

Virtual Influencers in Marketing: A Bibliometric Analysis of Current and Future Research Trends

Rohit Bansal¹, Abdul Hafaz Ngah^{2*}, Mohammad Sahabuddin³, Mosab I. Tabash^{4*}, Abdullah Hamadi⁵

¹ Postdoctoral Researcher, Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu;

² Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu;

³ Department of Business Studies, State University of Bangladesh;

⁴ College of Business, Al Ain University, United Arab Emirates ;

⁵ Business Management Departement, School of Management, Swansea University, Swansea SA2 8PY, UK;

rohitbansal.mba@gmail.com, hafaz.ngah@umt.edu.my (Corresponding Author),

sahabuddingme@gmail.com, mosab.tabash@aau.ac.ae (Corresponding Author),

abdullahhamadi68@yahoo.co.uk

Abstract. Virtual influencers, or computer-generated characters designed to engage with audiences on social media, have emerged as a new frontier in digital marketing. This study conducts a comprehensive bibliometric analysis of the research on virtual influencers in marketing, using data from the Scopus database. The analysis covers 222 documents published between 1997 and 2023, and employs a combination of performance analysis, citation analysis, and science mapping techniques. The results reveal the most influential contributors, knowledge clusters, and future research directions in this field. Three major themes are identified: the social presence of avatars on e-commerce platforms, the impact of avatars on customer behavior, and the credibility of virtual influencers. The findings suggest that research on virtual influencers is growing rapidly, with opportunities for further exploration of their effectiveness, risks, and ethical implications. This study provides a valuable resource for researchers and practitioners seeking to understand and advance the use of virtual influencers in marketing.

Keywords: Virtual influencers; Computer-generated influencers; Avatar marketing; CGIs; Metaverse marketing

1. Introduction

The metaverse provides a substitute for physical social interaction by enabling people to communicate with one another in immersive, three-dimensional virtual environments (Dahan, 2022). We cannot overlook the likelihood that it will interfere with our daily lives even though it is still evolving. The growing trend of virtual influencers is a prime illustration of this. Virtual influencers are CGI (computer-generated imagery) characters that closely resemble humans but do not actually exist (Rozema, 2022). Virtual influencers are “created and controlled by teams of individuals often affiliated with digital agencies, and who account for a substantial enough follower base on social media platforms to attract attention from brands and consumers (Audrezet & Koles, 2023).”

The term Virtual influencers are often confused with other terms like avatars. There is a need to create a distinction between virtual influencers and its related terms. Virtual avatars are defined as "graphical representation of users in a shared online environment" (Fong & Mar, 2015). Online environment includes virtual world, games, webshops and online forums. Virtual influencers may not always reflect users but are generally created for business objectives by a group of people, usually by a company or marketing agency (Garnier & Poncin, 2013a).

The first companies to embrace virtual influencers as a trend were luxury fashion houses. In 2018, Margot, Shudu, and Zhi served as virtual models for the fashion army of Balmain. As of 2022, Fenty Beauty spokeswoman Shudu Gramme had 231,000 followers. Lil Miquela, a 3 million-follower adolescent who has been around for a while, took over Prada's Instagram for Milan Fashion Week. The number of virtual influencers has increased during the previous years. These digital beings are perfectly equipped to be the first occupants of the metaverse, which is why it has this effect. Virtual influencers will transition from being a fad to a mainstay as investment and interest in the metaverse increase (Aggarwal, 2022).

An online influencer Noonoori appears to be digitally altered. Lauren Coleman claims that Joerg Zuber, a graphic designer and studio owner at Opium, is the creator of this digital persona (Coleman, 2018), which currently has 438 thousand followers. Noonoori works for a variety of premium companies like Versace, Dior, and Marc Jacobs, and her feed is heavily focused on fashion and couture. Noonoori's feed frequently features pictures of her in various animated settings that correspond with the account's fashion theme.

In essence, these virtual characters blur the boundaries between the virtual and physical world, which has never happened before and has created entirely new marketing opportunities.

Brand marketers can reap several advantages from leveraging virtual influencers. Complete control over the brand, potential cost savings, relevance for attracting younger audiences, reduced controversy risk, increased engagement, accessibility from anywhere at any time, fit for specific niches, and a sizable fan base are just a few of its benefits. Working with virtual avatars may be prohibited by brand marketers due to a number of issues, including the possibility of unanimity, being expensive, time-consuming, increased control over brand messaging, risk of consumer backlash, need for skilled digital professionals and regarded as unauthentic. Though there are definitely many benefits and drawbacks, brands cannot ignore the rise of innovative virtual influencers.

Based on a research study on virtual influencers by the Influencer Marketing Factory in 2022, 58% of respondents stated they follow at least one virtual influencer, and 35% of customers claimed they had bought a product endorsed by a virtual influencer (Bringé, 2022). The increasing potential of virtual influencers caught the interest of marketing practitioners and scholars in this domain. The average publication per year in 1997 was just 1 which rises to 28 in the year 2022. The growing number of publications in this domain requires a comprehensive and scientific review of the literature in this domain.

Few researchers like (Garnier & Poncin, 2013b); (Miao et al., 2022) and (Oliveira & Chimenti, 2021) put efforts in this direction. (Garnier & Poncin, 2013b) conducted an interdisciplinary synthesis on this topic with a focus on avatar identification, its antecedents, and its effects in a commercial context.

This review presents a comprehensive overview of literature but the corpus of this field is growing. Thus there is a need to map the updated body of knowledge in this domain. Further, (Miao et al., 2022) identified and critically analyzed essential conceptual elements of the term avatar and a typology of avatar design features was also supplied. This literature review is a narrative review based on manual and subjective analysis. Thus, there is a need to perform a more structured literature review based on objective data. With this context, (Oliveira & Chimenti, 2021) conducted an SLR based on 32 articles to understand the use of VIs in marketing communication. This study is based on very few articles. Thus, conducting a bibliometric analysis is justified for various reasons such as the exponential growth of literature in recent years after 2020 and Bibliometric analysis is an advanced method to map the growth of the body of knowledge on a certain topic. It makes it possible to perform a more structured literature analysis based on objective data. It enables authors to identify influential contributors and knowledge clusters and help advance the field and guide future research.

In this vein, this research aims to conduct a comprehensive literature review using bibliometric analysis on marketing through virtual influencers and attempts to answer the following research questions:

RQ1: Who are the top influential contributors (e.g., journals, articles, authors, institutions, countries) on the topic of virtual influencers in the marketing domain?

RQ2: What are the various research (or knowledge) clusters that have emerged on the topic of virtual influencers in the marketing domain?

RQ3: What are the recommendations for advancing the knowledge base on the topic of virtual influencers in the marketing domain?

The rest of the paper is structured as follows: The next section belongs to the literature review followed by the methodology applied in this review and the results and discussion section. Afterwards, implications and limitations are discussed. At last, the conclusion section is provided.

2. Literature Review

The burgeoning field of influencer marketing in the metaverse combines the impact of social media marketing with the immersive qualities of virtual reality. The metaverse, a virtual environment increasingly embraced for social interaction and entertainment, is gaining significant traction (Deterding et al., 2011). Recognizing the growing popularity of the metaverse as a space for people to engage, companies are realizing the potential of IM to effectively connect with this expanding audience. Virtual influencers are fictional people created by computers who are entirely made of pixels and algorithms. Despite some of them being created as robots or animals, they seem to be incredibly lifelike humanoids (Moustakas et al., 2020). They live their lives virtually, posting about them, interacting with their followers, and working with different brands. Key Opinion Leaders (KOLs), who are actual people, are different from virtual influencers, which are wholly artificial entities created through programming. VIs are created by digital technology experts working with marketing and communication firms who can give them whatever age, appearance, lifestyle preference, daily activities, personal connections, and purchases they wish (Thobois, 2020).

