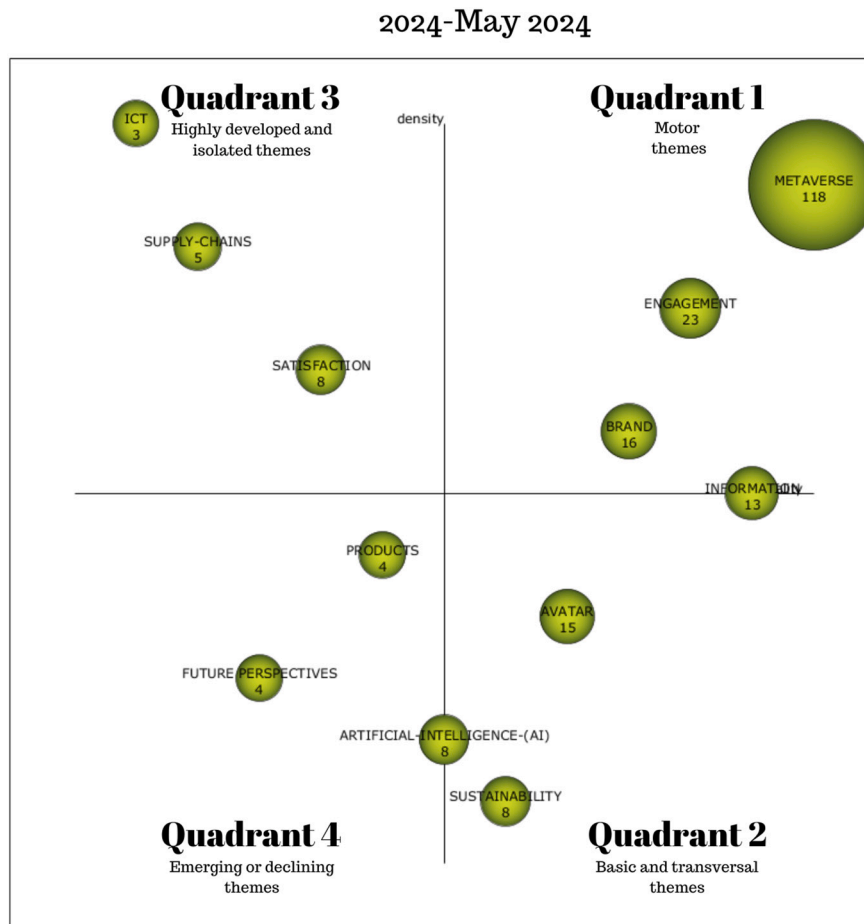


Fig. 9. Strategic diagram 2024–May 2024.

themes. Due to their low level of density and centrality, these themes are weakly developed and often marginal to the research field and for these reasons they may represent emerging themes with great potential for development in the near future or, on the contrary, they may disappear.

In addition, the cluster network map is drawn from the nodes representing the keywords that characterize the number of themes and the links between them. The sizes of the nodes are related to the number of documents included, and the thickness of the line corresponds to the strength of the correlation between the given two nodes (Xie et al., 2020). All the cluster network maps are presented in Web Appendix.

3.3.2.1. First period 2008–2021. Going into the specifics of this analysis on the Metaverse, the first period 2008–2021 is characterized by only one cluster that is located in Quadrant 1 of the motor themes, ‘Second Life’ (Fig. 8a).

Second Life is an internet-based 3D virtual world where ‘residents’ (this is how users are called), represented by animated human avatars, interact with one another using various communication methods such as text, voice, instant messaging, and blogs (Kaplan and Haenlein, 2009; Sharma et al., 2010). In this virtual world created by Linden Lab, users can create and trade virtual products or services through the virtual currency Linden Dollar that can be converted into US Dollars for business transactions. Notably, two of the most frequently cited works in the Metaverse research area relate to Second Life. The first, by Pappagiannidis et al. (2008), explored the evolving business prospects, barriers and ethical considerations in virtual worlds while the second, by Bourlakis et al. (2009), highlighted significant challenges and opportunities for retailers and provided insights into Second Life. In addition, other scholars focused on this emerging virtual world and its impacts on

real life, businesses, information sharing and decision making (Kaplan and Haenlein, 2009; Hassouneh and Brengman, 2015; Sharma et al., 2010). During the first period of analysis, the literature emphasized Second Life as a social virtual world where users can generate real business value (Sharma et al., 2010). Second Life’s virtual social world can be viewed as an evolution of the conventional online store, presenting interesting benefits and an enhanced shopping experience to its users (Hassouneh and Brengman, 2015).

Second Life was one of the first attempts at creating a ‘Metaverse’ and it still functions today with a dedicated user base on both PCs and smartphones. Initially, it had the potential to become a dominant force and revolutionize the way people understand the digital world. However, the Metaverse differs from Second Life due to inherent structural distinctions. The experience of the Metaverse does not depict a ‘closed’ universe but, instead, embodies a system that operates through ongoing interaction with the external world in an immersive and all-encompassing manner (Ball, 2022; Bourlakis et al., 2009).

