







# Patterns of scientific communication on E-commerce: a bibliometric study in the Scopus database

## Patrones de comunicación científica sobre E-commerce: un estudio bibliométrico en la base de datos Scopus

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### ABSTRACT

Research requires policies that help define the lines of work and that favor the production of knowledge in areas that interest the states. E-commerce is carried out through the Internet as any transaction or exchange of commercial information based on data transmission. This manuscript aims to describe the global, regional and national trends and patterns of scientific production in E-commerce in Scopus. We applied a descriptive bibliometric method (cross-sectional descriptive observation) of the scientific production on E-commerce indexed in the Scopus database from 2011 to 2020. The universe consisted of 20667 documents. A sustained increase in scientific production was evidenced after 2015. The conference and original articles stood out regarding the number of documents. The most cited documents were review articles, books, and original articles. Statistically significant correlations were found between the analyzed productivity and impact indicators. After 2018, more works on e-commerce were published; but more citations of works published before this year were generated. That is, there is an expansion of E-commerce and, in turn, a decrease in the pattern of literature consumption. Most of the articles on e-commerce were contributed by Chinese authors, followed by those from the United States and India.

**Keywords:** Bibliometrics, E-commerce, research trends.

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## INTRODUCCIÓN

The market dynamics have led organizations to focus on customer satisfaction, where information and communication technologies have become fundamental tools for selling goods and services online, known as e-commerce (Sanabria et al.,



2016).

There are significant differences between traditional and online shopping; the most crucial difference is the technological interactive degree (Sánchez and Arroyo, 2016). This component has prompted academic analysis to use technology adoption models to study the behavior of virtual consumers in countries or regions with different focuses or study areas, such as in tourism (Escobar-Rodríguez & Carvajal-Trujillo, 2014; Mohamed Fadel Bukhari et al., 2013); online banking (Vásquez, 2021) or general shopping (Tan et al., 2013).

Although the application context of these studies is typically presented in countries with advanced development in new information technologies, the Internet, and e-commerce (Europe, North America, and Asian countries like China and South Korea), few studies describe this dynamic in developing countries. This lack has hindered advanced theoretical research (Mesías et al., 2011; Sánchez and Arroyo, 2016).

While it is true that the found studies confirm the moderating effect of culture or other social factors, few studies consider the differences between developed countries and developing or third-world countries (Tan et al., 2013; Yoon, 2009).

Research requires policies that help define work lines and favor knowledge production in areas of interest to states (Zahra et al., 2021). Achieving this is crucially dependent on scientific collaboration, involving researchers' interaction to exchange skills, competencies, or resources, which leads to results surpassing those achieved by individual efforts (Katz and Martin, 2016). This collaboration becomes especially important in countries without the resources to produce research addressing their research needs (Ynalvez & Shrum, 2014), particularly in the e-commerce area, where multidisciplinary work is required.

The first step to enhancing global research capacity is better understanding trends in research publications. To date, few analyses objectively document global e-commerce research trends and patterns. The degree of e-commerce adoption development varies worldwide depending on the geographical area (Sánchez and Arroyo, 2016). In this scenario, considering the importance of bibliometrics and its subset, scientometrics, in decision-making, an analysis of scientific publication behavior becomes vitally important (López, 2017; Pal, 2020).

There needs to be more knowledge of scientific production in e-commerce from the perspective of its quantity, evolution, quality, specialization, performance, and scientific collaboration. Likewise, developing research that provides useful bibliometric information could become a tool for decision-making based on the best scientific evidence.

## METHODOLOGY

The research aimed to describe global, regional, and national trends and patterns of scientific production in E-commerce contained in Scopus from a scientometric perspective. For this purpose, a descriptive bibliometric design (Descriptive Observational cross-sectional) was used for the scientific production in E-commerce from 2011-2020. The universe consisted of 20,667 documents from the Scopus database.

### Data Source

Scopus (<http://www.scopus.com/home.url>), created in 2004 by Elsevier B. V., is the largest abstract and citation database of peer-reviewed literature and high-quality web sources, covering about 25,100 serial publication titles from more than 5,000 publishers; 23,452 of which are peer-reviewed journals. Scopus offers the most comprehensive overview of the world's research output in science, technology, medicine, social sciences, arts, and humanities (Elsevier, 2021a).