Influencer marketing in the metaverse works in a similar way to IM in the real world, where businesses pay virtual influencers to spread the word about their goods or services to their followers. But, the metaverse's singularly immersive nature allows for even more imaginative and compelling marketing strategies. Brands, for instance, might arrange virtual events or product debuts, and online influencers can go to these and spread the word to their followers "(Sands et al., 2022)". By collaborating with or developing virtual influencers, large brands and corporations are advancing towards digitization. One of the most well-known virtual influencers, Lil Miquela, has worked with brands like Calvin Klein and Prada, either by herself or in tandem with actual influencers.

For a number of reasons, virtual influencers are common in the metaverse. They provide brands greater control over their messaging and image because the virtual influencers' entire personas are meticulously curated and managed (Du, 2022). Additionally, because virtual influencers are not constrained by

geographic distance or linguistic limitations, they can connect with a larger audience than traditional influencers.

While virtual influencer marketing comes with its advantages, there are also notable drawbacks. One concern revolves around the potential for customer backlash from individuals who perceive virtual influencers as being dishonest or deceptive (Berryman et al., 2021). Additionally, a significant challenge lies in the necessity for costly and highly skilled digital professionals to create and sustain the virtual influencer (Conti et al., 2022).

Inevitably, the topic of IM in the metaverse is one that is expanding swiftly and promises to provide brands with fresh methods of connecting with their target consumers. The potential of using virtual influencers to produce interesting content and experiences for their audience is already being investigated by brands. It will be fascinating to watch how brands adjust to this new world as the metaverse develops and how virtual influencers influence the direction of IM.

3. Methodology

The foundation for this analysis is drawn from literature reviews that advocate for the adoption of a systematic approach (Donthu et al., 2021; Soni et al., 2021). In contrast to narrative reviews, which lack systematic procedures, bibliometric analysis presents the outcomes of the literature review through systematic methods based on a review protocol, rendering it more reliable and replicable compared to narrative reviews (Kumar et al., 2021). Moreover, bibliometric analysis employs AI and machine learning-driven scientific databases like Scopus, along with specialized tools such as Bibliometrix and Vosviewer, making it a more technologically advanced process than traditional review techniques. The methodological design of this review, as depicted in figure 1, is bifurcated into three sections: assembling, arranging, and assessing, which are elaborated upon in the subsequent subsections.

3.1. Assembling

The primary objective of the initial section is to gather relevant research concerning virtual influencers, further dividing them into sub-sections of acquisition and identification. The "Identification" phase serves as a preparatory stage where all activities aligned with the study's objectives are identified to ensure the proper implementation of the recommended methodological design.

A comprehensive list of keywords was used to do the most comprehensive and exhaustive review of this topic. Further, to relate virtual influencers with marketing and to extract only those articles that talk about the employment of virtual influencers in the marketing domain, key terms used for marketing were also included with the AND Boolean operator. The following search string was used for assembling the data:

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( TITLE-ABS-KEY ( ( "virtual influencer*" OR "computer generated influencer*" OR "computer-generated influencer*" OR "metaverse influencer*" OR "fictional influencer*" OR "fictional character*" OR "imagery influencer*" OR "avatar influencer*" OR "virtual persona" OR "computer generated imagery influencer*" OR "vtuber*" OR "virtual endorser*" OR "digital avatar*" OR "cgi influencer*" OR "virtual youtuber*" OR "computer generated person*" OR "computer generated endorser*" OR "lilmiquela" OR "lu do magalu" OR "guggimon" OR "Any Malu" OR "Anna Cattish" OR "Thalasya" OR "Janky" OR "Noonoouri" OR "virtual avatar*" OR "customer avatar*" OR "brand avatar*" OR "animated influencer*" OR "anthropomorphic influencer*" OR "artificial influencer*" OR "artificial influencer*" OR "embodied influencer*" OR "nonhuman influencer*" OR "non-human influencer*" OR "unreal influencer*" OR "spokesavatar*" OR "spokescharacter*" OR "avatar*" OR "virtual ambassador*" OR "virtual endorser*" OR "customer digital twin*" OR "virtual models" ) ) AND TITLE-ABS-KEY ( ( "marketing" OR "advertis*" OR "metaverse marketing" OR "experimental marketing" OR "digital marketing" OR "social media marketing" OR "e-marketplace" OR "product promot*" OR "brand promot*" OR "brand marketing" OR "hype marketing" OR "selling" OR "marketing planning" OR "customer" OR "buy*" OR "purchas*" OR "marketing activities" OR "consumer" OR "brand endorse*" OR
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"product endorse*" OR "endorse*" OR "marketing communication" OR "Retail marketing" OR "e-commerce" OR "online shopping")))

Selecting the best database is one of the section's other key decisions. Scholars select Scopus for two reasons: firstly, it includes articles that meet stringent standards for indexing (such as being scholarly and scientifically relevant); and secondly, it offers comprehensive bibliometric information for articles it indexes unlike google scholar. Furthermore, investigations aiming to select a substantial corpus for review might benefit greatly from Scopus, a scientific database that is often recommended for bibliometric assessments (Kumar et al., 2022; Paul et al., 2021a). Moreover, Scopus has been acknowledged as a high-quality database for bibliometric data (Baas et al., 2020), and highly correlates with alternate scientific databases like Web of Science (Archambault et al., 2009), Coverage of Web of Science is less than the Scopus (Paul et al., 2021b), making Scopus a more exhaustive yet high-quality data source for bibliometric data.

The following subsection is labelled "acquisition," and it is here that the previously indicated search query was employed to obtain materials from the Scopus database. Only the title, abstract, and keywords contained search terms. Using the search parameters, 1024 research documents covering the years 1997–2023 were found.

3.2. Arranging

The organisation of the 1024 research documents that were extracted in the previous step is the focus of the second stage of arrangement. The results of this research are limited to the fields of business, management, accounting, economics, and finance. English was chosen as the language of choice. There are sensible justifications for this. The choice of the topic areas—business, management, accounting, economics, and finance—aligns with the primary goal of the research, which is to map the body of knowledge on virtual influencers in the field of marketing. Only 222 research documents were chosen for further consideration after 802 were discarded due to this criterion. Furthermore, it was planned to eliminate research publications written outside of the English language for the pragmatic reason that the majority of bibliometric data analysis tools are limited to data written in English. Nevertheless, 222 articles from the corpus were chosen for the final synthesis, and no research paper was authored in a language other than English.

3.3. Assessing

The third step, assessment, focuses mostly on the dissemination of findings and the study of bibliographic data. It includes tasks connected to reporting and evaluation. Science mapping and performance analysis are included in the bibliometric analysis. Science mapping seeks to identify the connections between research parts, while performance analysis assesses the contributions made by individual research aspects. Performance analysis insights assist researchers in identifying sources of knowledge (e.g., authors and institutions) related to their area of interest. It also helps researchers determine which areas—such as countries—remain unexplored. Consequently, academic institutions seeking to collaborate on new projects in areas of mutual interest may find value in country analysis, researchers seeking to conduct fresh research in understudied regions may benefit from author and institution analysis, and business professionals seeking expert commentary or consulting may find value in academic researchers seeking advice. Researchers may find that journal analysis can be useful in figuring out where to begin when developing a deeper grasp of their area of interest. Science mapping is a sophisticated bibliometric analytical method. It reveals knowledge clusters that are representative of the primary research avenues in the domain. It demonstrates how a field's knowledge can be heterogeneously diverse while still being homogeneously concentrated. Researchers employed performance analysis to gain knowledge on the most productive writers, organisations, nations, and journals in order to respond to the first study question. To address the second and third research topics, science mapping was carried out. We used the "thematic map" tool to identify emerging themes to recommend future research topics and basic themes to find clusters in the current literature in order to

address RQs 2 and 3. Through the combination of centrality and density scores, we were able to classify themes into four categories: "basic, motor, emergent, and niche." The presence of basic and motor motifs suggests that the research topics are centrality-established. "Compared to motor themes, which often connect to topics outside of the cluster and have a larger density and impact, basic themes frequently relate to other topics within the cluster, which has a lower density and effect. Emerging themes are thought of as "developing or immature and as such have little importance or impact right now, but they may yet be significant in the future" . In contrast, niche themes have "strong internal connections within the cluster but weak external connections, demonstrating that these topical clusters are very central and, therefore, highly specific and peripheral in character"

The concept of "betweenness" centrality describes the degree to which other nodes rely on a specific node and, thus, the potential power that node may possess. The word "closeness centrality" refers to the degree of autonomy or effectiveness of access from likely intermediate control. Furthermore, "PageRank" centrality assigns a relevance score to each node based on how many in-links it has in comparison to other pertinent nodes.