3.3.2.2. Second period 2022–2023: motor themes. The first motor theme, ‘Blockchain’, has been identified as one of the most revolutionary factors for human resource management, operations, processes and marketing (Goldberg and Schär, 2023). The blockchain technology, with its unique features of decentralization, immutability, and transparency is a promising solution to secure users’ digital content and data within the Metaverse (Gadekallu et al., 2022). Several studies have indicated that blockchain is essential for the Metaverse (i.e. Park and Kim, 2024; Wang et al., 2022;), with Hartwich et al. (2023) stating that “*blockchain technology is the soul of the Metaverse*”. Lee et al. (2021) identified data storage, data sharing, and data interoperability as the primary

applications of blockchain technology. Gadekallu et al. (2022) identified five roles that blockchain plays in the Metaverse: a) ensuring the privacy and security of the vast amounts of sensitive information collected by organizations and applications; b) ensuring the accuracy of data shared by the users from the real world enabling individuals and organizations to validate transactions; c) enabling seamless and secure sharing of data through integrating the Metaverse with AR and VR on both digital and physical objects; d) facilitating interoperability of data across different virtual worlds using a cross-chain protocol allowing users to migrate more easily between them; e) ensuring data integrity in the Metaverse, maintaining consistency and accuracy of data thanks to the NFTs. By using blockchain technology, NFTs are able to imitate real-world economic behaviors, allowing for the transfer of value between the virtual and real worlds. This makes them a dynamic and flexible component of the crypto-economy, alongside cryptocurrencies and decentralization, and positions them as a key component of the Metaverse's infrastructure (Nofer et al., 2017; Vidal-Tomás, 2023). Finally, Vidal-Tomás (2023) explored how blockchain manages large data volumes, fostering decentralization in the digital economy of the Metaverse, thus supporting the creation of decentralized social ecosystems governed by decentralized autonomous organizations (DAOs). According to Wang et al. (2019), DAOs are organizational structures with rules encoded on the blockchain via smart contracts, enabling autonomous operations without central control. Goldberg and Schär (2023) emphasized the importance of implementing DAOs in the Metaverse for distributed decision-making and resource management, eliminating the need for a central authority.

Regarding the second motor theme, the concept of 'Intention' refers to users' willingness to embrace the Metaverse as a platform to perform an array of activities. Choi et al. (2023) and Sestino and D'Angelo (2023) have found that intentions for using the Metaverse can differ greatly, encompassing entertainment, social interaction, and fulfilling psychological needs. Choi et al. (2023) explored the influence of Metaverse on consumers' life satisfaction and usage intention to determine the psychological mechanisms behind consumers' adoption intentions for the Metaverse. They reported that intentions can be influenced by factors such as consumer experience, mood management, and the satisfaction of psychological and human needs. Regarding consumers' needs, the Metaverse provides psychological benefits by fulfilling users' social interaction, entertainment, and even higher-level needs such as autonomy and competence (Choi et al., 2023). The Metaverse fulfills relatedness and escape needs by allowing users to escape reality, indulge in fantasies, and experience an enhanced life (Choi et al., 2023). According to Maslow's hierarchy, the Metaverse aligns with love and belonging, addressing social connection (Choi et al., 2023). Self-determination, autonomy, and competency in the Metaverse correspond to Maslow's esteem needs, while creative entertainment relates to self-actualization (Choi et al., 2023). Moreover, Sestino and D'Angelo (2023) investigated intention in terms of people's readiness to employ the Metaverse for digital-based healthcare services. The intention to use the Metaverse in this context is determined by the perception of human-like interaction (anthropomorphism) and the recognition of human traits in interactions with virtual agents such as doctors and medical practitioners: the more individuals perceive human-like traits, the more likely they are to intend to use the services of the Metaverse (Sestino and D'Angelo, 2023). In addition, a branch of literature explored the intention to make purchases of physical or digital goods in the Metaverse. Kim and Bae (2023) examined the positive impact of self-congruence on luxury brand attachment and purchase intention among Metaverse users in South Korea. Park and Kim (2024) investigated how the degree of similarity between a user's appearance and their avatar in the Metaverse influences their purchase intention of virtual products, which in turn affects their willingness to purchase real products. The stronger the identification with the avatar due to its similarity to the user's real-life appearance, the greater the inclination to purchase virtual products. The interplay between Metaverse and real-world consumer behavior

emphasizes the importance of designing and communicating high-quality avatar customization options to boost sales within the Metaverse (Kim and Bae, 2023).

3.3.2.3. *Second period 2022–2023: basic and transversal themes.* Quadrant 2 reveals the basic and transversal theme of 'Virtual Reality (VR)' as a major theoretical contribution to the study of the Metaverse. Over the past few years, VR has emerged as transformative technology with significant impacts across various sectors, including communication, marketing, education, and tourism (Branca et al., 2023; Egliston and Carter, 2022; Martínez-Navarro et al., 2019). Branca et al. (2023) highlighted the considerable impact of VR on the evolution of scientific discourse due to its importance in revolutionizing various aspects of our daily lives and business environments. As the Metaverse has been defined, VR is one of its enabling components, and in its current form, the Metaverse is itself an embodiment of VR. The Metaverse, enabled by VR, offers to its users immersive and interconnected virtual environments (Branca et al., 2023; Martínez-Navarro et al., 2019). VR technologies allow individuals to become fully immersed in computer-generated environments, whether these are based on the real world or entirely innovative spaces. This facilitates real-time interactions and physical movement within the virtual setting (Hilken et al., 2022; Hoyer et al., 2020). The use of VR in replicating real-world behaviors has proven to be an effective research tool and environment for testing sensory cues and intangible attributes that researcher may consider for analyzing user behaviors (Hoyer et al., 2020). Branca et al. (2023) conducted studies, including focus groups and experiments, revealing that consumer behavior in VR aligns with real-life behavior, with some minor variations. Furthermore, VR can influence consumer behavior particularly regarding consumer-brand interactions (Dwivedi et al., 2022), customization of context and product evaluation, thereby providing valuable insights for product design (Martínez-Navarro et al., 2019). This indicates that VR-enabled Metaverse has the potential to support brands to provide offerings that are not feasible in the physical world (Dwivedi et al., 2022). For all these reasons, VR innovations have profound impacts not only on consumer behavior but also on industries like travel, tourism (Ampountolas et al., 2024; Buhalis et al., 2022) and education (Han et al., 2023; Hines and Netland, 2023). Several studies have explored the educational potential of the Metaverse, providing a versatile platform for educational activities. Virtual learning environments for problem-solving, education, simulation and game creation build and model authentic environments for socialization, learning, experimenting and working through high-quality multimedia resources in virtual environments (Ng, 2022). Recent research conducted by Han et al. (2023) and Hines and Netland (2023) indicated that VR can be effectively used for teaching in the Metaverse, presenting various benefits and challenges, particularly regarding depth of immersion and engagement when compared to traditional classroom settings. However, the potential data-intensive nature of VR raises concerns regarding impacts of data ownership and equity. Egliston and Carter (2022) emphasized the need for regulatory intervention as VR gains wider adoption in society, especially concerning data privacy and wealth inequality.

