

Review

Intellectual Capital: A Review and Bibliometric Analysis

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Abstract: Intellectual capital is managed by competencies and the development of information and communication technologies, which have seen high growth and impact in higher education institutions related to scientific publications. The main objective of this study was to provide a summary of the general review of studies related to intellectual capital around the world. Methodology: the Bibliometric analysis was carried out using the Bibliometrix library and BiblioShiny platform of the RStudio® software through the data obtained from the Scopus database. Findings: in total, 389 documents in the Scopus database used “capital”, “intellectual”, “research” and “institutions” as keywords with a growth rate of 2.34% every year from 1947 to 2021. The publications were written by around 866 authors, mainly from the USA, the UK, and Spain. Original value: the data obtained show that intellectual capital has been important and relevant in the scientific publications of the last six years, which were related by the number of authors by institutions.

Keywords: bibliometric; human capital; universities; trends; higher education



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1. Introduction and Overview

The study of intellectual capital at a global level appeared from the 1960s, with the rise of the knowledge economy, the process of management by competencies, and the development of information and communication technologies (ICTs), to generate competitive advantage in economies that prioritize knowledge and learning in organizations in different sectors. The evolution of the study on intellectual capital has been established with the conviction of valuing intangible assets in organizations. In 1963, the term “human asset accounting” was used to include people in the financial statements of organizations, recognizing the potential value for companies and fixed assets [1]. Later, in 1967, the term intellectual capital appeared for the first time, established by the economist J.K. Galbraith, who considered it as the result of an “intellectual action” rather than just knowledge, creating value as another asset in the traditional economy [2]. In the 1970s, the term “human asset” appeared to refer to people who collaborate in organizations, proposed by Flamholtz in different studies [3].

The historical development on the study of intellectual capital was consolidated during the 1990s and later. Nonaka and Takeuchi [4] defined it as the “Ability of a company to generate new knowledge, disseminate it among the organization members and materialize it in products, services, and systems”. Similarly, intellectual capital is made up of three dimensions. The first is human capital, which is related to employing skills. The second is structural capital, which is related to the internal component. The third is relational capital, which is constituted by the external component of the organizations [5].

On the other hand, in the mid-1990s, four stages were established on intellectual capital. Considering the first stage, intellectual capital and its importance in creating competitive advantages in companies is created. There is also interest in the measurement of intellectual capital through some attempts at the creation of norms and standards for empirical investigations [6,7]. The second stage arose at the end of the 1990s, where efforts were

developed to recognize intellectual capital as an academic discipline. Different models were developed for their measurement to increase the competitiveness of organizations [8,9]. The third stage was presented in 2004, with the interest of measuring the commercial implications of intellectual capital in practice through empirical work to determine its measurement and to compare theory with practice [8,10,11]. Finally, the fourth stage is a complement to the previous stage, focusing on the study of the future of intellectual capital, in which it is intended to go beyond CI reports by expanding to broader open and collaborative ecosystems to understand ethical, social, and environmental impacts according to an ecosystem approach to IC [12,13]. In this same period, the concept of structural capital, and its distinction from human capital, appeared, where structural capital is considered a product of human capital and is mainly made up of client capital, innovation capital, and intellectual property of the human resources linked to the organization [8,14,15].

The emergence of intellectual capital is based mainly on the theory of resources and capacities of organizations. According to Reed et al. [16], the intellectual capital approach allows defining the intangible resources and capacities that organizations must possess to obtain a competitive advantage. It identifies three dimensions of intellectual capital, thus providing greater precision. For Reed et al. [16] and Foss et al. [17], the theory based on the intellectual capital of organizations represents a specific aspect of the more general theory of resources and capabilities, considering three resources that have been theoretically linked to competitive advantage through the knowledge created and accumulated in the three components of the capital of the company: in its people (human capital), its social relations (social capital), and its systems and processes (organizational capital) [18].

Considering the evolution throughout history on the importance of this issue in organizations, intellectual capital is considered the organizational knowledge and organizational processes necessary for the competitiveness of companies. Therefore, both should be pursued jointly. In this way, Ratogi [19] argues that intellectual capital (IC) and knowledge management (KM) represent organizational activities related to knowledge from stock to knowledge management. Knowledge management and intellectual capital are naturally connected in a bidirectional way, where IC represents the stock of knowledge in terms of human capital, structural capital, and relational capital [7,20].

1.1. Studies about Intellectual Capital around the World

Several studies have been developed in different organizations and sectors of the world economy. Spanish companies [21], technology and ICT companies [22], and Pymes [23] have found that IC positively influences human resource management practices based on knowledge and performance in innovation, partially favoring structural and relational capital through human capital. Likewise, the IC components referring to client capital, structural capital, social capital, technological capital, and spiritual capital are positively related to the organizational performance of higher education institutions.

