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Analysis of the global scientific production on virtual reality as a marketing tool in Scopus

Análisis de la producción científica global sobre realidad virtual como herramienta del marketing en Scopus

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Abstract

The aim of this study was to describe the global scientific production on virtual reality as a marketing tool contained in the SCOPUS database, in order to map its trends and implications. The study is descriptive and cross-sectional under a bibliometric approach. The results respond to the analysis of bibliometric indicators of production, visibility, impact and collaboration. It is concluded that between 1993 and 2021 there is a total of 1046 articles that address the topic of virtual reality as a marketing tool, showing a sustained increase in its scientific production, demonstrating the interest in its study in recent decades.

Keywords: Marketing, Virtual Reality, Scientific Production, Bibliometric.

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Abstract

El objetivo de este estudio fue describir la producción científica global sobre realidad virtual como herramienta del marketing contenida en la base de datos SCOPUS, con la finalidad de elaborar un mapa sobre sus tendencias e implicaciones. El estudio es descriptivo y transversal bajo un enfoque bibliométrico. Los resultados responden al análisis de indicadores bibliométricos de producción, visibilidad, impacto y colaboración. Se concluye que entre 1993 y 2021 existe un total de 1046 artículos que abordan la temática de realidad virtual como una herramienta para el marketing, evidenciando un incremento sostenido de su producción científica, demostrando el interés por su estudio en las últimas décadas.

Palabras Claves: Marketing, Realidad Virtual, Producción Científica, Bibliométrico.

Introduction

Nowadays, consumers are increasingly interacting through the Internet to share their opinions, knowledge and experiences (de Valck et al., 2009). (de Valck et al., 2009).. The adoption of three-dimensional environments such as virtual reality in business practices is increasing and requires a multidisciplinary research approach for its study, recognizing the different scenarios in which they operate, areas such as automotive (Henriques and Winkler, 2021), commerce (Krasonikolakis et al., 2021) and retail (Krasonikolakis et al., 2021). (Krasonikolakis et al., 2021), tourism (Krasonikolakis et al., 2021)tourism (Guttentag, 2010)education (Castellanos-Quiroga and Melo-Castro, 2019; Vías et al., 2018)health sciences (Harichane and Ayestas, 2020; Pérez-Salas, 2008), among others.

Thus, while virtual reality technology continues to evolve (Rigueros Bello, 2017; Vidal et al. (Rigueros Bello, 2017; Vidal et al., 2017)the number and importance of such applications is undoubtedly expanding, thus, the number of publications that address the subject is increasing, making it necessary to map the scientific contributions to determine the evolution of virtual reality and its possible relationship with marketing.

Therefore, the objective of this study was to describe the global scientific production on virtual reality as a marketing tool contained in the SCOPUS database, with the aim of mapping its trends and implications to encourage the execution of future studies.

Materials and methods

The research is qualitative, descriptive and cross-sectional. Bibliometric analysis was used to map the scientific literature on virtual reality and marketing and thus identify the behavior of publications worldwide (Tomás-Górriz and Tomás-Casterá, 2018).. The SCOPUS database was used to identify the papers.

To construct the search equation, the thesaurus "Marketing" and the term "Virtual Reality" were used, in English and Spanish, concatenated with the Boolean terms AND

and OR. As a result, 1,183 documents were found, linking the descriptors to the title, abstract and keywords.

For the selection of documents, only those articles published in completed years were considered without considering a specific SCOPUS thematic area, in addition, they had to be articles, reviews, books, book chapters and those presented at scientific conferences, and no distinction was made between languages.

After applying the inclusion and exclusion criteria, the titles, abstracts and keywords were read to check their relevance and adherence to the subject of the study, and 1,046 manuscripts were selected for bibliometric analysis.

The database was constructed using Microsoft Excel, including the year, type of document, area of knowledge, authors, country and institutions of affiliation to elaborate the graphs and frequency tables, identifying scientific productivity and collaboration. In addition, the VOSviewer tool was used to elaborate the network of co-occurrences of authors and keywords.