'Technology' is the second basic and transversal theme that emerges as a relevant research cluster in the study of the Metaverse. Digital transformation is a disruptive process and a true cultural, organizational and economic metamorphosis that cannot be ignored. It upsets conventional and established systems by introducing new paradigms to developing customer experiences, operating procedures, and business models. The topic's significance underscores the increasing research interest in technology and its innovative solutions, encompassing development, evolution, adoption and investment. Nevertheless, its low density implies possible room for future exploration indicating considerable potential for future research and suggested directions, delineated in the research agenda by the main analyzed contributions (e.g. Fang

et al., 2022; Rauschnabel et al., 2022; Tan and Salo, 2023; von der Au et al., 2023). Recent studies offer insights into the developing realm of emerging technologies and concepts of AR (Rauschnabel et al., 2022; von der Au et al., 2023) and blockchain technology, including their definitions and adoptions, as well as their implications across various domains and for Metaverse marketing strategies. In line with the significance of technology in human interactions, Fang et al. (2022) integrated service management into the Metaverse framework to establish methods for creating an appealing virtual space that can enhance the value-delivery process. However, both service management and Metaverse adoption perspectives remain underdeveloped and require further investigation.

3.3.2.4. Second period 2022–2023: isolated themes. The topics in the top-left Quadrant 3, which represents highly developed and isolated themes, are ‘Hospitality’ and ‘Behavior’.

Although well-developed in the general field of Metaverse research, ‘Hospitality’ is isolated from the rest of the research cluster discussed in this analysis, which pertains specifically to business, management and marketing. While the connection between the Metaverse and hospitality is not central to this research, it is noteworthy that the hospitality and tourism industry remains one of the most rapidly developing global sectors. The rise of the Metaverse and virtual travel presents opportunities for future business ventures. Ampountolas et al. (2024) argued that conventional online travel agencies must adapt their business models to suit the evolution of the Metaverse, which provides adaptable travel options, tailored consumer services, and superior entertainment experiences. Moreover, Buhalis et al. (2022) examined the possibilities and difficulties that the Metaverse offers for hospitality, tourism management and marketing, particularly for customer experience and value co-creation. The authors proposed a research agenda to further investigate the development of hospitality-Metaverse and its potential impact and implementation.

The second isolated theme pertains to the concept of ‘Behavior’ as the Metaverse has the potential to reshape digital and social interactions. The increasing popularity of the Metaverse underscores the significance of understanding how individuals interact and behave in the digital realm, socially connect through avatars in immersive VR, and employ Metaverse technologies for social connections and learning (Han et al., 2023; Hennig-Thurau et al., 2023). Han et al. (2023) employed the Transformed Social Interaction paradigm to investigate diverse avatar identities and environments longitudinally. Specifically, the study explored how avatar appearance and the virtual environment’s features affected participants’ attitudes and behaviors over time. The studies by Han et al. (2023) and Hennig-Thurau et al. (2023) showed evidence that the use of avatars resembling users enhances synchronization and nonverbal behavior similarities among users. Similarly, exposure to outdoor environments was found to improve rest and enjoyment (Hennig-Thurau et al., 2023). Further, Hennig-Thurau et al. (2023) suggested a research roadmap for exploring the Metaverse’s impact on behaviors and social interactions, particularly focusing on real-time multisensory social interactions (RMSIs) encompassing interaction performance, evaluation, and emotional responses. In addition, researchers investigated the potential of the Metaverse also for mood-management. Choi et al. (2023) explored the impact of the Metaverse on users’ mood, usage intentions and satisfaction. They observed that positive mood enhancement and negative mood alleviation within the Metaverse considerably impact satisfaction and, thus, usage intentions. Alashoor et al. (2023) conducted a study on mood-management in the Metaverse, exploring the privacy paradox in the digital age showing how under specific circumstances, such as adequate cognitive capacity or a negative mood state, individuals exhibit a negative correlation between privacy concerns and disclosure behaviors. Finally, recent studies on the Metaverse revealed the importance of emotions in influencing and driving behavior in virtual environments (Han et al., 2023; Hennig-Thurau

et al., 2023; Sestino and D’Angelo, 2023).