Software such as INSPIRE, Histcite, VantagePoint, Pajek (Persson et al., 2009), CoPalRed, CiteSpace II(Li et al., 2018), Gephi (Xu et al., 2018), Bibexcel (Fahimnia et al., 2015), Network Workbench Tool, Biblioshiny, and Vosviewer (Caviggioli & Ughetto, 2019) are some of the programmes that can be used for bibliometric analysis. Biblioshiny, developed by R, was utilised in this study to analyse bibliometric data. It is a tremendous software which has a number of tools and techniques (Donthu et al., 2021; Mukherjee et al., 2022). Biblioshiny's output data was utilised to create graphs in Microsoft Excel. This study follows the reporting guidelines of earlier SLRs by presenting its findings as a blend of text (accompanying narratives), tables (metrics), and figures (network visualisation). The review relies exclusively on bibliometric data, and the study acknowledges that its findings may be limited by the accuracy and comprehensiveness of the bibliometric data available on Scopus. In this study, studies from Web of Science and Dimensions were not considered. Additionally, using other databases or combining the two bibliometric databases, such as Web of Science and Scopus may provide the depth of research in this area and can overcome the limitations of a single database.

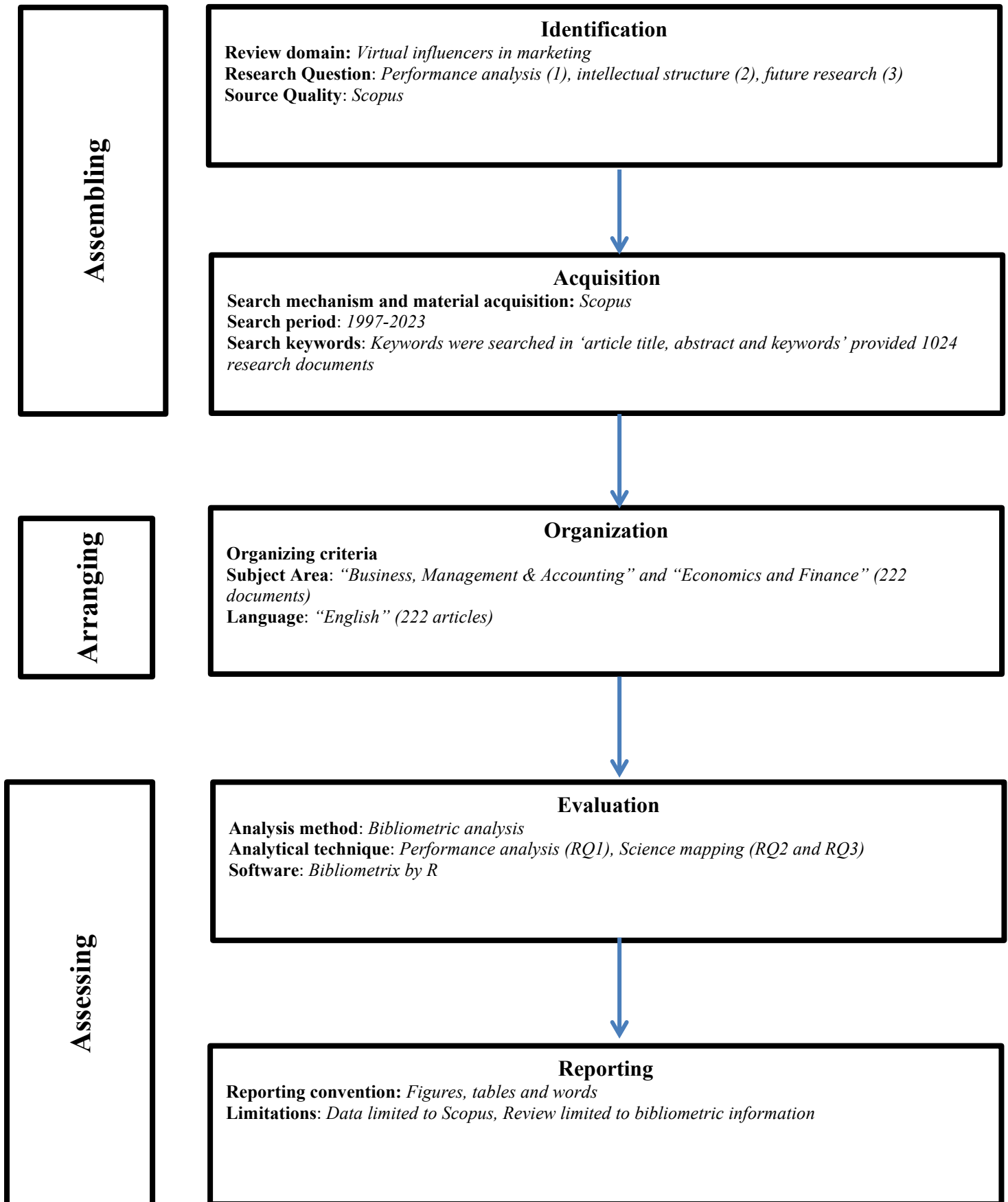


Fig. 1: Protocol for mapping research on virtual influencers in the marketing domain

4. Results

4.1. Performance Analysis

4.1.1. Publication Trend

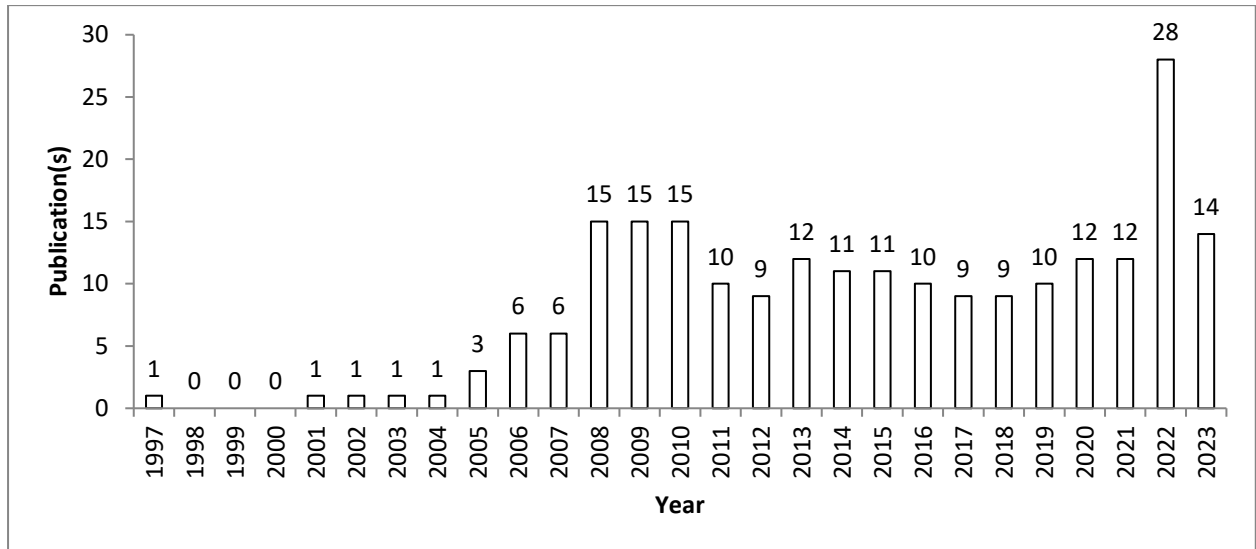


Fig 2: Publication trend of research on virtual influencers in the marketing domain

Figure 2 illustrates that there is an increasing trend in the number of publications. It is depicted from the figure that up to the year 2007, the no. of articles was in one digit constantly. In the year 2008, the number of articles rises to double digits. There is a significant jump in the no. of articles in the year 2022. Thus, the year 2022 is the highest contributing year with 28 publications in the domain of virtual influencers.

