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ORIGINAL

Productivity and Impact of the Scientific Production on Human-Computer Interaction in Scopus from 2018 to 2022

Productividad e impacto de la producción científica sobre Human-Computer Interaction en Scopus de 2018 a 2022

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ABSTRACT

Introduction: bibliometrics plays a crucial role in scientific research by providing valuable insights and guiding future research endeavors.
Objective: to assess the productivity and impact of the worldwide scientific production on HCI in Scopus (2018-2022).
Method: a descriptive observational bibliometric study of scientific production on HCI in Scopus (2018-2022) was conducted. A population of 178,914 documents in the "Human-Computer Interaction" research area was identified using SciVal. All data were extracted from SciVal. IBM SPSS Statistics 27 was used to determine Pearson's correlation coefficients, with statistical significance for $p < 0,05$.
Results: the number of documents (Ndoc) and field-weighted citation impact (FWCI) showed a quantitative increase during the period studied. The highest Ncit corresponded to the oldest documents. Conference papers and articles were the main types of documents. *ACM International Conference Proceeding Series* led the list of sources in both Ndoc and Ncit. The highest FWCI corresponded to *Computers in Human Behavior*. A positive and statistically significant correlation ($r=0,494$, $p<0,001$) was found between the authors' Ndoc and Ncit and between the countries' Ndoc and Ncit ($= 0,967$, $p<0,001$). China was the most productive country while the United States led in terms of Ncit and FWCI. International collaboration was the most common type of collaboration.
Conclusions: the examination of the scientific production revealed a trend characterized by quantitative expansion. This, coupled with impact indicators reliant on citations, substantiates the prominence of the investigated research domain.

Keywords: Human-Computer Interaction; Humans; Computers; Bibliometrics; Scientific Publication Indicators.

RESUMEN

Introducción: la bibliometría desempeña un papel crucial en la investigación científica, ya que proporciona información valiosa y orienta futuras investigaciones.
Objetivo: evaluar la productividad y el impacto de la producción científica mundial sobre HCI en Scopus (2018-2022).
Método: se realizó un estudio bibliométrico observacional descriptivo de la producción científica sobre HCI en Scopus (2018-2022). Se identificó una población de 178 914 documentos en el área de investigación "Human-Computer Interaction" utilizando SciVal. Todos los datos se extrajeron de SciVal. Se utilizó IBM SPSS Statistics 27 para determinar los coeficientes de correlación de Pearson, con significación estadística para $p<0,05$.
Resultados: el número de documentos (Ndoc) y el impacto de citas ponderado por campo (FWCI) mostraron un incremento cuantitativo durante el periodo estudiado. El Ncit más elevado correspondió a los documentos más antiguos. Las ponencias de conferencias y los artículos fueron los principales tipos de documentos. *ACM International Conference Proceeding Series* encabezó la lista de fuentes tanto en Ndoc como en Ncit. El FWCI más alto correspondió a *Computers in Human Behavior*. Se encontró una correlación positiva y estadísticamente significativa ($r=0,494$, $p<0,001$) entre el Ndoc y el Ncit de los autores y entre el Ndoc y el Ncit de los países ($r=0,967$, $p<0,001$). China fue el país más productivo, mientras que Estados Unidos se situó a la cabeza en términos de Ncit y FWCI. La colaboración internacional fue el tipo de colaboración más común.
Conclusiones: el examen de la producción científica reveló una tendencia caracterizada por la expansión cuantitativa. Esto, unido a los indicadores de impacto basados en citas, corrobora la prominencia del ámbito de investigación investigado.

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Palabras clave: Interacción Persona-Ordenador; Humanos; Ordenadores; Bibliometría; Indicadores de Publicación Científica.

INTRODUCCIÓN

Human-Computer Interaction (HCI) is a multidisciplinary field that focuses on understanding and designing the interaction between humans and computers. It has evolved over the years, incorporating approaches, theories, and methods from various disciplines such as anthropology and sociology. HCI techniques range from ethnography to controlled experiments, and its research covers a wide range of topics including wearable devices, virtual reality, and conversational agents.[1,2,3]

HCI has three waves of development, with the third wave emphasizing emotional aspects and user experience. In the healthcare domain, HCI aligns well with current trends such as patient-centered care and shared decision making. However, challenges remain in applying it to health applications. HCI aims to create user-friendly interfaces between people and computers, improving the usability and functionality of technology.[4,5]