3.3.2.5. Second period 2022–2023: emerging themes. Quadrant 4 presents the emerging theme of ‘Games-gaming-gamification’. As emerging theme, it demonstrates potential for future research and warrant consideration in future research agendas. This topic embodies the future potential of the Metaverse, as gaming ecosystems, game engines and platforms converge into an immersive digital universe that blends physical and digital realms enabling effective user engagement (Chia, 2022; Jungherr and Schlarb, 2022). The emergence of the Metaverse marks a significant change of paradigm that carries extensive consequences for the role of game engines in the digital landscape where platform tools are gradually aligning themselves with the Metaverse’s business model (Chia, 2022). According to Jungherr and Schlarb (2022) game engines like Epic Games, Unity Technologies and Unreal are software products that equip developers with tools and pre-built solutions for fundamental programming tasks in creating games, and virtual and digitally augmented environments. Game engines have become a vital element of the Metaverse providing not only essential infrastructures for content creation and the development of online and digital games, but their influence extends beyond gaming and into architecture, manufacturing, film and television production, AI, and extended reality (XR) (Chia, 2022; Jungherr and Schlarb, 2022). Chia (2022) examined the effects of game engines on workers and industries, the potential for safe in-game shopping and online profits, and the move towards innovative platform tools for designing and simulating interactive 3D worlds. Jungherr and Schlarb (2022) highlighted that game engines have redefined platform dynamics, influencing future online and digital experiences, platform ecosystems, and impacting user behavior and online payments, while also offering vast ludic potential in the Metaverse. The rise of online interactive gaming such as Fortnite, Roblox and Minecraft underscores the Metaverse’s capacity to generate revenue for platform entities by fostering user engagement, retention, and in-game purchases including avatar accessories and outfits (Jungherr and Schlarb, 2022). Finally, Jungherr and Schlarb (2022) discussed the role and impact of game platforms in society, as well as the relationship between game engine companies and developers of AI applications. According to the authors, these topics provide a rich new research field that emphasizes the growing significance of XR across several sectors, from industrial design to AI for gaming.

3.3.2.6. Third period 2024–May 2024: motor themes. While VR was the most studied topic during the second period, in the last year 2024, the term ‘Metaverse’ has emerged as a key concept in academic literature with the number of contributions that has increased significantly. Scholars have engaged in debate regarding the definition of the Metaverse and have examined its impact across various sectors, including business and management, healthcare, engineering, education, finance, marketing, social change and user behavior, thus outlining its multidisciplinary relevance (Piñeiro-Chousa et al., 2024). Piñeiro-Chousa et al. (2024) conducted a bibliometric analysis of the Metaverse in business and management, emphasizing its transformative impact on technology, companies, and user interactions. However, they highlighted the need for further research to establish a foundational theory and enable informed decision-making. Hadi et al. (2024) confirmed the Metaverse’s multidisciplinary nature and its transformative potential. The authors examined implications of the Metaverse for consumer behavior and the evolving and uncertain nature of its future development, as well as its potential societal impacts underscoring the importance of its thoughtful and safe development. In the field of marketing, Yadav et al. (2024) conducted a study investigating the consumer and firm-level impacts of marketing within the Metaverse. They discovered that the Metaverse has the potential to enhance consumer loyalty and brand attachment, while simultaneously offering firms the advantages of decentralization and cost reductions. Furthermore, the study

discussed the potential use of NFT technology by marketers to create unique product offerings. Gleim et al. (2024) investigated the impact of the Metaverse on services marketing, identifying potential avenues for service providers to create distinctive customer experiences and adapt to the Metaverse by offering innovative experiences, considering sustainability, integrating ethical principles, and developing responsible guidelines. Moreover, Klaus and Manthiou (2024) emphasized the necessity for empirical research and an understanding of consumer processes within Metaverse retail environments to examine its potential as a retail powerhouse, its impact on consumer behavior and retail dynamics, as well as the shift to immersive 3D spaces. Recently, researchers have been engaged in investigating the potential impact of the Metaverse on the fashion industry. For example, Donvito et al. (2024) concentrated on consumer behavior, business strategies, NFTs, and the challenges associated with ensuring a secure experience for fashion consumers. The authors argue that the Metaverse offers the fashion industry a unique opportunity to engage consumers through immersive virtual environments, innovative marketing strategies, and digital assets.

Furthermore, the Metaverse presents a distinctive opportunity for companies to enhance consumer 'Engagement' and 'Brand' identity. Several authors underlined the pivotal role of engagement in fostering consumer-brand relationships as well as the multitude of opportunities offered by the Metaverse for immersive brand experiences, marketing strategies and consumer-brand interactions (e.g., Arya et al., 2024; Bilgihan et al., 2024). For instance, Zuo and Shen (2024) emphasized the significance of developing features for high-fidelity user experiences with the objective of promoting engagement, while Ghali et al. (2024) examined the impact of social presence, attachment, and engagement on revisit intentions among Generation Z consumers in the context of destination marketing and tourism within the Metaverse. Moreover, Kumar et al. (2024) investigated the influence of personality traits on individuals' inclination to engage with the Metaverse, emphasizing the role of engagement in shaping consumer behavior and brand equity. Similarly, Arya et al. (2024) highlighted the potential of immersive experiences, and brand engagement in driving consumer-based brand equity within the Metaverse. This is achieved through the creation of interactive 3D digital spaces and immersive experiences within the Metaverse (e.g., virtual boutiques, product testing, immersive marketing, and exclusive events). Additionally, Rauschnabel et al. (2024) discussed how AR, an effective tool for brand management, can enhance brand love by increasing perceived physical closeness between consumers and brands. Consequently, global brands are increasingly recognizing the Metaverse as a marketing platform, integrating NFTs into their branding strategies for purposes such as customer retention and revenue generation (Deventer et al., 2024). SanMiguel et al. (2024) found that luxury, sportswear, and beauty sub-industries are the most active, with Nike, Gucci, and Hermès leading the way in considering NFTs to enhance brand and shopping experiences within the Metaverse.