### Search Strategy

To select the scientific production on E-commerce, the following search strategy was used: TITLE-ABS-KEY(E-commerce) OR TITLE-ABS-KEY(e-commerce) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011)).

**Table 1.**  
Main bibliometric indicators

Variable	Concepto
Number of documents (Ndoc)	Total number of documents
Type of documents	Ranking according to document classification by the Scopus database total number of documents
Percentage of citable documents	Percentage of documents belonging to the typology of Originals, Revisions, and Conference Proceedings, concerning the total number of documents.
Number of Citations (Ncit)	Number of citations received for any document
Citations per document (Cpd)	Number of citations divided by document number
International collaboration (Ncolab)	A percentage of the production published in collaboration is considered an article with international collaboration when authors from different countries participate.
H-index	<p>The H-index is the number of articles (h) that have received at least h citations. It is used to quantify the productivity and scientific impact of aggregates.</p> <p>It is the relative effort that the country dedicates to a specific discipline.</p> <p>The Subject Matter Specialization Rate (TTR) is calculated as follows:</p> $TS = \frac{(NdocCE(country)/NdocTotal(country))}{(NdocCE(world)/Ndoc(world))}$
Thematic Specialization	<p>The Thematic Specialization Index (TSI) is calculated as follows:</p> $TSI = (TSI - 1) / (TSI + 1)$ <p>TSI values (between -1 and 1):            The 0 represented the position of the world.            Values above 0 indicate greater specialization of scientific production concerning the world.            Concerning the world.            Values below 0 indicate lower specialization concerning the world.</p>
Number of documents per million inhabitants	Number of documents between the inhabitants for the aggregates (countries) per million.
Number of documents per Gross Domestic Product per capita of the country	Number of documents between Gross Domestic Product per capita for the aggregates (countries).
Number of documents per country's Ease of Doing Business Index	Number of documents among the Ease of Doing Business Index provided by the World Bank (Banco Mundial, 2021) for aggregates (countries).

Source: Own elaboration.

## Data Processing and Analysis

Documents were downloaded into a database from Scopus in RIS (Research Information Systems) format. They were then processed using various programs (Bibexcel, Excel, and Access) to obtain bibliometric indicators according to aggregates.

*Network Visualization:* The co-occurrence matrices for analyzing social networks among countries and terms were developed with the Bibexcel and VOSviewer 1.6.17 programs (<https://www.vosviewer.com/>) to visualize the relationships within these networks. Field normalization for countries and keywords was carried out, specifically focusing on the latter, selecting terms with an appearance frequency of 700 or more.

The co-occurrence of categories was determined based on the categories to which the resources (journals, conference proceedings) belonged and where the documents were published, following the categories provided by Scopus for journals termed All Science Journal Classification Codes (ASJC) (Elsevier, 2021b). Terms with an appearance frequency of 300 or more were selected.

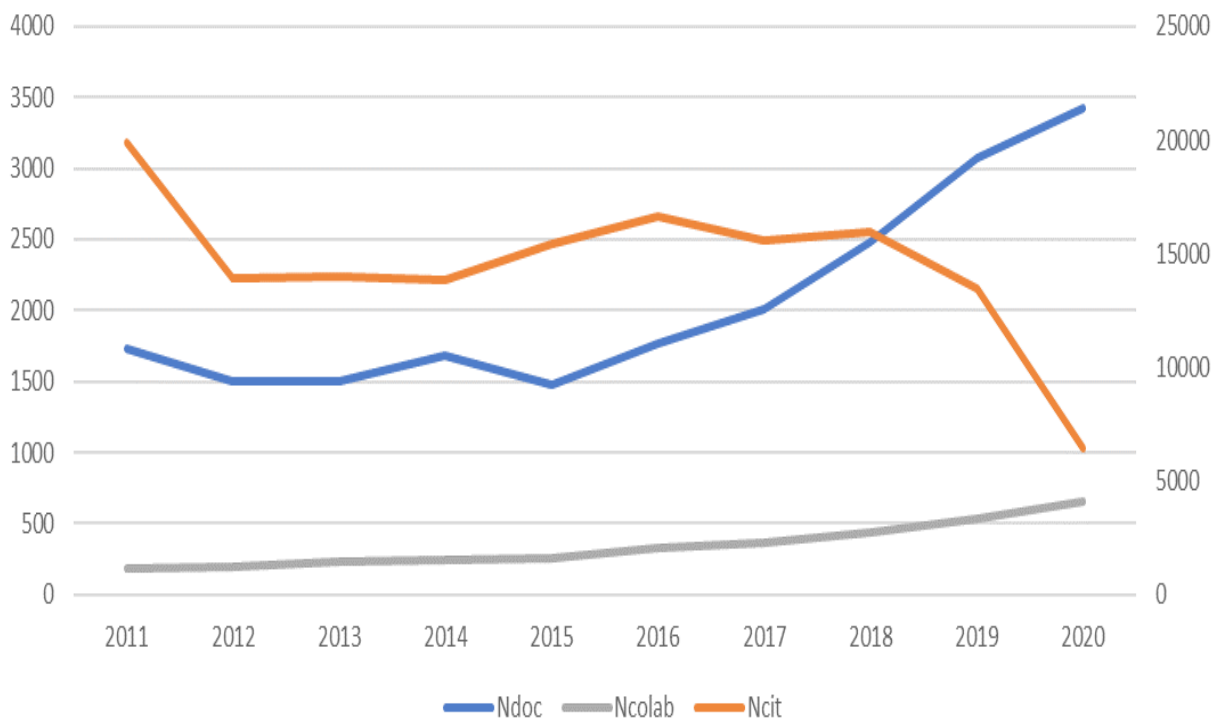
*Statistical Analysis:* Descriptive statistical techniques were used (absolute numbers and percentages) as well as inferential statistics. Differences will be considered significant with p-values less than 0.05. Results for the variables will be processed using Microsoft Excel and the SPSS statistical package.