Bibliometric studies are important for identifying research gaps, potential future research directions, and trends in scientific publications. They allow researchers to avoid duplication of effort, identify new study prospects, and ensure effective resource utilization. Bibliometric analysis can also provide insights into the state of the art, map research directions, and identify research problems for future works. They are a valuable tool for classifying and quantitatively assessing bibliographic material, such as publications, citations, authors, and institutions. Additionally, bibliometrics can be used to support literature reviews, enhance the efficiency of different types of reviews, and identify influential papers, authors, and institutions on a given topic. Overall, bibliometrics plays a crucial role in scientific research by providing valuable insights and guiding future research endeavors.[6,7,8,9,10]

The objective of this study was to assess the productivity and impact of the worldwide scientific production on HCI in Scopus (2018-2022).

METHOD

A descriptive observational bibliometric study of the scientific production on HCI in Scopus (2018-2022) was conducted.

A population of 178 914 documents in the "Human-Computer Interaction" research area was identified using SciVal.

The following variables were studied: number of documents (Ndoc), year of publication, type of document, number of citations (Ncit), field-weighted citation impact (FWCI), source, author(s), country, type of collaboration, and subject area.

All data were extracted from SciVal. IBM SPSS Statistics 27 was used to determine Pearson's correlation coefficients, with statistical significance for $p<0,05$.