In addition to engagement and branding, the Metaverse also transforms the conveyance of 'Information' and social interactions, facilitating real-time communication and learning experiences (Vega and Camarero, 2024). This underscores the potential of the Metaverse to transform the accessibility and dissemination of information, transcending technological limitations.

3.3.2.7. Third period 2024–May 2024: basic and transversal themes. The topics of 'Avatar', 'Sustainability', and 'Artificial Intelligence' (AI) have emerged as crucial areas of basic and transversal themes, showing the interplay between technological innovation and societal impact. This underscores the importance of interdisciplinary research in addressing complex challenges and advancing knowledge in these areas.

The topic of 'Avatars', which represent a crucial element of the Metaverse, encompasses investigations into the creation, advancement, usefulness in virtual situations and their impact on user behavior and

identity (Shin et al., 2024; Yadav et al., 2024; Zhu and Yi, 2024). Zhu and Yi (2024) defined avatars as graphic representations that users create to depict themselves in the Metaverse. They emphasized the role of avatar-user similarity in influencing self-awareness and behavior. Similarly, Shin et al. (2024) and Yadav et al. (2024) stressed the role of avatars as digital representations that facilitate interactions and connections within the Metaverse. Specifically, Shin et al. (2024) investigated the impact of avatars on customers' offline behavioral intentions in the hospitality context, while Yadav et al. (2024) explored the manner in which avatars engage users and bridge the gap between tangible and digital influencers, underscoring their importance in shaping user experiences. Overall, research on avatars in the Metaverse contributes to an understanding of their role in enhancing user immersion, interaction, and engagement with avatars. This provides users with an enhanced immersive experience of self-expression and interaction, as opposed to traditional text-based communication.

The integration of Metaverse technology into various business practices is receiving considerable attention in academic literature, particularly with regard to its potential to enhance 'Sustainability'. Several studies have examined how the Metaverse can support sustainable development, focusing on areas such as supply chain management, marketing, and business model innovation (Davies et al., 2024; Pham and Vu, 2024; Zhong and Zhao, 2024). Zhong and Zhao (2024) investigated the relationship between sustainable marketing and supply chain management within the Metaverse, demonstrating how their integration can optimize resource allocation, reduce waste, and enhance both operational and financial performance, thereby promoting sustainable development in enterprises. Similarly, Pham and Vu (2024) examined the role of the integration of Metaverse technology in circular business models in streamlining processes, reducing waste, promoting sustainability and encouraging the internationalization of small and medium-sized enterprises. Moreover, Davies et al. (2024) explored how NFTs, offering digital alternatives to physical items, can drive sustainability in supply chains, enhance customer willingness to pay for sustainable products and support the growth of circular business models.

Finally, the integration of 'Artificial Intelligence' within the Metaverse is a rapidly evolving field, attracting significant attention due to its potential to transform digital experiences and operations and for its central role in the evolution of the Metaverse (e.g., Marabelli and Lirio, 2024; Paul et al., 2024). Paul et al. (2024) provided a comprehensive overview of the impact of digital transformation on business and society. They emphasized the role of AI and the Metaverse, and showed how AI technologies, including generative AI such as ChatGPT, are expected to significantly influence the digital transformation of society. The authors also addressed the ethical considerations and corporate digital responsibility associated with AI's integration into the Metaverse. As Marabelli and Lirio (2024) have argued, AI plays a multifaceted role within the Metaverse, enhancing content, diversity, and immersive experiences. The Metaverse can be enhanced by leveraging AI to offer personalized content, automated interactions, and intelligent virtual assistants, as well as to optimize processes and decision-making. Furthermore, Marabelli and Lirio (2024) examined the potential of AI in creating fairer assessments of employee performance and enhancing the overall employee experience. The authors argued that AI and the Metaverse are poised to revolutionize workplace environments, improving operational efficiencies and addressing workplace challenges in order to achieve positive outcomes in workplace diversity and equity.

3.3.2.8. Third period 2024–May 2024: isolated themes. Among the isolated themes, the concept of 'Satisfaction' within the Metaverse encompasses a range of factors, including service quality, user engagement, social presence and business performance (Choi et al., 2023; Ghali et al., 2024; Gil-Cordero et al., 2024; Gleim et al., 2024). As Gleim et al. (2024) posited, service quality is a pivotal factor in determining user and customer satisfaction within the Metaverse. Firms that prioritize

satisfaction in their Metaverse strategies are likely to observe enhanced customer retention, loyalty, and overall performance. Furthermore, user satisfaction in the Metaverse is also significantly influenced by social presence, which enhances user engagement and creates richer brand experiences, thus positively impacting customer experiences, behaviors, and continuance intentions (Ghali et al., 2024). Additionally, in the business context, Gil-Cordero et al. (2024) highlighted the importance of business satisfaction in influencing businesses' intentions to integrate immersive technologies. Business satisfaction, which involves the gathering of relevant information, the reduction of uncertainty, and the analysis of competition is central to strategic development and behavioral analysis and guides businesses in formulating performance strategies within Metaverse systems (Gil-Cordero et al., 2024).

Several studies have investigated the potential of the Metaverse to support the management of 'Supply-chains' (Zhong and Zhao, 2024; Davies et al., 2024). Zhong and Zhao (2024) examined the integration of Metaverse technology with supply chain management, demonstrating its potential to enhance collaboration and real-time monitoring, optimize logistics, resource allocation, reduce waste, and improve operational and financial performance. This can be achieved through virtual logistics, supply chain simulation, IoT and AI technology (Zhong and Zhao, 2024). Furthermore, Davies et al. (2024) investigated the potential of NFTs to enhance supply chain management and facilitate the adoption of blockchain technology, particularly in contexts where the replacement of physical products with digital ones is becoming increasingly common.