## RESULTS

The distribution of the 20,667 documents on e-commerce from 2011 to 2020 is shown in Figure 1. The production of literature exhibits a rising trend, which becomes more pronounced after 2015. As for international collaboration, it has been increasing steadily and gradually each year. On the other hand, citations display a seasonality, with a noticeable decline after 2018.

**Figure 1.**

Worldwide distribution of scientific production, number of citations, and international e-commerce collaboration by year.



Source: Own elaboration.

The year-on-year growth rate of global scientific production in e-commerce by year, was positive in most years, except in 2013, 2013, and 2015. Table 2 shows the distribution according to the type of documents, where original conference papers, original articles, and book chapters stand out; the most cited types of documents were review articles, followed by books and original articles.

**Table 2.**

Distribution of worldwide scientific production in e-commerce according to the type of documents.

Tipo de documento	Ndoc	Ncit	Cpd
Original conference article	9962	37288	3,74
Original article	8723	96742	11,09
Book Chapter	838	1865	2,23
Conference review article	482	1	0,00
Review	337	6261	18,58
Book	122	2006	16,44
Editorial	50	186	3,72
Short communication	37	533	14,41
Others	116	301	2,59
<b>Total</b>	<b>20667</b>	<b>145183</b>	<b>7,02</b>

Source: Own elaboration.

Table 3 shows the distribution of countries from 2011 to 2020; China is the most productive country with a share in 30.72% of the documents, followed by the United States (14.55%), India (11.78%), United Kingdom (4.16%).

**Table 3.**

Indicators of productivity, collaboration, leadership, and scientific impact of scientific production in e-commerce by country.

Quartile	Country	%Ndoc	%Ncolab	%Lider	Cpd	H-Index
Q1	China	30,72%	19,7%	94,5%	5	67
	United States	14,55%	42,3%	71,7%	14	84
	India	11,78%	9,7%	95,6%	5	40
	United Kingdom	4,16%	49,7%	65,9%	14	50
	Indonesia	3,49%	9,6%	97,9%	2	16
	Germany	3,29%	34,8%	81,0%	10	42
	Taiwan	3,05%	23,6%	90,0%	12	39
	Malaysia	2,73%	31,4%	84,4%	6	26
	Australia	2,70%	56,0%	62,1%	13	42
	Italy	2,28%	37,9%	79,7%	10	32
	Canada	2,11%	51,7%	64,5%	15	38
	Spain	2,00%	38,7%	77,0%	14	38
	South Korea	1,98%	37,8%	75,9%	14	36
	Hong Kong	1,82%	73,5%	49,3%	18	39
	France	1,67%	51,9%	69,6%	13	34
	Japan	1,63%	30,0%	79,2%	4	19
	Iran	1,38%	21,3%	88,8%	7	24
	Brazil	1,37%	24,3%	91,2%	5	19
	Singapore	1,20%	63,7%	62,1%	13	32
	Netherlands	1,10%	57,9%	64,5%	13	27
	Turkey	1,00%	27,1%	84,5%	7	19
	Poland	1,00%	22,2%	87,4%	6	18
	Saudi Arabia	0,91%	52,9%	66,1%	10	23
	Russian Federation	0,88%	15,5%	90,1%	2	11
	Greece	0,75%	28,8%	84,6%	8	20
	Thailand	0,75%	22,1%	87,7%	5	14
	Portugal	0,70%	37,5%	82,6%	8	18
	South Africa	0,63%	25,4%	83,1%	5	15
	Pakistan	0,60%	50,8%	76,6%	7	15
	Belgium	0,58%	49,2%	70,0%	12	19
Viet Nam	0,58%	50,4%	68,9%	8	16	
Sweden	0,56%	46,6%	67,2%	13	21	
Switzerland	0,56%	54,8%	67,8%	14	20	