Results

The search strategy used retrieved a total of 1,046 documents, where most of the manuscripts are published through academic events (47.04%), followed by original articles (41.59%), book chapters (6.12%), review (5.26%), which were published between 1993 and 2021 (2022 was not considered because it is not a current year), written mostly in English (97.90%) (See Table 1).

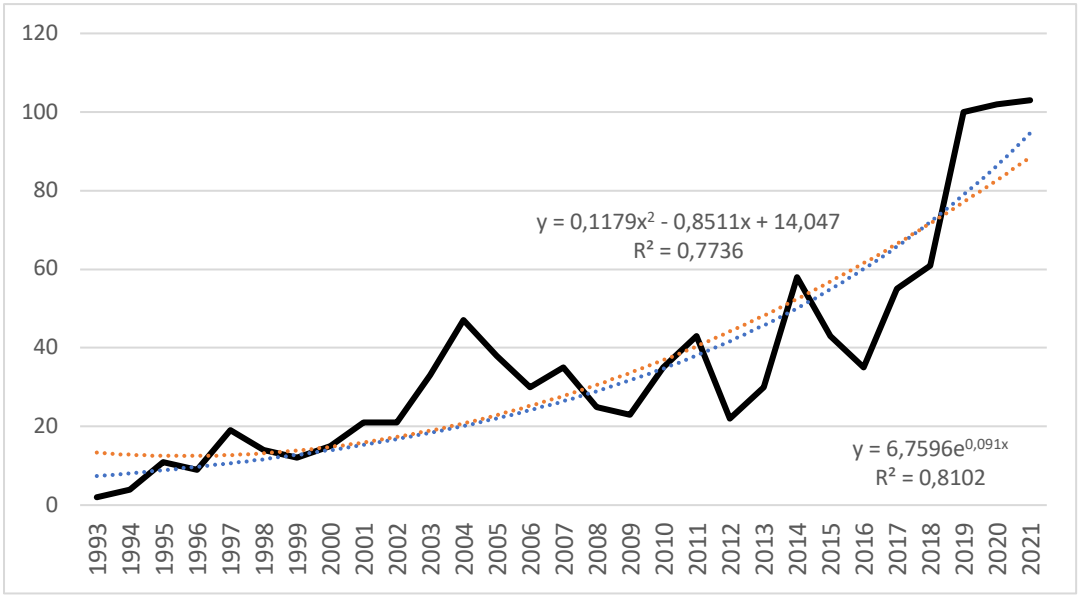
Table 1. *Type of document*

Type	Document	Percentage
Conference Paper	465	44.46%
Article	435	41.59%
Book chapter	64	6.12%
Magazine	55	5.26%
Review of a conference	27	2.58%
Grand total	1046	100.00%

Source: Prepared from SCOPUS findings.

Likewise, Figure 1 shows the scientific production using Price's exponential model (Price, 1963). (Price, 1963)revealing an exponential increase between 1993 and 2021, with a goodness-of-fit index of R^2 =77% according to the second-order polynomial trend line.

Figure 1. Cumulative growth of scientific production, virtual reality and marketing.