4.1.2. Source analysis

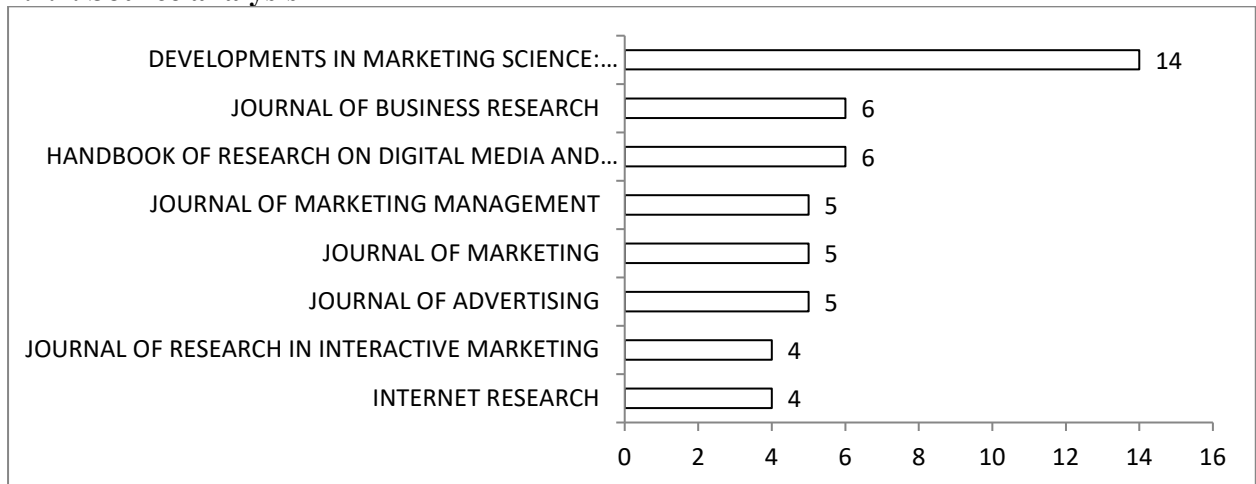


Fig 3: Most relevant sources

Table 1. Most impactful journals

Source Title	TC	TP	CPP	h-index
Journal of Marketing	1063	5	212.6	5
“Journal of Management Information Systems”	373	1	373	1
“Journal of Retailing and Consumer Services”	230	3	76.66	1

Harvard Business Review	220	2	110	2
Technovation	204	1	204	1
Information Systems Research	200	2	100	2
Internet Research	176	4	44	4
“Journal of Electronic Commerce Research”	125	2	62.5	2
“Journal of Marketing Management”	123	5	24.6	4
Psychology and Marketing	105	3	35	3

TC= Total Citations TP= Total Publication CPP= Citations Per Publication

Figure 3 illustrates the most relevant sources that contributed domain. It is depicted by the figure that “Developments in Marketing Science: Proceedings of the Academy of Marketing Science” is the top contributing source. It is followed by “Journal of Business Research” and “Handbook of Research on Digital Media and Advertising: User Generated Content Consumption”. Both sources contributed 6 research documents. Further, table 1 illustrated the top cited sources and highlighted that “Journal of Marketing” is the top cited journal with 1063 citations. It is followed by “Journal of Management Information Systems” (TC= 373) and “Journal of Retailing and Consumer Services” (TC=230). When the ranking criterion changed to the h-index, “Journal of Marketing” stood at first rank with a 5 h-index. “Internet Research” and “Journal of Marketing Management” are ranked as second as they have a 4 h-index. Another important observation is that the presence of leading journals in the contributor’s list indicates the interest of high-quality journals on this topic.

4.1.3. Document analysis

4.1.3.1 Global citations

The total no. of citations to an article in the Scopus database is represented by global citations, which are the no. of citations acquired without any filtration. Table 2 presents the top 5 papers in terms of worldwide citations.

Table 2. Most globally cited articles

Title	Year	Authors	Journal	TGC
“Can A Retail Web Site be Social? (L. C. Wang et al., 2007)”	2007	“Liz C. Wang, Julie Baker, Judy A. Wagner, and Kirk Wakefield”	Journal of Marketing	444
“The Influence of Avatars on Online Consumer Shopping Behavior(Holzwarth et al., 2006)”	2006	Martin Holzwarth, Chris Janiszewski, and Marcus M. Neumann	Journal of Marketing	444
“Evaluating Anthropomorphic Product Recommendation Agents: A Social Relationship Perspective to Designing Information Systems”(Qiu & Benbasat, 2009a)	2009	Lingyun Qiu & Izak Benbasat	Journal of Management Information Systems	373
“Influences of online store perception, shopping enjoyment, and shopping involvement on consumer patronage behavior towards an online retailer”(Kim et al., 2007)	2007	“Jihyun Kim, Ann Marie Fiore, Hyun-Hwa Lee”	“Journal of Retailing and Consumer Services”	229
“Avatar-based innovation: Using virtual worlds for real-world innovation(Kohler et al., 2009a)”	2009	Thomas Kohler, Kurt Matzler, Johann Füller	Technovation	204

TGC= Total Global Citations

Table 2 demonstrated that an article titled “Can A Retail Web Site be Social?” authored by (L. C. Wang et al., 2007) and “The Influence of Avatars on Online Consumer Shopping Behavior” authored by (Holzwarth et al., 2006) are the most global cited research documents and have 444 total global citations. They are followed by an article titled “Evaluating Anthropomorphic Product Recommendation Agents: A Social Relationship Perspective to Designing Information Systems” published in 2009 and authored by (Qiu & Benbasat, 2009a). It is also observed by authors that out of the 5 most globally cited articles, 2 research documents were published by the Journal of Marketing.

4.1.3.2 Local citations

Put more simply, local citations are drawn from papers in the review corpus. The top five articles based on local citations are displayed in the table.

Table 3. Most locally cited journals

Title	Year	Authors	Journal	TLC
“The Influence of Avatars on Online Consumer Shopping Behavior”(Holzwarth et al., 2006)	2006	Martin Holzwarth, Chris Janiszewski, and Marcus M. Neumann	Journal of Marketing	36
“Can A Retail Web Site be Social?”(L. C. Wang et al., 2007)	2007	Liz C. Wang, Julie Baker, Judy A. Wagner, and Kirk Wakefield	Journal of Marketing	20
“Can avatars enhance consumer trust and emotion in online retail sales?”(L. C. Wang & Fodness, 2010)	2010	Liz C. Wang and Dale Fodness	“International Journal of Electronic Marketing and Retailing”	7
“The Role of Spokescharacters as Advertisement and Package Cues in Integrated Marketing Communications”(Garretson & Burton, 2005)	2005	Judith A. Garretson and Scot Burton	Journal of Marketing	7
“Avatars as information: Perception of consumers based on their avatars in virtual worlds”(Bélisle & Bodur, 2010)	2010	Jean-François Bélisle, H. OnurBodur	Psychology and Marketing	6

TLC= Total Local Citations

Table 3 highlighted that “The Influence of Avatars on Online Consumer Shopping Behavior” (TLC=36) and “Can A Retail Web Site be Social?” (TLC=20) are not only the top globally cited but also the top locally cited research articles. They are followed by an article titled “Can avatars enhance consumer trust and emotion in online retail sales?” (TLC=7) authored by Liz C. Wang and Dale Fodness and “The Role of Spokescharacters as Advertisement and Package Cues in Integrated Marketing Communications” (TLC=7) authored by Judith A. Garretson and Scot Burton. It is also observed by authors that out of the top 5 locally cited articles; three were from the Journal of Marketing.