Q2	Czech Republic	0,53%	21,1%	84,4%	3	9
	Austria	0,52%	60,7%	62,6%	11	17
	Romania	0,50%	16,3%	92,3%	3	10
	Jordan	0,48%	34,3%	83,8%	7	13
	Israel	0,47%	42,3%	81,4%	13	17
	Finland	0,46%	48,4%	63,2%	10	14
	Morocco	0,45%	10,8%	94,6%	2	7
	United Arab Emirates	0,44%	47,3%	73,6%	9	15
	Bangladesh	0,39%	22,2%	92,6%	4	9
	Egypt	0,39%	46,3%	70,0%	6	10
	Nigeria	0,37%	54,5%	75,3%	7	12
	Ukraine	0,35%	29,2%	87,5%	8	14
	New Zealand	0,33%	57,4%	66,2%	7	12
	Ireland	0,30%	41,0%	70,5%	6	11
	Norway	0,28%	68,4%	57,9%	16	18
	Mexico	0,25%	44,2%	73,1%	6	9
	Slovakia	0,24%	44,0%	82,0%	6	11
	Colombia	0,23%	66,7%	77,1%	4	8
	Macau	0,21%	59,1%	56,8%	12	10
	Denmark	0,20%	54,8%	64,3%	12	13
	Iraq	0,20%	48,8%	70,7%	5	9
	Philippines	0,19%	32,5%	82,5%	3	5
	Chile	0,18%	64,9%	83,8%	15	10
	Tunisia	0,18%	35,1%	94,6%	8	9
	Lithuania	0,17%	31,4%	74,3%	9	9
	Serbia	0,16%	50,0%	79,4%	5	5
	Oman	0,16%	63,6%	57,6%	8	9
	Sri Lanka	0,15%	12,9%	93,5%	2	4
	Qatar	0,15%	77,4%	48,4%	6	7
	Peru	0,14%	24,1%	82,8%	2	5
	Hungary	0,14%	58,6%	79,3%	17	10
	Slovenia	0,13%	48,1%	59,3%	6	8
	Lebanon	0,13%	59,3%	70,4%	6	8
Croatia	0,13%	23,1%	92,3%	2	4	
Q3	Cyprus	0,12%	60,0%	84,0%	11	6
	Kuwait	0,12%	40,0%	72,0%	12	8
	Kazakhstan	0,12%	33,3%	95,8%	1	3
	Algeria	0,11%	50,0%	86,4%	8	5
	Ghana	0,10%	38,1%	81,0%	7	7
	Ecuador	0,10%	45,0%	80,0%	4	3
	Bulgaria	0,09%	15,8%	84,2%	2	3
	Latvia	0,09%	16,7%	88,9%	2	3
	Argentina	0,08%	70,6%	58,8%	7	5
	Bahrain	0,08%	31,3%	87,5%	5	5
	Luxembourg	0,06%	84,6%	53,8%	8	5
	Uzbekistan	0,05%	36,4%	72,7%	8	3
	Estonia	0,05%	60,0%	90,0%	1	3
	North Macedonia	0,04%	33,3%	77,8%	9	2
	Zimbabwe	0,04%	33,3%	66,7%	1	2
	Palestine	0,04%	75,0%	75,0%	6	4
	Costa Rica	0,04%	12,5%	100,0%	6	3
	Myanmar	0,04%	25,0%	87,5%	8	3
	Georgia	0,03%	57,1%	42,9%	12	3
	Cuba	0,03%	85,7%	71,4%	7	2
	Bosnia and Herzegovina	0,03%	57,1%	71,4%	3	2
	Sudan	0,03%	50,0%	83,3%	0	1
	Trinidad and Tobago	0,03%	66,7%	33,3%	11	4
Ethiopia	0,03%	50,0%	66,7%	1	1	