The final isolated item refers to the field of 'Information and Communication Technologies (ICT)', which forms part of a broader discussion on technological advancements and the adoption of the Metaverse by businesses. Gil-Cordero et al. (2024) discussed the strategic use of ICT within immersive technologies by firms to adopt the Metaverse and enhance their business operations and strategies in order to adapt to new digital landscapes. Similarly, Vega and Camarero (2024) discussed the role of ICT, namely blockchain technology and cryptographic assets, in the adoption of NFTs to provide guidelines for companies on incorporating NFTs into their marketing strategies.

3.3.2.9. Third period 2024–May 2024: emerging themes. The emerging topic of 'Products' refers to the integration of products and the Metaverse, which is transforming consumer experiences and reshaping the retail landscape. This offers unique opportunities for firms to enhance product visualization, consumer engagement and shopping experience (Hadi et al., 2024; Kumar et al., 2024; Nam et al., 2024). Kumar et al. (2024) emphasized the potential of AR to bridge the divide between digital and physical products in the Metaverse environment. Thanks to AR technology, a variety of consumer and retail products can be visualized and experienced in the Metaverse, thus enhancing the shopping experience and the consumer decision-making process. Similarly, Hadi et al. (2024) discussed the role of virtual goods, NFTs and experiences in the Metaverse, where consumers are increasingly willing to invest in digital products that enhance their virtual presence and social interactions. In particular, the transition towards the utilization of avatars for social interaction, gaming, and the expenditure of real money in virtual settings has the potential to have a far-reaching impact on consumer behavior (Hadi et al., 2024).

Finally, the evolving nature of the Metaverse requires continuous research to fully comprehend its implications and to develop strategies for its integration into different sectors. The potential for transformative change across various business domains, including consumer behavior, retail, fashion, healthcare and education, is indicated by the 'Future Perspectives' on the Metaverse (e.g., Damar and Koksalmis; Mkedder and Das, 2024; Prashar and Prashar, 2024). The growing body of academic contributions highlights the importance of addressing both opportunities and challenges associated with the Metaverse, paving the way for informed and responsible development. Researchers and practitioners

are encouraged to concentrate on several thematic clusters, including VR and AR technologies, IoT and wearable devices (Damar and Koksalmis, 2024), adoption barriers in the Metaverse, practical insights for businesses and managers, and the evolving Metaverse regulations to foster trust and confidence among users (Mkedder and Das, 2024).

4. Conclusions

4.1. Implications to theory and practice

The study provides a comprehensive bibliometric analysis of the academic literature on the Metaverse, as it pertains to business, management, marketing, and communication, based on VOSviewer and SciMAT software. The results present various theoretical and practical implications for researchers and practitioners that require further study.

At the theoretical level, the analysis has organized the literature on the subject identifying research patterns, and arranging past studies to suggest future research directions. The existing literature has focused on providing objective descriptions of the technology used by and in the Metaverse (the hard dimension of the Metaverse) as well as its applications (the soft dimension of the Metaverse). Initially, research focused on virtual environments and Second Life, both conceptually and as an online platform. The term Metaverse gained prominence after Facebook's rebranding to Meta in October 2021, with subsequent publications concentrating on VR and related technologies. More recently, research has shifted towards exploring the potentials and risks of the Metaverse, emphasizing elements such as AR, gamification, blockchain, cryptocurrency, and NFTs. Furthermore, there is a growing interest in understanding user perceptions with a view to identifying barriers and facilitators for Metaverse adoption. Current trends highlight the Metaverse's transformative potential, covering aspects such as brand and engagement, technology, opportunities, sustainability, challenges, future trends, and products or consumption patterns. By investigating the lines of research identified, it is possible to gain insights into what can actually change in the Metaverse from what is known, thereby enabling the construction of new knowledge.

At a managerial level, the present analysis provides useful suggestions for all businesses currently interested in entering the Metaverse to increase their profits and create new and stronger relationships with their customers. Moreover, there is a crucial need to comprehend the potential integration of the Metaverse into the value chains of manufacturers and retailers, and how it can generate tangible value. This study provides guidance to marketers on effective strategies that avoid inefficient investments and to help them in making informed decisions for the future.

As technology advances, the Metaverse has gained attention for its potential to revolutionize customer experiences, marketing strategies, and overall business operations. It presents a new frontier for innovation, communication, and collaboration in the business and management context. In current literature, the term 'Metaverse' commonly refers to VR, which is a parallel realm where individuals become immersed. Although located within the real world, human interactions go beyond the physical and explore the complexities of a virtual environment, whether it is a realistic representation of reality (a digital twin), a partial depiction, or a completely imaginative and fantastical space. It feels as though individuals currently reside within a galaxy comprised of a myriad of worlds, where the physical Earth - the world in which individuals reside - serves as the central point, flanked by similar or completely distinct digital twins or partial replicas.

The interplay between Metaverse and real-world forces researchers and practitioners to comprehend users' intentions to engage in the Metaverse. This enables the Metaverse industry to design more effective and user-friendly platforms and services which can encourage individuals to use them (Choi et al., 2023; Sestino and D'Angelo, 2023). Moreover, it is essential to consider the role of the avatar in shaping the user experience and influencing behaviors and interactions within the

new immersive world. In particular, the greater the resemblance between an avatar and a user's real-life appearance, the stronger the identification with it (Kim and Bae, 2023; Shin et al., 2024; Yadav et al., 2024). Consequently, companies wishing to enter the Metaverse will be required to consider the presence of the real user's digital twin in the virtual world and its evolving dynamics during the development phase of their virtual presence. For instance, the provision of high-quality avatar customization options not only enhances the user experience, but can also lead to increased user engagement and sales within the Metaverse (Kim and Bae, 2023).