4.1.4. Author’s analysis

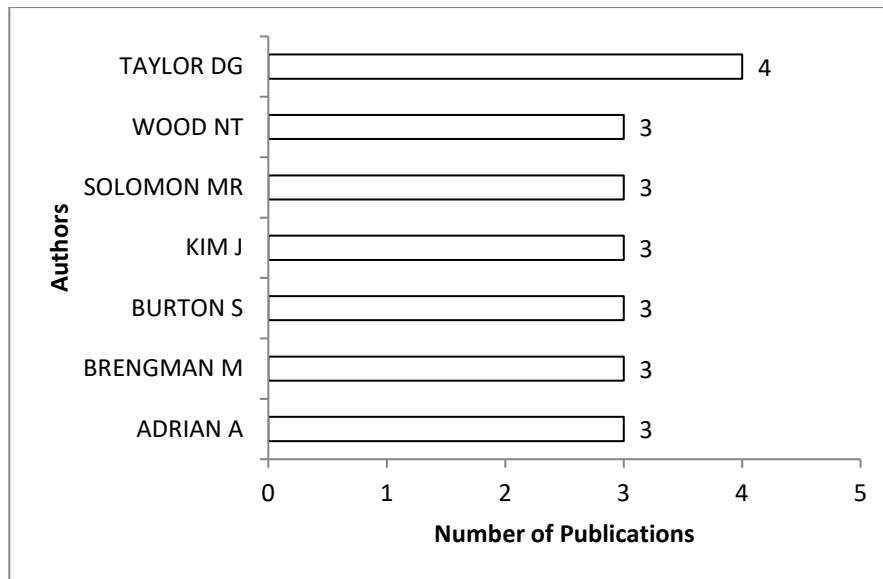


Fig 4: Most prolific authors

Table 4. Most impactful authors

Author	Affiliation	TP	TC	h-index
Wang Lc	University of Dallas	2	463	2
Baker J	Texas Christian University	1	444	1
Holzwarth M	MP Management Consultants GmbH	1	444	1
Janiszewski C	University of Florida	1	444	1
Neumann Mm	University of Mannheim	1	444	1
Wagner Ja	East Carolina University	1	444	1
Wakefield K	Baylor University	1	444	1
Benbasat I	University of British Columbia	1	373	1
Qiu L	Peking University	1	373	1
Kim J	University of New Brunswick in Saint John	3	327	3

TP= Total Publication, TC= Total Citation

Figure 4 illustrates the top prolific authors who contributed at least 3 research documents to the domain of virtual influencers in marketing. It is shown in figure 4 that Taylor DG (Welch College of Business & Technology) is the most contributing author as he contributed four research documents on this topic. Further, table 4 illustrates the most cited authors in this domain. It is highlighted by the table that Wang LC affiliated with the University of Dallas has the highest citations (TC= 463). He is followed by Baker J (Texas Christian University), Holzwarth M (MP Management Consultants GmbH), Janiszewski C (University of Florida), Neumann MM (University of Mannheim), Wagner JA (East Carolina University) and Wakefield K (Baylor University). They all have been cited 444 times. When the ranking criterion was changed to h-index, Kim J (University of New Brunswick in Saint John) ranked as first with a 3 h-index.

4.1.4.1 Author's Collaboration

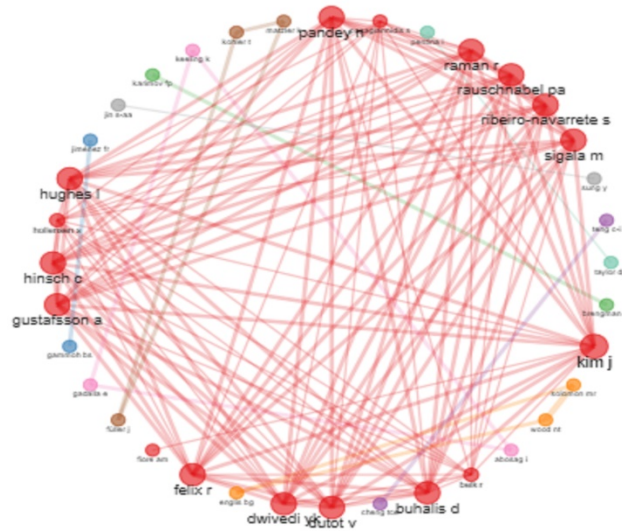


Fig 5: Collaboration among authors

The social structure tab of the Bibliometrix-R programme (Donthu et al., 2021) has a "collaboration network" option that essentially serves as a scientific mapping to analyse prominent author collaborations that have occurred in the literature on virtual influencers in the marketing area. The network of highly collaborative authors is shown in Figure 5. The frequency of articles linked to the author is shown by the size of the circle (node), and the frequency of author collaboration is indicated by the width of the lines that connect two nodes. The Collaboration map highlighted that the biggest cluster (red colour) comprises 17 authors namely, Kim J (University of Georgia), Belk R (York University), Buhalis D (Bournemouth University), Dutot V (IPAG Business School), Dwivedi YK (Swansea University), Felix R (University of Texas Rio Grande Valley), Fiore AM, Gustaffson A (Norwegian Business School), Hinsch C (Grand Valley State University), Hollensen S (University of Southern Denmark), Hughes L (Swansea University), Pandey N “(National Institute of Industrial Engineering)”, Papagiannidis S “(Newcastle University Business School)”, Raman R (Symbiosis International (Deemed University)), Rauschnabel PA (Universität der BundeswehrMünchen), RiebiroNavarrete S (ESIC Business & Marketing School), Sigala M (University of Piraeus).