Q4	Kenya	0,02%	100,0%	20,0%	35	4
	Botswana	0,02%	60,0%	60,0%	4	2
	Albania	0,02%	40,0%	80,0%	1	2
	Jamaica	0,02%	50,0%	75,0%	1	2
	Fiji	0,02%	25,0%	100,0%	5	2
	Tanzania	0,02%	50,0%	100,0%	4	3
	Belarus	0,02%	100,0%	25,0%	3	2
	Nepal	0,01%	33,3%	100,0%	19	2
	Azerbaijan	0,01%	0,0%	100,0%	0	1
	Cameroon	0,01%	100,0%	100,0%	1	1
	Yemen	0,01%	100,0%	33,3%	30	2
	Brunei Darussalam	0,01%	66,7%	66,7%	0	0
	Libya	0,01%	33,3%	66,7%	1	1
	Iceland	0,01%	100,0%	66,7%	18	2
	Guatemala	0,01%	100,0%	33,3%	21	3
	Kyrgyzstan	0,01%	33,3%	66,7%	0	1
	Papua New Guinea	0,01%	100,0%	66,7%	22	3
	Mongolia	0,01%	0,0%	100,0%	1	1
	Uganda	0,01%	50,0%	50,0%	2	1
	Namibia	0,01%	0,0%	100,0%	0	0
	Uruguay	0,01%	50,0%	50,0%	2	1
	Swaziland	0,01%	50,0%	50,0%	7	2
	Malta	0,01%	50,0%	50,0%	5	1
	Zambia	0,01%	100,0%	50,0%	11	2
	Mauritius	0,01%	50,0%	100,0%	18	1
	Montenegro	0,01%	50,0%	100,0%	1	1
	Monaco	0,01%	50,0%	50,0%	7	2
	Liechtenstein	0,01%	100,0%	0,0%	77	2
	Bhutan	0,00%	0,0%	100,0%	1	1
	Venezuela	0,00%	100,0%	0,0%	19	1
	Armenia	0,00%	100,0%	0,0%	3	1
	Dominican Republic	0,00%	100,0%	0,0%	1	1
Moldova	0,00%	100,0%	0,0%	0	0	
Rwanda	0,00%	100,0%	0,0%	12	1	
Guam	0,00%	100,0%	100,0%	0	0	
Maldives	0,00%	0,0%	100,0%	2	1	
Senegal	0,00%	0,0%	100,0%	3	1	
Cambodia	0,00%	100,0%	100,0%	1	1	
Togo	0,00%	100,0%	100,0%	1	1	
Mozambique	0,00%	100,0%	0,0%	2	1	
Bolivia	0,00%	100,0%	0,0%	9	1	
Syrian Arab Republic	0,00%	100,0%	100,0%	0	0	
Guinea	0,00%	100,0%	0,0%	2	1	
Puerto Rico	0,00%	100,0%	100,0%	10	1	