RESULTS

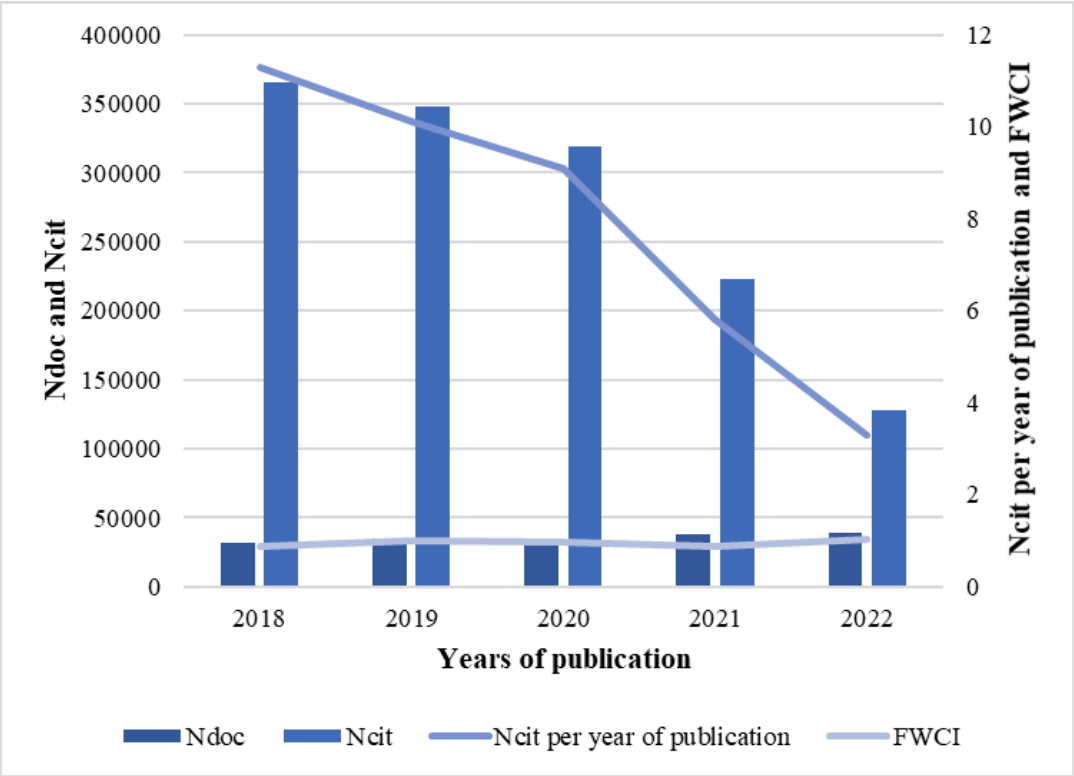


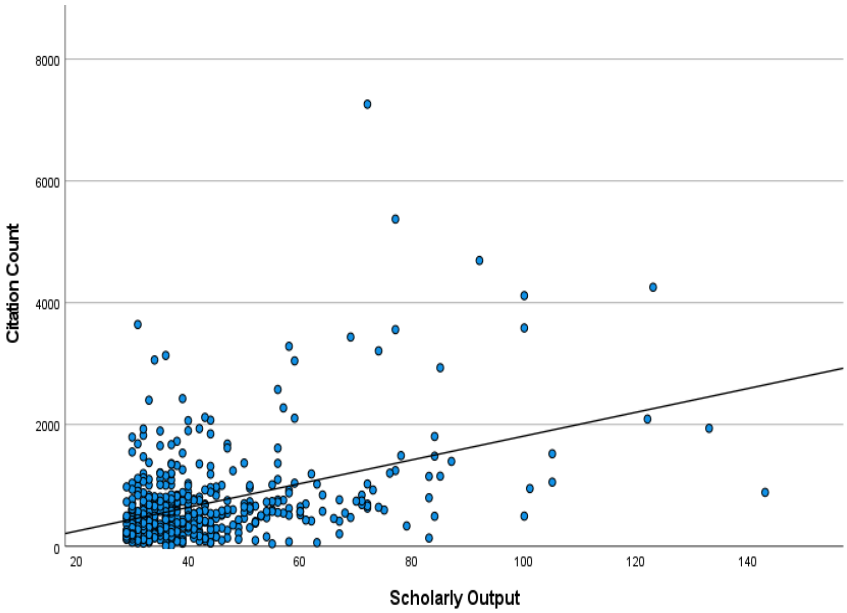
Figure 1. Metrics by year of publication

Table 1. Main types of documents

Type of document	Ndoc	%
Conference paper	125 717	70,3
Article	44 479	24,9
Editorial	3 371	1,9
Conference review	2 422	1,4
Review	1 484	0,8

Table 2. Top 10 sources' Ndoc, Ncit and FWCI

Source	Ndoc	Ncit	FWCI
ACM International Conference Proceeding Series	58 064	127 201	0,36
Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH	4 830	51 585	1,79
IEEE Robotics and Automation Letters	4 743	80 937	1,37
IEEE Transactions on Cybernetics	2 810	109 801	3,18
Conference Proceedings - IEEE International Conference on Systems, Man and Cybernetics	2 493	7 498	0,81
Conference on Human Factors in Computing Systems - Proceedings	2 487	56 373	2,2
IEEE Transactions on Systems, Man, and Cybernetics: Systems	2 254	78 460	2,69
Computers in Human Behavior	2 021	77 323	3,62
Proceedings of the ACM on Human-Computer Interaction	1 810	23 480	1,59
Proceedings of the International Display Workshops	1 592	501	0,1



r=0,425; p<0,001; IC95%: 0,350–0,494.

Figure 2. Correlation between the authors' scholarly output (Ndoc) and citation count (Ncit)

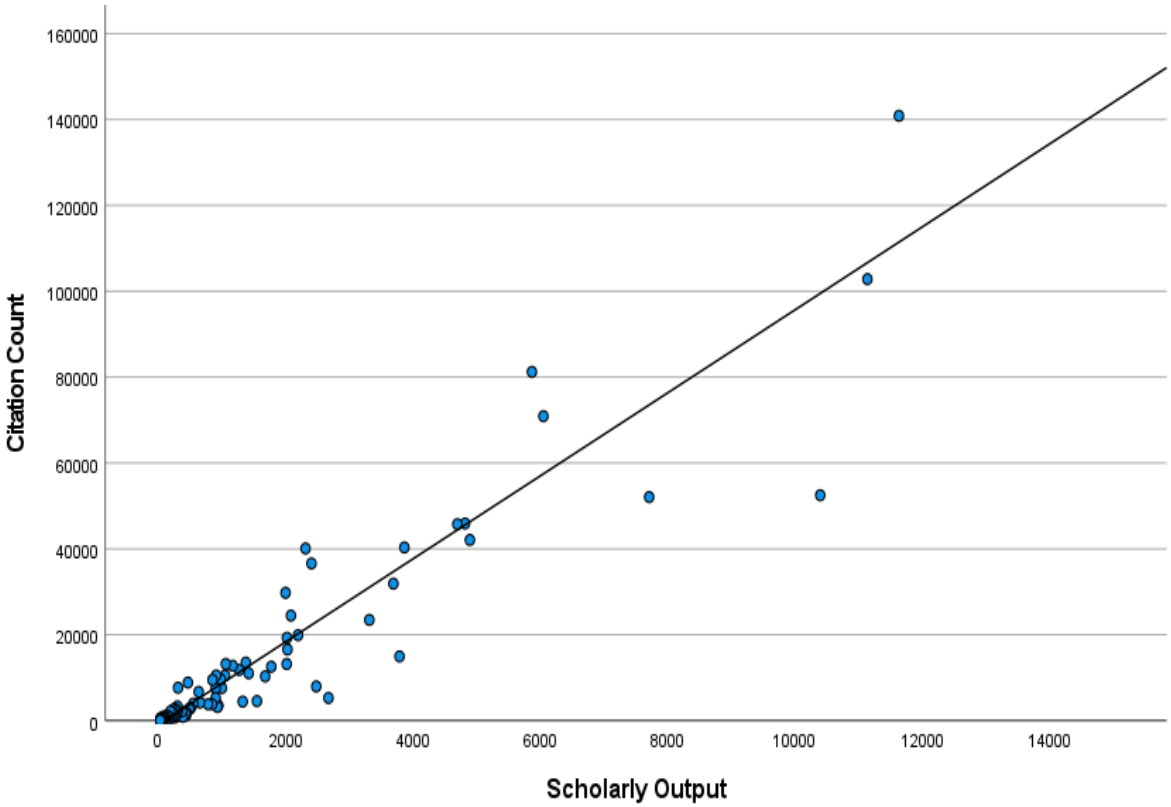
The top 10 most productive countries are shown in table 3.