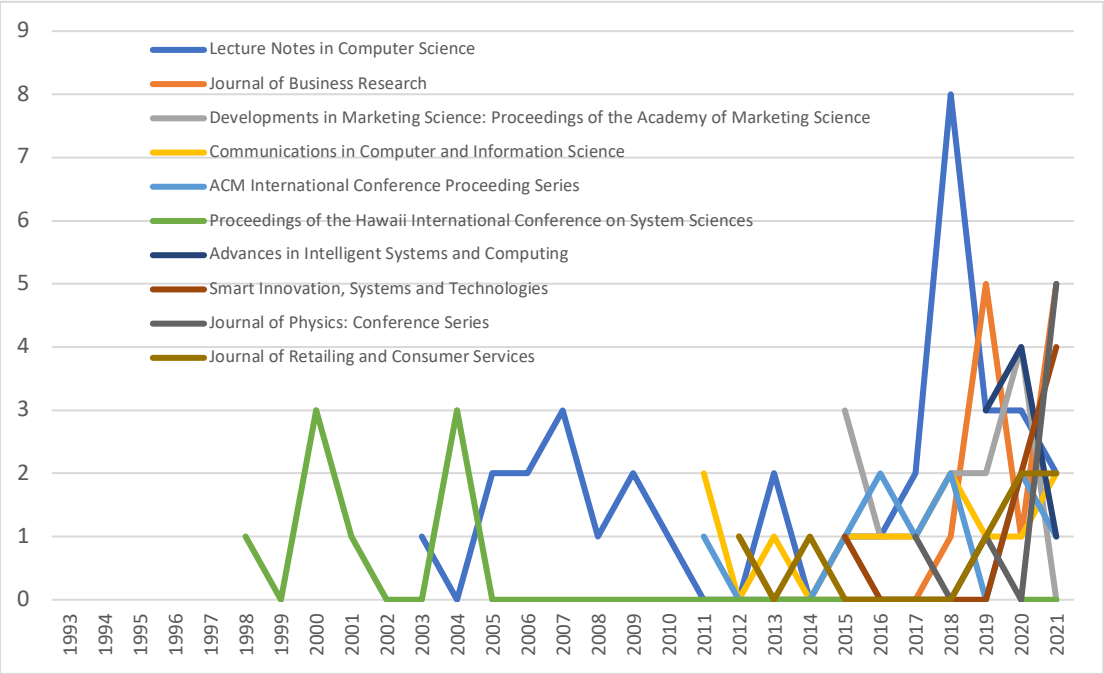
Source: Prepared from SCOPUS findings.

The bibliometric analysis identified a total of 112 sources that publish topics related to virtual reality and marketing. Figure 2 shows the behavior of the 10 main sources. Being, 18.6% cataloged as "Book Series", 6.28% as "Conference Proceedings" and only 5.03% belong to the typology of "Journals".

In the top three, with the highest number of papers, is the book series "Lecture Notes In Computer Science" topping the list with 34 manuscripts, followed by "Developments In Marketing Science Proceedings Of The Academy Of Marketing Science" and "Journal Of Business Research" with 13 papers each.

In addition, the year with the highest number of publications was 2018, with 8 papers published in "Lecture Notes in Computer Science". Four of the bibliographic sources maintain an H index greater than 100. Most of the published articles belong to quartile 1 of the Scimago Journal Rank. The predominant subject matter in SCOPUS belongs to "Computer Science", followed by the area of "Business, Management and Accounting" and the category of "Marketing", which, allows evidencing the possible relationship between the advancement of technology and marketing.

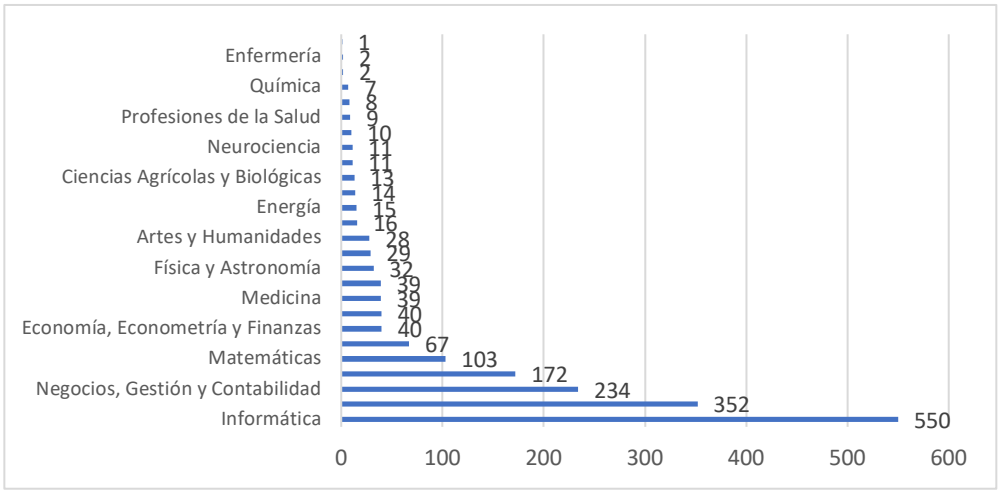
Figure 2. Top 10 scientific journals that address the subject of the study.



Source: Prepared from SCOPUS findings.