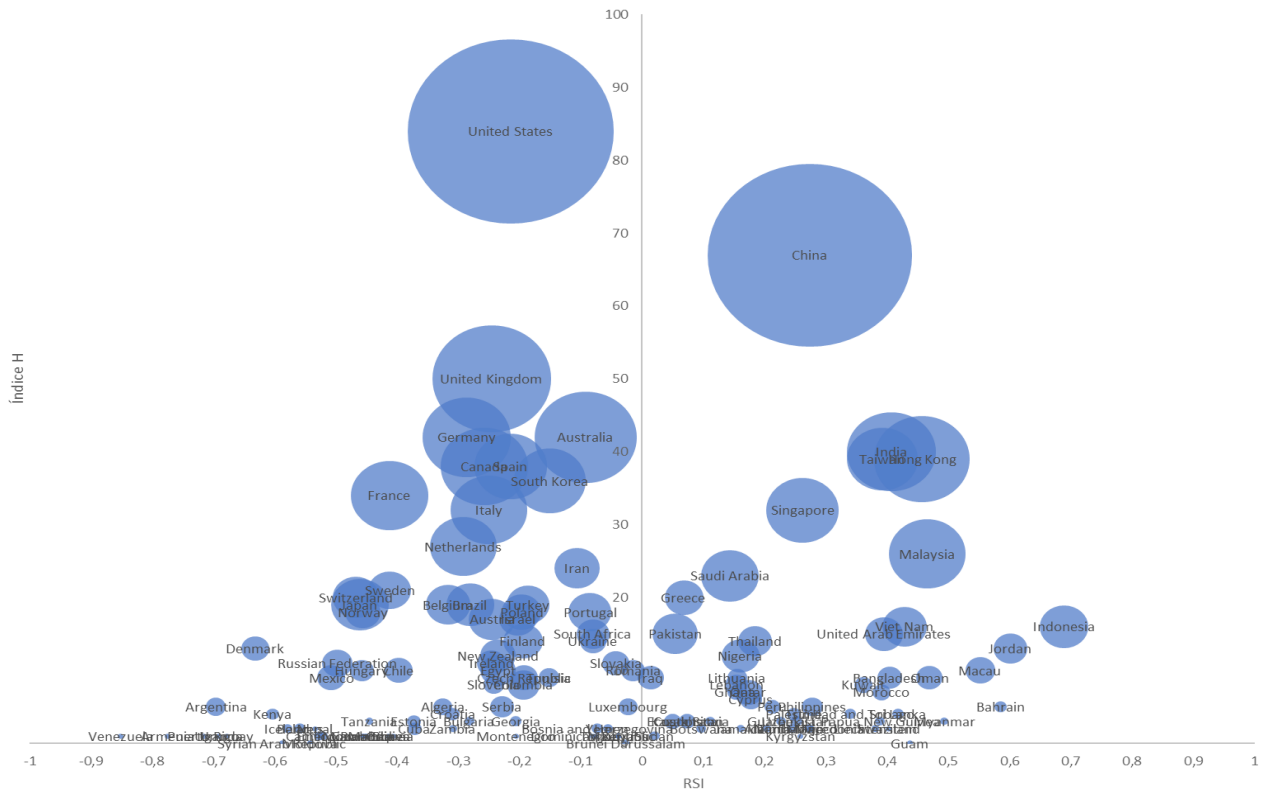
Source: Own elaboration.

Figure 2 shows the thematic specialization and the H Index, where the size of the kernel is the number of documents in the country. Countries further up the axis have a greater impact, and those to the right have a greater subject specialization. In contrast, those further to the left of the axis have subject specialization below the world average.

Table 4 shows the correlation between productivity indicators (Ndoc, Ncolab, Lider) and impact (Ncit, H Index), where a statistically significant correlation was found in all cases with a p-value of less than 0.0001.

When analyzing the matrix of co-occurrence of terms (Figure 3) and thematic categories (Figure 4) using the bibliometric maps, those with co-occurrence for terms 100 or more times and for categories 2 or more times were considered.

**Figure 2.**  
Thematic specialization and H-index of scientific production in e-commerce by country.



Source: Own elaboration.

**Table 4.**

Pearson correlation coefficient between indicators of productivity, collaboration, leadership, and scientific impact of scientific production in e-commerce by country.

Variables	Ndoc	Ncolab	Ncit	Lider	Índice_H
<b>Ndoc</b>	-				
<b>Ncolab</b>	0,9020 P<0,0001	-			
<b>Ncit</b>	0,8795 P<0,0001	0,9862 P<0,0001	-		
<b>Lider</b>	0,9943 P<0,0001	0,8525 P<0,0001	0,8252 P<0,0001	-	
<b>Índice_H</b>	0,7090 P<0,0001	0,8425 P<0,0001	0,8394 P<0,0001	0,6531 P<0,0001	-

Source: Own elaboration.