The Metaverse offers unique opportunities for firms to enhance product visualization and shopping experience (Hadi et al., 2024; Kumar et al., 2024; Nam et al., 2024). In particular, the integration of AR/AI, blockchain and NFTs bridges the gap between digital and physical products in the Metaverse, allowing users to purchase digital products in the virtual environment. Concurrently, the Metaverse may be regarded as a novel marketing tool and platform for product design and testing for retail brands and products. Retailers seeking to expand their retail channels could employ the Metaverse as an experimental platform to assess consumer reactions to new products in virtual forms prior to their introduction to the physical market (Park and Kim, 2024).

Furthermore, the integration of Metaverse technology into various business practices is gaining significant attention due to its potential to enhance sustainability in several areas, including supply chain management, marketing, and business model innovation (Zhong and Zhao, 2024; Davies et al., 2024; Pham and Vu, 2024). Finally, it is important for practitioners to consider the role of AI integration within the Metaverse in terms of enhancing content, immersive experiences, workplace environments and gaming (Jungheer and Schlarb, 2022; Marabelli and Lirio, 2024; Paul et al., 2024). This latter topic of AI for gaming emphasizes the pivotal role of game engines and platforms in the Metaverse landscape (Jungheer and Schlarb, 2022).

4.2. Future research agenda

Due to its characteristics, the Metaverse offers a multitude of possibilities for various activities, including education, marketing, branding, and customer engagement. These potential applications require further investigation and development, as outlined in Table 5, which presents a proposed future research agenda.

The immersive nature of the Metaverse enhances teaching methods and promotes knowledge production and exchange through visual stimuli. Even a lecture on dinosaurs, for example, can be presented in a virtual environment by observing a T-Rex without being attacked. Similarly, millennials can interact with ancient Rome as if they were living in that time. This approach is particularly suitable for younger generations, whose attention span may decrease with traditional teaching methods (Miller et al., 2013) but can be improved through active participation. As learning takes place not only by seeing but also by doing, the Metaverse provides a safe environment to practice and learn without fear of real-world consequences (e.g. doctor operating in a simulated operating theatre). The Metaverse is widely used for professional training, including medical education. Virtual conferences, meetings and team-building activities are taking place across the Metaverse, breaking down geographical barriers and facilitating the creation of a diverse, inclusive training environment. Therefore, it is important to consider how to adapt the education system and teaching methods at all levels of education from pre-school to postgraduate level, to incorporate the potential of the Metaverse and comprehend its impact on educational programs and their performance in the near future.

The Metaverse provides a favorable environment for conducting market research, where tests, experiments and simulations can be carried out as in a physical reality. As such, marketing research experts must consider how the Metaverse can facilitate research progress and potentially modify research protocols. To fully understand the potential of the Metaverse, it is necessary to assess whether and to what extent it

Table 5
Future research agenda.

Topic	Issues to be explored
Education	<ul style="list-style-type: none"> Investigate how to adapt educational systems and teaching methods to incorporate the Metaverse Explore the effectiveness of immersive teaching methods in enhancing engagement and learning outcomes Assess the impact of the Metaverse on educational programs and performance at all levels from pre-school to postgraduate Examine how the Metaverse can facilitate market research in virtual environments
Market Research	<ul style="list-style-type: none"> Determine the relevance and value of modifying existing research techniques or developing new ones to be used within the Metaverse Analyze how user-avatars behave in the virtual dimension, interact with the environment, and move in virtual worlds
User-Avatar Behavior	<ul style="list-style-type: none"> Investigate if avatar behaviors mirror real-world consumer behaviors or exhibit unique dynamics Investigate emotional responses and whether traditional psychological and behavioral principles apply Study the physiological and psychological aspects of how individuals move, interact with, and navigate the Metaverse while staying connected to their physical bodies
Spatial Perception and Interaction	<ul style="list-style-type: none"> Focus on spatial perception and psycho-emotional responses to identify business implications Apply neuro-marketing techniques to tailor strategies for the Metaverse Examine social influences in the Metaverse (i.e., peer interactions, socialization, and privacy) Investigate how social relationships between avatars impact consumer behavior (using experiments, neuro-marketing tools, or observational research techniques)
Social Interactions	<ul style="list-style-type: none"> Assess whether the Metaverse can be considered a global platform without cultural boundaries, affecting market entry and target audience strategies Explore the role of gaming (dynamics, trends, and interactions within online gaming communities) in enhancing virtual experiences within the Metaverse
Gaming and Gamification	<ul style="list-style-type: none"> Analyze the impact of gaming infrastructure on businesses, communication codes, brand identity, language, and visual codes Determine effective strategies to engage with customers through gaming elements in the Metaverse Identify how to design virtual stores in the Metaverse compared with physical stores
Retail and Virtual Stores	<ul style="list-style-type: none"> Explore changes in store layouts, displays, and personal selling techniques Examine new ways to communicate in the virtual environment
Brand Image and Identity	<ul style="list-style-type: none"> Examine the effects of creating a digital twin or a distinct virtual world on brand image, message continuity, and brand identity

makes sense to modify existing research techniques or add new ones in the near future. For instance, would it be meaningful to have a survey completed in the Metaverse or would it provide no added value?

The Metaverse offers the possibility of conducting marketing activities within a virtual environment connected to tangible goods, services, events, and ideas. The questions to be answered are diverse and relate to various areas and impacts.