Figure 3 shows that there are several publications dealing with virtual reality and Marketing, recognizing its application in different fields of science, revealing that "Computer Science", "Engineering", "Business, Management and Accounting", "Social Sciences" and "Mathematics" concentrate the largest number of published articles, where the sum of their production (76.52%) is above the average of 70 documents, which allows us to assume the possibility of using marketing and virtual reality not only in the field of business, but also provides opportunities for its adoption in the exact, social and health sciences.

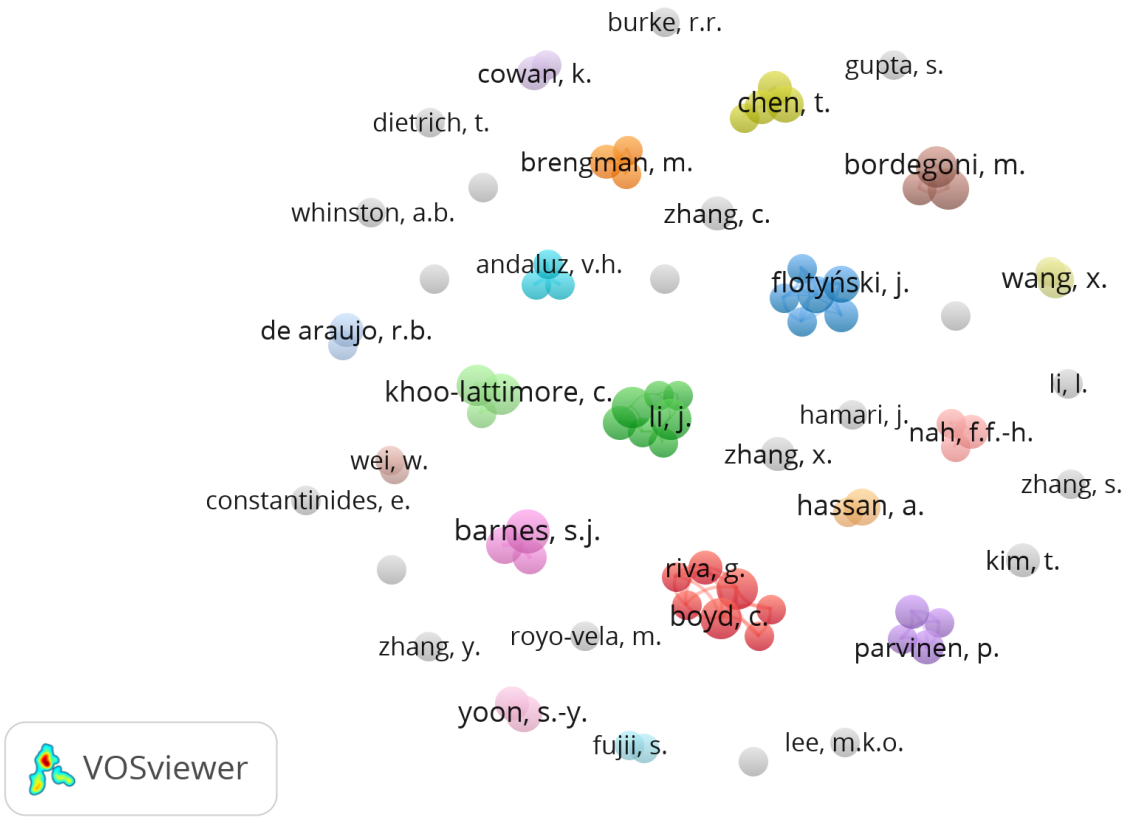
Figure 3. Areas of science that refer to virtual reality as a marketing tool.



Source: Prepared from SCOPUS findings.

On the other hand, through VosViewer, the network of researchers is constructed in order to analyze the co-authorship links, for this, the type of analysis is configured as "Co-Authorship", the authors as the unit of analysis, the counting method will be complete, the minimum number of documents per author will be 3, so that, of 2471 authors only 80 meet the proposed requirements, which are grouped into 38 clusters linked by 74 lines of linkage (See Figure 4).