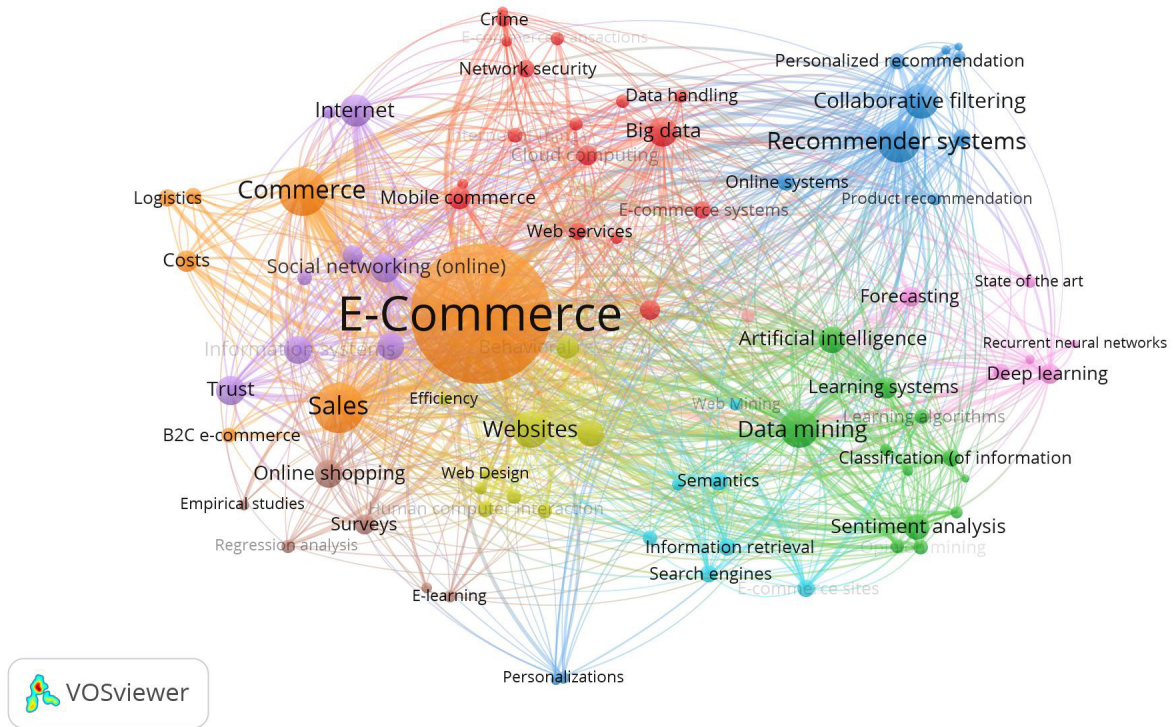
The sustained growth in scientific production over time reflects the need and interest in research in this area of knowledge. Today, the research and development results carried out by universities and other organizations are applied to the industry in various ways. Research and development increase consumer confidence, the ultimate end-user of the product or process (Sibiya, 2011).

There is a need for agile, cross-sector partnerships to research, test, and implement analyses in a “perpetual beta testing” model and have an honest conversation with the public about how to use their data best to meet these needs (Curtis, 2016). By focusing on the sustained growth of scientific production since 2016, and noting that only 3 of the prior periods experienced a negative growth rate, it can be inferred that, from an academic perspective, research and knowledge transfer over the past decade indicate that globalization and information technologies are advancing



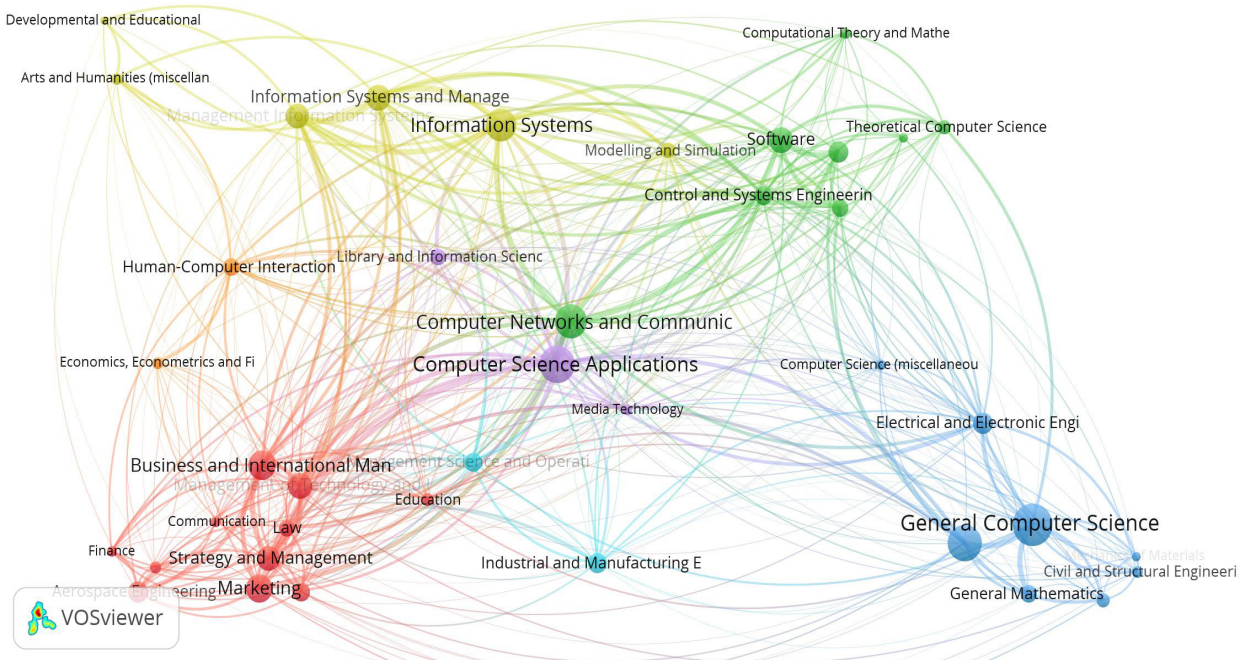
rapidly. E-commerce has become an innovative means to enhance the scientific performance of organizations (Cui et al., 2017; Shiau & Dwivedi, 2013).