Table 3. Top 10 countries' Ndoc, Ncit and FWCI

Country	Ndoc	Ncit	FWCI
China	45 155	360 348	0,84
United States	35 318	444 027	1,52
United Kingdom	11 631	140 878	1,45

Germany	11 136	102 837	1,27
Japan	10 395	52 506	0,66
India	77 08	52 078	0,88
Canada	6 047	70 916	1,43
Australia	5 866	81 237	1,48
France	4 892	42 086	1,01
Italy	4 816	45 917	1,18

An almost perfect positive and statistically significant correlation ($r = 0.967$, $p < 0.001$) was found between the countries' Ndoc and Ncit (figure 3).



r=0,967; p<0,001; IC95%: 0,950–0,977

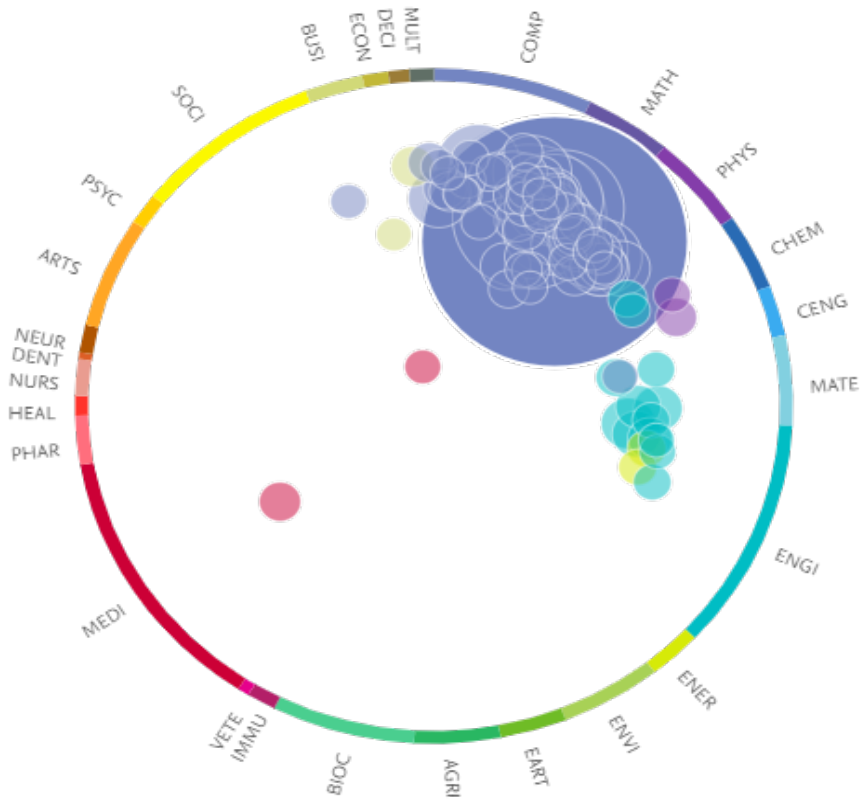
Figure 3. Correlation between the countries' scholarly output (Ndoc) and citation count (Ncit)

International and only national collaboration were the most common types of collaboration. In only 9,1 % of the documents there was no collaboration due to single authorship (table 4).