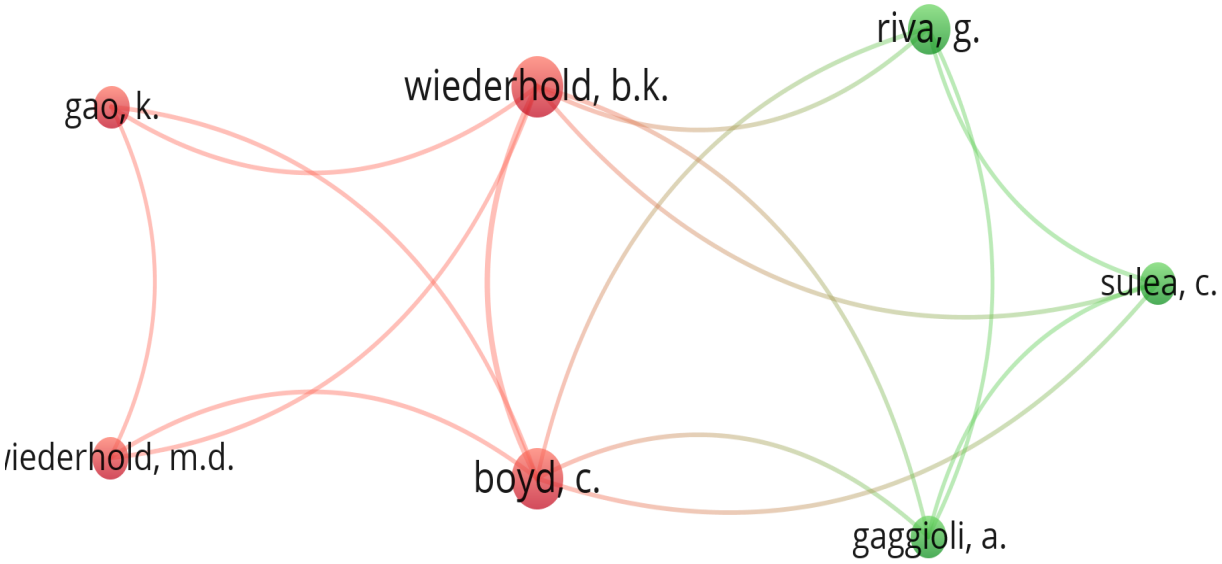
Figure 4. Cluster network of authors involved in research on Virtual Reality and Marketing.



Source: Prepared from co-authorship analysis using VOSviewer.

However, some of the 80 elements of the identified author network are not connected to each other, where, the largest set of items is formed by 7 authors divided into 2 clusters with 15 links. In the first cluster we find K. Gao, M. D. Wiederhold, B. K. Wiederhold, C. Boyd, in the second cluster are G. Riva, A. Gagglioli and C. Sulea (see Figure 5).

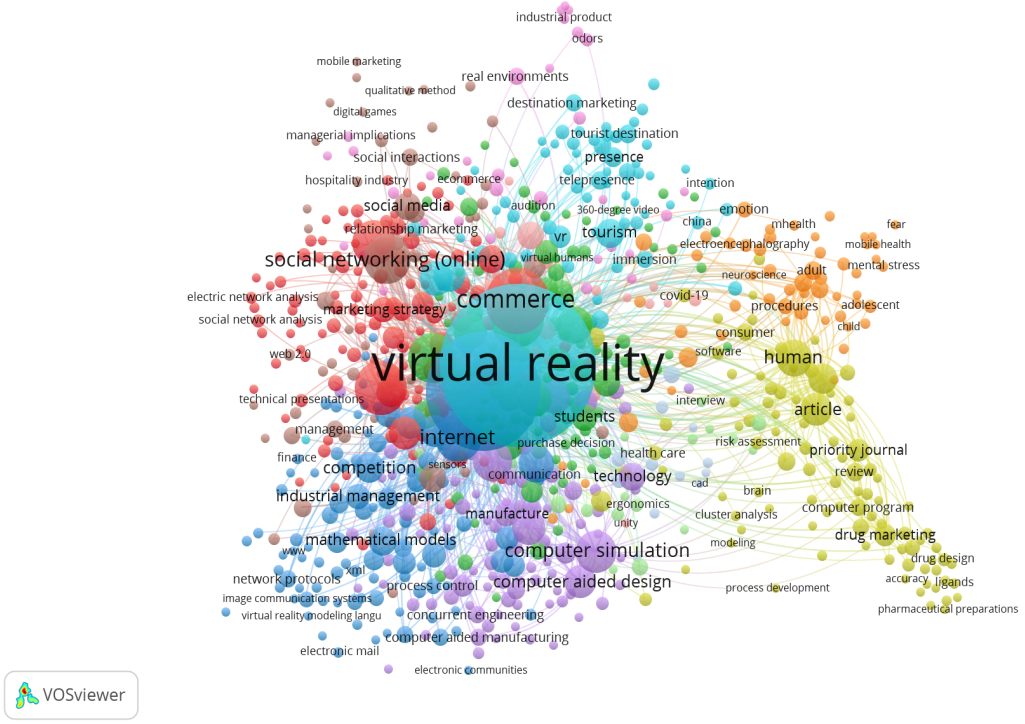
Figure 5. Cluster network of authors with the highest number of links to each other.