**Figure 3.** Network of co-occurrence of terms of scientific production in e-commerce.



Source: Own elaboration.

**Figure 4.** Category network of scientific production in e-commerce by country.



Source: Own elaboration.

Although journals published more articles in the earlier years, those specific to e-commerce began publishing more after 2007. This may be because information science journals were more consolidated and were better positioned to capture the trend. The citation count, however, shows a different trend. This trend could have been more perceptible in the initial years. However, the number of works published in information science journals surpassed those in e-commerce after 2001, even as both experienced significant growth spurts. However, around 2007, the number of articles published in e-commerce journals eclipsed those in information science journals (Hsu & Chiang, 2017).

### **Study Limitations**

This research has some limitations. Firstly, the analysis was based on publications retrieved from the Scopus database using "e-commerce" as the main keyword. Therefore, the analysis should have considered more articles related to e-commerce that did not include this keyword. This is a significant limitation as an article about internet marketing that uses the e-business model is generally seen as highly related to e-commerce but might have yet to be retrieved using our search criteria. On the other hand, the results might differ if resources from other bibliographic databases were included in the study. Nevertheless, the findings presented in this study provide valuable insights for those interested in the general profile of high-quality e-commerce research.

## **CONCLUSIONS**

This study employed bibliometric analysis to explore the research profile on e-commerce in resources indexed in Scopus. Likewise, the documents were analyzed, observing a mostly positive growth rate, more pronounced in the last 5 years of study.

Post-2018, more e-commerce papers were published, but more citations were generated from works published before this year. This implies expanding knowledge in the study area and, concurrently, decreasing the literature consumption pattern. However, the fact that the documents are more recent means they have had fewer opportunities to be cited.

The majority of the articles on e-commerce were contributed by Chinese authors, followed by those from the United States and India. This may reflect the popularity of e-commerce practices in the United States and China.

The analysis showed that e-commerce research is significantly developing globally, with large research hubs concentrating on almost all scientific production. This could be because these countries have the highest implementation of this commercial channel. Current studies are being carried out focused on emerging economies, as it is in these countries where SMEs constitute a large proportion of the business sector.

The marked polarization in productivity, collaboration, and impact indicators suggests a need to delve deeper into the interpretations of network structures and associated relational indicators. Moreover, it's crucial to advance the analysis of the value and implications that the results of this study might have for the management of scientific and technological activities of the countries analyzed on the subject, with a more interdisciplinary and comprehensive perspective.

From a qualitative perspective, it was observed that the main research fields on e-commerce were electronic markets, consumer behavior, social theory, and economic analysis. These focus on macro variables in the context of e-commerce adoption. The researchers' interest in these aspects of e-commerce adoption study may be explained by the fact that research has been centered and specialized in particular factors determining its use. It is oriented towards the business sector and consumers' perception and satisfaction with the variables involved in its adoption. These variables are perceived trust, attitude towards use, perceived ease of use, perceived utility, security, and innovative nature.

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