4.1.5. Institution analysis

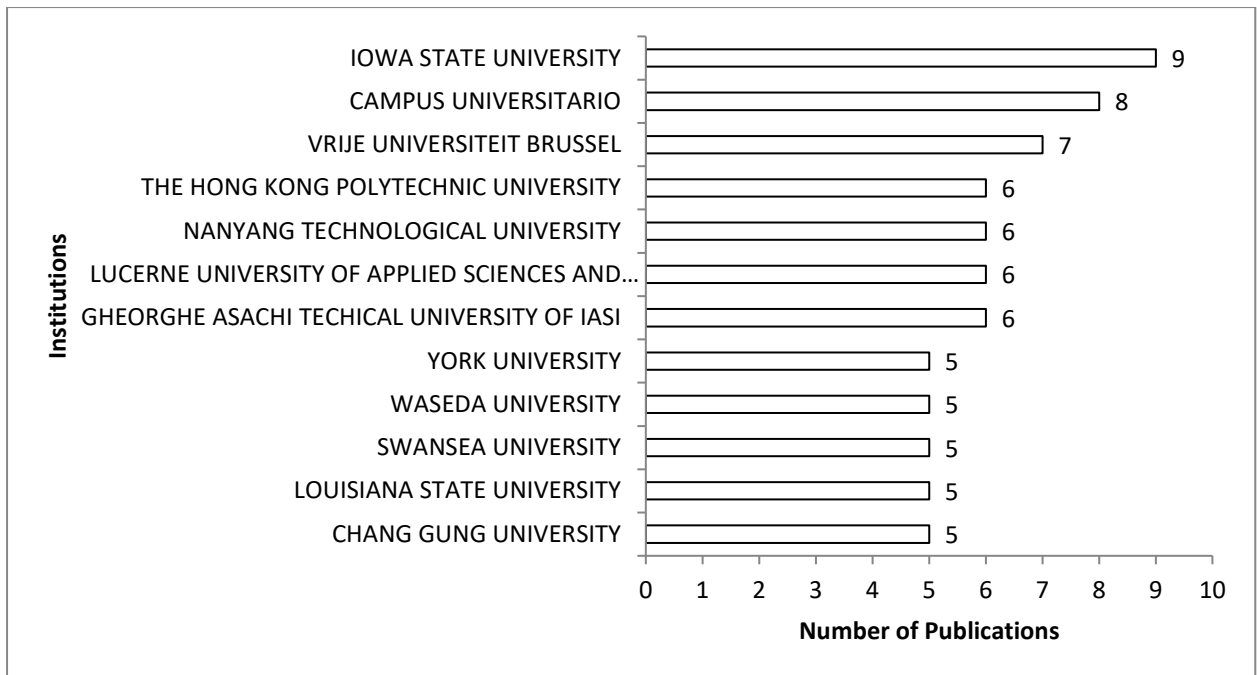


Fig 6: Most prolific institutions

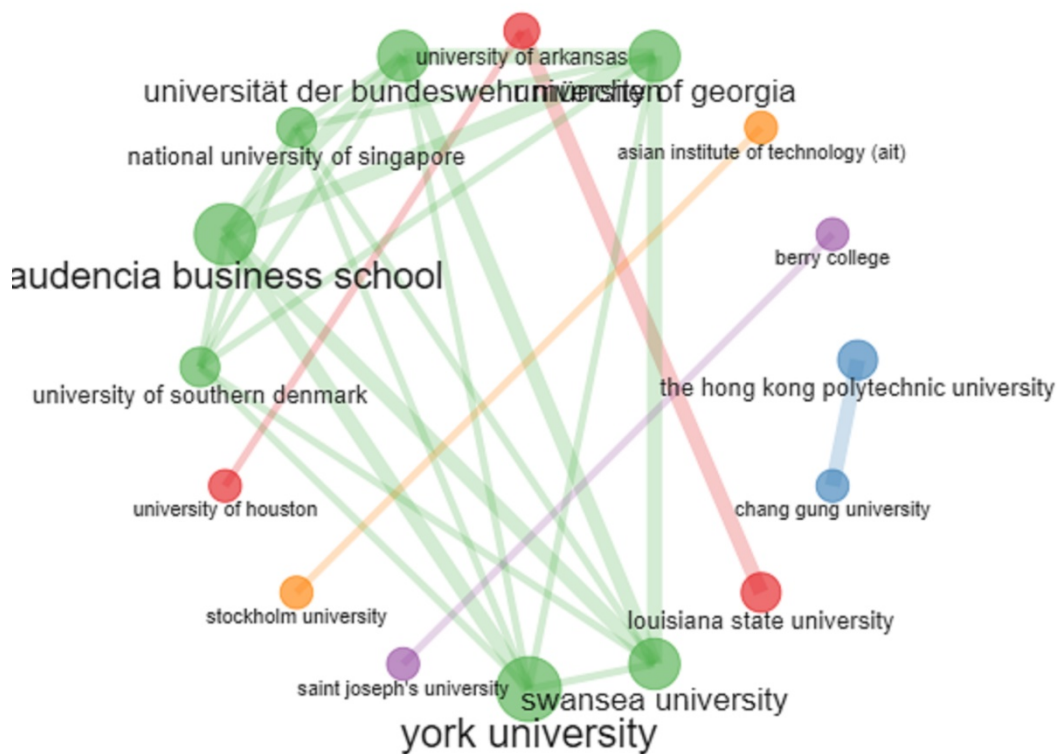


Fig 7: Collaboration among institutions

Figure 6 illustrates the most contributing institutions that contributed to the literature on virtual influencers in the marketing domain. It is demonstrated by figure 6 that IOWA State University is the most contributing institution as it contributes 9 research articles in the review corpus. It is followed by Campus Universitario (total publications=8) and Vrije Universiteit Brussel (total publication= 7). The

collaboration network of institutions in Figure 7 highlighted that the biggest cluster (green colour) comprises 7 affiliations namely, Swansea University, York University, University of Southern Denmark, Audencia Business School, National University of Singapore, Universität Der Bundeswehr München And University of Georgia. The Second major cluster (red colour) comprises of University of Houston, Louisiana State University and University of Arkansas.

4.1.6. Country analysis

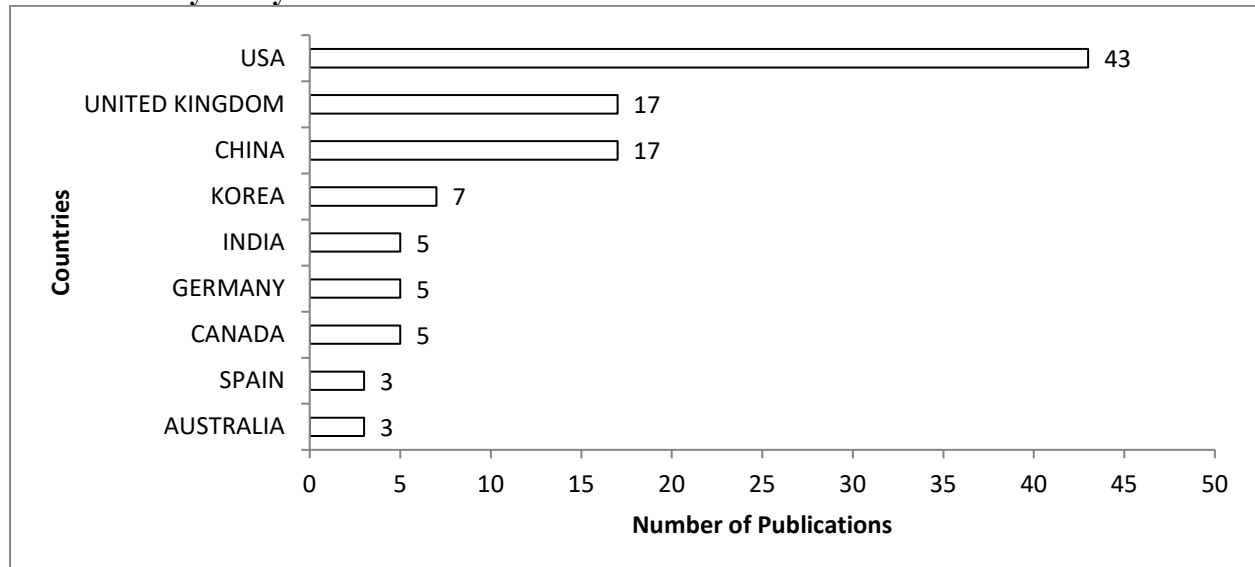


Fig 8: Most contributing countries

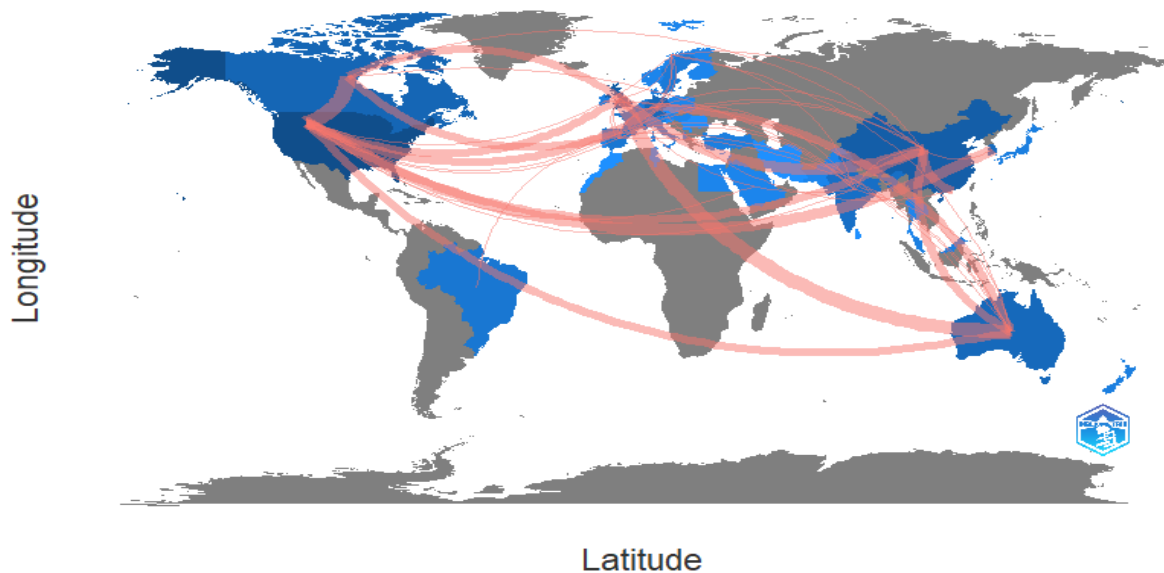


Fig 9: Collaboration among countries

Figure 8 illustrates the top prolific countries that contributed at least three research papers. It is observed by this analysis that the United States is the top contributing country as it contributes 43 research documents on this topic. It is followed by the United Kingdom (TP=17) and China (TP=17). Further, figure 9 demonstrates the collaboration map between the countries. It was prepared by the Bibliometrix software. In Figure 9, various colours represent the contributions of different nations, with dark blue indicating a substantial number of publications and dark grey suggesting a minimal count.