Source: Prepared from co-authorship analysis using VOSviewer.

Now, key terms maintain links to each other, differentiating pairs of words that are connected by a link, where the strength of the link is represented by a positive numerical value (van Eck and Waltman, 2010) In this sense, Figure 6 shows the main keywords associated with the subject of study, 12 clusters can be observed with 787 elements represented by colored circles that group the relationships of the concepts to form the network of co-occurrences with 34,815 links of strength. Being, "Virtual Reality" the term with the highest number of occurrences, followed by "Marketing", "Commerce", "Sales", "Electronic commerce" with 887, 474, 147 88 and 99 occurrences respectively.

Figure 6. Network of keyword co-occurrences.



Source: SCOPUS findings analysis using VOSviewer.

When reviewing the scientific literature to determine the different implications that virtual reality has had on marketing, it is noted that, in 1993, marketing was already considered an emerging technology with a high potential for simulation, where the authors Coddington and Chapman (1993) in their study, detail the advantages of using virtual reality for the marketing of new products in industrial environments, which will allow future customers and business partners to test machinery safely in three-dimensional environments. In this regard, Olsen (1993)recognizing the complex competitive environment of today reveals the need to identify the relationship between product concepts, technologies and the ability to convert them into high quality products with competitive prices, under the integration of the organization's resources and marketing systems.

In addition, marketing processes applied within tourism businesses can promote virtual experiences that can function as substitutes for actual visits to locations with peculiar or hazardous features (Guttentag, 2010)where interactive web-based interfaces can present products, destinations in terms of marketing elements, and other marketing elements (Dahan and Hauser, 2010). (Dahan and Hauser, 2002).

Therefore, the use of virtual reality as a tool is growing rapidly (Redlinger and Shao, 2021). (Redlinger and Shao, 2021)In the automotive area, for example, virtual reality as a marketing tool must solve challenges and opportunities such as cost, location for customers, flexibility of interactions, transportation model, depth perception, haptic perception, motion, motion perception/physical collision, color and texture, sound feedback, product interaction/manipulation, visual-spatial, graphic quality,

intuitiveness, cybersecurity and cyber-disease. (Henriques and Winkler, 2021)Also, marketing is a key tool in analyzing the behavior of people who use virtual stores (Krasonikolakis, 2021). (Krasonikolakis et al., 2021).

Conclusions

The findings determine that between 1993 and 2021 there is a total of 1046 articles that address virtual reality as a marketing tool, showing a sustained increase in its scientific production, demonstrating the interest in its study in recent decades.

In addition, a total of 2,471 authors were identified, divided into 84 groups and only 7 of them have published documents in common. Furthermore, there are 112 sources that publish topics related to virtual reality and marketing, revealing that most of the publications do not belong to the category of articles; they are concentrated in documents published through academic/scientific events and are framed in the areas of computer science, engineering, business, administration and accounting.

On the other hand, it is revealed that the adoption of Virtual Reality as a tool that can be used within marketing processes is currently booming, being an essential element for automation in market research.

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