Table 4. Types of collaboration

Type of collaboration	%	Ndoc	Ncit	Ncit per document	FWCI
International collaboration	38,50	12 151	290 987	23,9	2,1
Only national collaboration	35,80	11 319	153 215	13,5	1,51
Only institutional collaboration	16,60	5 242	59 502	11,4	1,23
No collaboration	9,10	2 859	15 943	5,6	1,03

Most of the scholarly output corresponded to Computer Science, Mathematics, Physics and Astronomy, Chemistry and Chemical Engineering (figure 4).



Source: SciVal.
Figure 4. Topic wheel

DISCUSSION

The increasing scientific production evidenced in this study illustrates the growing worldwide research interest in HCI. This can be attributed to its multidisciplinary nature and its ability to enhance how humans and computers interact. It encompasses a wide range of techniques for understanding, designing, and evaluating interactions, including ethnography, usability testing, and research through design methods. HCI research now extends to various aspects of people's lives, including spirituality, global crises, disabilities, and emerging technologies like wearable devices and virtual reality applications. As new systems and devices continue to be developed, HCI research remains crucial in understanding the impact of technology on individuals, organizations, and society.[1,4,11,12]

As it was found in this study, the most cited articles tend to be older because they have had more time to accumulate citations and establish themselves as foundational works in their respective fields. Older articles have had more opportunities to be referenced by subsequent research and have had a longer time to gain recognition and influence within the scientific community. Additionally, older articles may have addressed fundamental questions or introduced groundbreaking concepts that have shaped the direction of research in their field, leading to their continued citation.

Conference papers refer to scholarly articles initially presented at conferences and subsequently modified for publication in journals. In contrast, regular articles typically showcase original research findings and undergo a more meticulous and rigorous review process.[13] A considerable number of the most productive sources in this study are especially dedicated to the dissemination of this type of document, which explains their predominance.

On the other hand, it is understandable that *Computers in Human Behavior* has been the source with the highest FWCI since it "… is a scholarly journal dedicated to examining the use of computers from a psychological perspective (…) The journal addresses both the use of computers in psychology, psychiatry and related disciplines as well as the psychological impact of computer use on individuals, groups and society. The former category includes articles exploring the use of computers for professional practice, training, research and theory development. The latter category includes articles dealing with the psychological effects of computers on phenomena such as human development, learning, cognition, personality, and social interactions. The journal addresses human interactions with computers, not computers *per se*".[14]

As highlighted by Castillo-González *et al*.,[15] a positive and statistically significant correlation between the authors' Ndoc and Ncit "suggests that authors who publish more papers tend to receive more citations, which may indicate their impact and productivity in the field of research". A similar analysis could be made of the correlation observed with respect to countries.

According to some authors,[16,17] while China produces a larger quantity of research in HCI, the research from the United States is more influential and highly cited. This is consistent with the findings of this study.

International collaboration, the most common type of collaboration in this study, is imperative for the progression of scientific research. This approach enables a smooth exchange of knowledge, resources, and expertise among researchers worldwide, leading

to a substantial improvement in the quantity, quality, and impact of research initiatives. The collaborative efforts extend beyond geographical boundaries, giving rise to interconnected networks crucial for facilitating the production and dissemination of knowledge, as well as the transfer and adoption of scientific concepts, methodologies, and theories. Moreover, active engagement in international collaboration elevates the significance of scientists within their local networks, underscoring their importance and influence in their respective fields. Ultimately, international collaboration functions as a catalyst for innovation, advocates for interdisciplinary research, and reinforces national capabilities in the creation and assimilation of scientific knowledge.[18,19,20]

CONCLUSIONS

The examination of the scientific production revealed a trend characterized by quantitative expansion. This, coupled with impact indicators reliant on citations, substantiates the prominence of the investigated research domain.

FUNDING

None.

CONFLICT OF INTERESTS

None.

AUTHORSHIP CONTRIBUTION

Conceptualization: Javier Gonzalez-Argote, William Castillo-González.
Investigation: Javier Gonzalez-Argote, William Castillo-González.
Formal analysis: Javier Gonzalez-Argote, William Castillo-González.
Data curation: Javier Gonzalez-Argote, William Castillo-González.
Writhing – original draft: Javier Gonzalez-Argote, William Castillo-González.
Writhing – review and edition: Javier Gonzalez-Argote, William Castillo-González.

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