Collaboration between countries is depicted through red lines, and the breadth of these lines reflects the frequency of collaborations. Notably, the United States emerges as the most collaborative country, engaging in the highest no. of collaborations, particularly with Canada, evident in a total of five research documents. The United Kingdom with Australia is another most collaborating pair of countries. Moreover, in terms of intra-country collaboration, the UK is the most collaborating country.

4.2 Science Mapping

4.2.1 Major themes

A network depiction of the links between research articles on a particular subject is called science mapping, and it may be completed with a range of instruments, methods, and software (Di Vaio et al., 2021). One such science mapping technique that is employed in this investigation is thematic analysis. In order to do this, researchers analysed the subjects according to their degree of development (density) and relevance (centrality) using the Bibliometrix-R software's "thematic map" tool. The concept of "betweenness" centrality describes the degree to which other nodes rely on a specific node and, thus, the potential power that node may possess. The word "closeness centrality" refers to the degree of autonomy or effectiveness of access from likely intermediate control. Furthermore, "PageRank" centrality assigns a relevance score to each node based on how many in-links it has in comparison to other pertinent nodes. By employing this method, researchers managed to classify themes into basic, motor, emergent, and niche categories through the amalgamation of centrality and density scores (Cobo et al., 2018). Research subjects with established status are those categorised under basic themes (Kumar et al., 2022). Consequently, the bulk of excellent studies have concentrated exclusively on these subjects, with three well-established thematic clusters under core themes (Table 5) that are centred on virtual influencers in the marketing domain.

Table 5. Keywords in each cluster

Keyword	Betweenness	Closeness	Pagerank
Cluster 1: Social presence of avatars on E-commerce platforms			
social presence	482.7768	0.004065	0.019893
e-commerce	332.1153	0.003534	0.016504
trust	314.3444	0.003831	0.015508
purchase intention	179.6482	0.003534	0.008045
social presence theory	228.6264	0.003953	0.007492
relationship satisfaction	23.77278	0.003049	0.006427
personalization	123.6697	0.003802	0.006424
internet	132.8177	0.004292	0.006362
recommendation agents	24.23111	0.003367	0.005906
attitude	111.3993	0.003846	0.005723
3d virtual world	70.80774	0.003378	0.004863
communication source	0	0.002874	0.004602
3d virtual worlds	121.9681	0.003717	0.00389
Cluster 2: Avatars and Customer behaviour			
avatar	1713.274	0.005128	0.04283
avatars	154.5076	0.003788	0.027169
second life	382.2674	0.003817	0.02359
virtual reality	252.2935	0.003788	0.02243
virtual world	145.6703	0.003817	0.01721
augmented reality	64.8302	0.004132	0.015179

metaverse	24.58175	0.003484	0.014656
marketing	382.8532	0.004274	0.014249
virtual worlds	280.8131	0.003484	0.013382
consumer behaviour	455.6344	0.004348	0.012459
extended reality	0	0.003215	0.009449
advertising	135.4556	0.003846	0.006848
customer relationship management	53.90439	0.003846	0.006355
branding	96.81965	0.003597	0.006091
consumer behaviour	100.4304	0.003448	0.006034
co-creation	65.80533	0.00361	0.005657
flow theory	39.18497	0.003322	0.005145
brand management	4.301587	0.003344	0.004759
web 3.0	5.583654	0.003425	0.00464
real life	66.70359	0.003333	0.004525
marketing communications	27.21443	0.003226	0.004446
consumer research	0	0.002703	0.0038
innovation	35.30972	0.003774	0.003786
customer relationship	0	0.002786	0.003218
clothing	0	0.003077	0.001741
ontologies	0	0.002801	0.001706
Cluster 3: Credibility of Virtual Influencers			
virtual influencers	175.1847	0.003215	0.009973
social media	225.5871	0.003333	0.00694
influencer marketing	54.21723	0.003484	0.006849
CGI	188.5	0.002681	0.006806
source credibility	61.47213	0.003058	0.003735

The basic themes identified are provided in detail below:

Cluster 1: Social presence of avatars on E-commerce platforms

This cluster contains prominent keywords like social presence, e-commerce, trust, purchase intention, social presence theory, relationship satisfaction, personalization, internet, recommendation agents, attitude, 3d virtual world, communication source, 3d virtual worlds. Social Presence and e-commerce keywords have the highest PageRank score; hence the theme is deduced as the social presence of avatars on e-commerce platforms. (L. C. Wang & Fodness, 2010) employed social presence theory to determine whether avatars had a social influence on customers comparable to those seen with actual sales representatives. The findings showed that, in comparison to text-only and low-likeability avatar circumstances, a customer's emotional responses and trust in online retail will be stronger at the website with a highly likeable avatar. According to the findings of (Qiu & Benbasat, 2009b), users' opinions of social presence boost their degree of trust and satisfaction, which in turn enhances their intention to utilise the product recommendation agent as a tool for making decisions. (Kao et al., 2010) applied the Elaboration Likelihood Model (ELM) to analyse how the anthropomorphic interface of recommendation agents on e-commerce platforms affects the social presence and also suggested that social presence boosts customers' emotional and cognitive trust. (De Cicco et al., 2020) compares the effects of visual signals “(avatar presence vs. absence)” and interaction patterns “(social-oriented vs. task-oriented)” on social presence using a between-participants factorial technique. It also looks at how social presence influences millennial perceptions of enjoyment, trust, and attitude.

Cluster 2: Avatars and Customer Behaviour

This cluster comprises keywords like avatar, avatars, second life, virtual reality, virtual world, augmented reality, metaverse, marketing, virtual worlds, consumer behaviour, extended reality, advertising, customer relationship management, branding, consumer behaviour, co-creation, flow theory, brand management, web 3.0, real life, marketing communications, consumer research, innovation, customer relationship, clothing and ontologies. Keywords avatar and avatars have the highest PageRank score and the presence of keywords like consumer behaviour, consumer behaviour, customer relationship management and customer relationship along with related technologies indicates the theme of this cluster as avatars and customer behaviour. (Jin, 2009) investigated the effects of engagement and modality richness on consumer behaviour in 3D virtual marketplaces. (de Amorim et al., 2022) looked into the potential behavioural and emotional changes that an augmented reality shopping assistant may cause in customers as well as how it can influence their emotional responses. (Kohler et al., 2009b) highlighted the active roles that avatars can play throughout the entire co-creation process and illustrated the opportunities for customers and product makers to collaborate on projects together. They gave an example of how companies may use virtual worlds to bring together consumers, producers, and like-minded individuals to create creative things, and then draw in customers to try, consume, and provide feedback on the products they build. (Saad & Choura, 2022) examined and contrasted the performance of two virtual reality technologies: anthropomorphic virtual agents and avatars.