A relevant area of investigation is the avatar's presence, which is the user's only representation in the Metaverse. The avatar facilitates self-expression and self-experience via technology, and plays the role of the consumer in the decision-making process. The doubling up of the consumer necessitates an understanding of whether the avatar's behavior mirrors that of the consumer in the real world. If individuals participate in the Metaverse, their actions can have consequences in the physical world and vice versa, similar to living a second life. It is yet to be determined whether users in the Metaverse, via the avatar's presence,

behave, conduct commercial activities, and socialize with other users-avatars in the same manner as they would in the physical world. Alternatively, individuals may lead a digital life that is distinct from their physical one, exhibiting different behaviors and novel dynamics that are not simply a replica of the physical world in the Metaverse.

The key challenge is to examine the behavior of individuals seeking to engage with the Metaverse and the one of the avatars, who businesses persistently target with actions that affect both the physical and digital realms. The following questions arise. How does the consumer avatar behave in the virtual dimension? What is the association between avatars and their surrounding environment? What are the movements of avatars in virtual worlds like? Do they resemble those in the physical world through the use of visors? What are the emotional responses of avatars in the digital world? If identical behavioral and psychological principles apply, then it would be adequate to replicate all marketing strategies and activities in the virtual world based on the same widely researched and validated psychological, behavioral, and social theories in scholarly literature. Conversely, it is imperative to explore the conduct of users-avatars within the Metaverse by means of neuro-marketing. This would enable the tailoring of strategies and activities to a world that is distinctive from the physical realm.

On the one hand, there is the physiological aspect of how individuals move, interact with, and navigate the new world while staying connected to their physical bodies, which primarily relates to spatial perception. On the other hand, there are psycho-emotional responses and affective behavior that are essential in identifying consequences, spillovers, and implications for business. As people use virtual interactions and relationships to fulfill their social needs, it is important to delve deeper through further research into the influence of the Metaverse on consumer psychology, emotions, and subsequent behaviors (Córdova González, 2022; Sestino and D'Angelo, 2023). It is important to acknowledge the impact of social interactions with other avatars on consumer behavior, which can be categorized into three distinct types. Each of these influences requires detailed investigation.

First, situational influences pertain to the way in which the context affects the individual. Therefore, it is important to investigate how the context of the Metaverse (e.g. atmosphere, colors) affects the user-avatar's behavior. Retail companies should consider whether to address the avatar in the Metaverse or the consumer present in the physical context. Additionally, companies should determine whether to create digital twins of the real context in the Metaverse, a partial replica, or a completely new retail environment. If the behaviors in the Metaverse are identical to those in the physical world, it would be enough to act on a context simply made of pixels, which is easier to shape than the physical world.

Secondly, psychological influences pertain to the way an individual interacts with their environment through the five senses. The current situation where sight and hearing are the only two senses that function in the virtual world indicates to researchers that behavior in the Metaverse cannot adhere to the same principles as the physical world. Neuromarketing could offer guidance to cope with these ambiguities.

Moreover, social influences should be taken into consideration, referring to peer interactions within an individual's social environment. In the Metaverse, objective analysis of the notions of socialization, social distance, and personal privacy is critical, as their physical-world counterparts. Therefore, it is important to explore the behavior and social relationships between avatars in the virtual context through experiments, neuromarketing tools or observational research techniques. It is essential to determine whether the Metaverse can be considered a global place where there are no cultural problems and where it is possible to speak to an American and a Chinese in the same way and with the same nonverbal language. If such a scenario exists, companies can expand their reach and presence in the Metaverse without constraints. The following questions arise. What implications does it have to establish and maintain a market position within the Metaverse? Is the Metaverse devoid of business boundaries or not? How does this affect theories of

market entry and target audience?

Focusing specifically on the growing trend of gaming and gamification, exploring how these methods can improve virtual experiences is of particular interest. Companies seeking investment in the Metaverse must comprehend the dynamics, trends, and interactions within online gaming communities. If gaming serves as the primary platform in these worlds, it is essential to assess their impact on businesses and ways businesses can effectively engage with customers. For retailers, for instance, the main issue is how to design a virtual store in the Metaverse. Several questions arise. Is the store comparable or distinct from a physical one? How do store layouts and display change? How do personal selling techniques change? Moreover, if the infrastructure of the Metaverse adopts that of gaming, this results in a transformation of communication codes with consumers. Consequently, it is mandatory to investigate the effects of these models on the brand image, message continuity, and brand identity, as well as the language and visual codes employed.

The idea of realizing a new virtual reality that exploits technology for the unfolding of a parallel life has met with both enthusiasm and skepticism that still clash today. Opinions oscillate between viewing it as a bubble that is destined to burst (which might be termed a 'metacrash') and as the natural evolution of the Internet and the way humans live, socialize, work, and entertain themselves. This unfolding scenario's intersection of technological advancement, human behavior and business strategy presents an intriguing yet complex field for both academic study and business application.

5. Limitations

The study has some limitations. Firstly, it solely focuses on bibliometric data, excluding input from companies and neglecting their perspectives which could have enriched the theoretical and managerial implications. Moreover, although a meticulous protocol was employed through citation databases for article identification, the ever-changing nature of the information source results in fluctuations in the availability of citations and documents. Additionally, constraints related to the selected timeframe and the scope of search terms utilized may impact the comprehensiveness of the collected data. Future research efforts could broaden the scope of this study by integrating a variety of databases and documents, resulting in a more comprehensive knowledge map of the Metaverse in the coming years. Finally, the research considered WoS results without applying any country-specific filters; for future studies, researcher can analyze new perspectives based on geographic diversity.

CRediT authorship contribution statement

Simone Aiolfi: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Beatrice Luceri:** Writing – review & editing, Writing – original draft, Conceptualization.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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