Cluster 3: Credibility of Virtual Influencers

This cluster is smaller as compared to other clusters under the basic themes of the thematic map. This cluster has keywords like virtual influencers, social media, influencer marketing, CGI, and source credibility. Out of these keywords virtual influencers have the highest PageRank score. Keywords depict the theme of this cluster as the credibility of virtual or computer-generated influencers on social media. (Yang et al., 2022) assessed the persuasiveness of Virtual influencers with varying levels of humanness and looked at the relationship between humanness, endorser-CSR fit and source credibility. (Baumgarth et al., 2021) stated that (CGIIs) are obfuscating the distinction between real and artificial influencers, and as a result, many companies have started creatively incorporating them into both their marketing plans and initiatives. (Mrad et al., 2022) in their article titled “Computer-generated influencers: the rise of digital personalities” stated that “although people expect influencers to be genuine, our findings show that even if CGIIs were viewed as having a great life and image, their followers still believed they were real”.

4.2.2 Future research avenues

Virtual Try-On on Customers' Avatar

Customers are greatly impacted by mobile 3D body scanning, which enhances interactive marketing in terms of size and fit in virtual commerce. This enables customers to verify the size and fit before making any kind of purchase. This reduces the annoyance associated with returning products online. In order to gain a personalised, incredibly detailed 3D body avatar and body proportions, as well as interactive augmented reality, virtual reality, and mixed reality capabilities, fashion consumers use mobile devices to scan in the fashion metaverse. This provides comprehensive visual product information within the fashion metaverse, enables sensory engagement, and allows for viewing that is the right size and fit (Idrees et al., 2023). Customers can encounter realistic and compelling features with greater functionality, engagement, convenience, and time efficiency in an online buying environment. (Nam & Kim, 2021) investigated the impact of virtual try-on technologies and their perceived diagnoses on consumers' inclination to purchase men's suits by asking participants to virtually try on customised avatars of various sizes, colours, fits, and patterns of men's suits. The effects of customisation and personalisation affordances in the newest generation of garment VTOs were studied by (Tawira & Ivanov, 2022). Studies under this theme are reflecting the benefits of the customer avatar try-on feature and fewer studies are concerned about challenges. Thus, the following research proposition is formulated for future researchers:

Research proposition: Future researchers might also look at the perceived risks of using a VTO, such as the media irritation caused by the avatar creation process and the privacy concerns brought on by the exposure of a customer's biometric information.

Virtual influencers in the tourism industry

The use of VIs in the tourism industry is still in its infancy. Esther Olofsson, the first VI of the “Netherlands”, was named a brand ambassador for Postillion Hotels in 2020, while “Kizuna AI”, a Japanese virtual YouTuber, served as a tourism ambassador for Japan in 2018. One industry that would be significantly impacted by VI marketing in the near future is tourism, according to (Moustakas et al., 2020). Because the tourism sector relies heavily on information and is influenced by current IM trends, there is a tremendous opportunity to use VI’s involvement in marketing tourism experiences. Thus, the following research proposition is formulated for future researchers:

Research proposition: Future researchers may look into the benefits and challenges of employing virtual influencers in the tourism industry.

5. Discussion

Virtual influencers are digital characters that closely resemble humans but do not actually exist. It has become a topic of interest for marketing scholars. This study advances the existing literature in this domain by providing a comprehensive bibliometric analysis. It shows exponential growth in the no. of publications in this field. Firstly this analysis aims at identifying the top influential contributors (e.g., journals, articles, authors, institutions, countries) on the topic of virtual influencers in the marketing domain. In this review, performance analysis was used to identify the most contributing author, institution, country and source. Results revealed that Taylor DG (Welch College of Business & Technology) is the most contributing author, IOWA “State University” is the top contributing institution, the “United States” is the top contributing country and “Developments in Marketing Science: Proceedings of the Academy of Marketing Science” is the most contributing source. Researchers may gain from locating the most prolific authors and organizations in this domain as potential collaborators and foci for expanding the research in this domain. These authors should be relied upon by the researchers to theorize this field and to surround their theories with exceptional research depth. Citation analysis revealed that Wang LC affiliated with the University of Dallas is the top cited author and the Journal of Marketing is the top cited journal, the article titled “Can A Retail Web Site be Social?” and “The Influence of Avatars on Online Consumer Shopping Behavior” are the most global cited research documents and article titled “The Influence of Avatars on Online Consumer Shopping Behavior” is also the most locally cited article. Influential studies might be considered as the cornerstones of this field of study and could help future researchers. In addition to that this analysis aims at finding the various research (or knowledge) clusters that have emerged on the topic of virtual influencers in the marketing domain and also to provide the recommendations for advancing the knowledge base on the topic of virtual influencers in the marketing domain. For this, thematic mapping, which is a tool of science mapping, was used to identify basic themes in the existing literature and emerging themes to propose future research avenues. Three themes were identified in the existing literature i.e. Social presence of avatars on E-commerce platforms, Avatars and Customer behaviour and Credibility of Virtual influencers. Additionally, future research avenues are also proposed for future researchers. The study acknowledges that its findings may be limited by the accuracy and comprehensiveness of the bibliometric data available on Scopus. Bibliometric analysis has the limitation of focusing on quantitative metrics rather than qualitative content. In this study, studies from Web of Science and Dimensions were not considered. Additionally, using other databases or combining the two bibliometric databases, such as Web of Science and Scopus may provide the depth of research in this area and can overcome the limitations of a single database.

6. Implications

Based on the findings, we offer five theoretical implications. Firstly, our results assist researchers in comprehending the extent and existing boundaries of research in this domain. Consequently, the findings of this study may be utilized by scholars to draw attention to the innovative and understudied topics that will help virtual influencers be more widely adopted in marketing domains. Secondly, researchers may gain from locating the most prolific authors and organizations in this domain as potential collaborators and foci for expanding the research in this domain. Thirdly, it provides researchers with important details on influential studies that might be considered the cornerstones of this field of study. This knowledge will be useful to future scholars. Fourthly, we are able to suggest important research agendas that could be addressed by scholars in the future. Lastly, our analysis may potentially be used as a springboard for encouraging methodological improvements in subsequent research by conducting empirically based studies.

The results of this study may also be of interest to practitioners looking to expand the knowledge base. We provide various useful implications for managers and marketing professionals based on the findings to facilitate the deployment of virtual influencers for marketing. Firstly, the research suggests that professionals, who monitor technological advancements in business houses, may utilize our analysis to comprehend the vast spectrum of applications of virtual influencers in the marketing domain. Secondly, these experts may use the results of prominent publications that are uncovered in this analysis that talk about opportunities and challenges of deployment of virtual influencers. Additionally, the findings imply the need to practically investigate the marketing potential of VIs to serve as effective communicators.

7. Limitations

This research aims at providing a bibliometric overview of the literature on marketing through virtual influencers. For this purpose, the Scopus database was selected to gather bibliometric information on publications. Web of Science, dimensions and PubMed etc. are also reliable sources for data collection. Combining two or more databases may result in slightly different findings. Further, this analysis is limited in scope in terms of subject domain and language. As a result, the conclusion must be interpreted with these limitations in mind.

8. Conclusion

This study provides a comprehensive and systematic review of the research on virtual influencers in marketing, using bibliometric analysis techniques. The results reveal the rapid growth and evolving landscape of this field, with contributions from a diverse range of authors, institutions, and countries. The study identifies three major themes in the existing literature, centered on the social presence of avatars, their impact on customer behavior, and the credibility of virtual influencers. The findings also point to several emerging topics and future research directions, such as the use of virtual try-on technologies, the role of virtual influencers in the tourism industry, and the potential risks and ethical concerns associated with their use.

The implications of this study are twofold. For researchers, the findings provide a roadmap for future investigations, highlighting the key contributors, knowledge clusters, and research gaps in the field. For practitioners, the study offers insights into the opportunities and challenges of using virtual influencers for marketing, and the need for careful consideration of their design, implementation, and evaluation.

However, the study also has some limitations, such as the reliance on a single database (Scopus) and the focus on quantitative bibliometric indicators rather than qualitative content analysis. Future research could address these limitations by incorporating multiple data sources, conducting more in-depth reviews of specific themes or topics, and using mixed-methods approaches to triangulate the findings.

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