Intellectual capital in higher education institutions (HEIs), according to Leitner et al. [24] and Sanchez et al. [25], is called the set of intangible assets that allow educational institutions to transform material, financial, and human resources into a system capable of creating value for their clients. Therefore, they are the most valuable resources that teachers, researchers, administrative personnel, managers, and students possess, including their organizational relationships and routines. This set of intangible assets is constituted by its processes; its capacity for innovation; the patents and intellectual property rights obtained; the tacit knowledge of its members; their capacities and skills; the recognition of society; its networks of collaborators, allies, and contacts; and scientific research processes, among other resources. Intellectual capital is the set of intangibles that “allows an organization to transform a set of material, financial and human resources into a system capable of creating value for stakeholders”. Ramírez-Córcoles Y. and Manzanque-Lizano [26] argued that HEIs and research organizations are the ideal organizations to apply the theory of intellectual capital since these institutions create knowledge through scientific research or teaching processes.

Giustina et al. [15], determined that the conceptual framework for IC management creates multi-stakeholder participation within the university network, where the main components are the ultimate goal of a university (what); the collective human capital to achieve the goal (who); the processes activated within the university (how); and, finally, the motivations behind achieving the goal (why). Likewise, Guistina et al. [27] studied the collective intelligence approach to managing intellectual capital, determining that IC management must change and incorporate an ecosystem perspective, reflecting the fourth stage of IC research.

Elena-Mădălina et al. [28] analyzed the points of view and practices of 210 university students from European developing countries, concluding that the policies and practices of universities have a positive and significant impact on the assessment of Internet-based IC components and showing that 63% of the professional and organizational competitiveness of HEIs is determined by the exploitation of IC integrated into online academic networks. Zhuravlev et al. [29] evaluated the effectiveness of education as the most important factor in forming IQ, based on modern Russian and foreign studies, on historical examples from the late nineteenth century, concluding that the labor productivity of more-educated workers is higher than the less-educated. Therefore, continuing education is the most important factor influencing employees' earnings and attitudes towards work, labor efficiency, and development of the state economy.

Passaro et al. [30] investigated the impact of higher education on the emergence of entrepreneurial intention and human capital in students and academics, concluding that there are significant differences between the two samples concerning the level and the specific characteristics of entrepreneurial education that are the key factors for the development of business intent and human capital. Di and Corsi [31] analyzed the contribution of intellectual capital to the development of the third mission in 71 Italian universities financed by the government in the period 2004–2014, concluding that there is a significant revelation of IC in the quality assessment model; in the same way, it was identified that the activities of the third mission have a positive impact on the university ecosystem, with a relevant performance of structural capital and relational capital in the development of the third mission. Veltri and Puntillo [32] analyzed whether the performance management systems (PMS) of the universities consider IC management as a criterion to evaluate their managers, a case study from the Universidad de Calabria, which is far from considering IC substantially as a key criterion to evaluate your managers.

Ramirez et al. [33] proposed a model of an intellectual capital product of a study carried out in Spanish public universities to indicate which intangible elements it is necessary to measure, and a new framework for the measurement and management of intellectual capital was presented that helps universities in the method of presenting useful information for its stakeholders, contributing to greater transparency, accountability, and comparability in the higher education sector. Eugenia et al. [34] demonstrated that intellectual capital positively and directly influences sustainable development practices, and said practices contribute significantly to the quality of life in 738 students and 587 professors/researchers in seven Portuguese higher education institutions. Chatterji and Kiran [35] studied how universities can create a knowledge economy, using data collected from 13 universities in North India. The findings reveal that human capital has a significant influence on the performance of a university, and relational capital partially mediates this effect.

Naranjo and Chu [36] designed a model and instrument to measure its structural capital at the Universidad Nacional Autónoma de México (UNAM) from 2011 to 2012. The results showed that the university has the human and technical resources necessary to generate a competitive advantage, since it permanently invests in technological infrastructure and the R+D+i process, becoming a great advantage and taking into account strengths in terms of structural capital, which are based on measurements of communication channels and annual studies on the culture and organizational climate.

Kichuk et al. [37] studied the impact of the knowledge economy in the education sector through the classifications in international rankings of Ukrainian universities, demonstrat-

ing the importance of IC management in higher education institutions in the current knowledge economy and the capacity they possess to increase the competitive advantage in the positioning and quality of these institutions worldwide.

The study developed by Nicolò et al. [38] established the relationship between academic performance and the voluntary disclosure of Intellectual Capital (IC) in 59 Italian public universities, showing that educational institutions with the highest academic performance transfer or disseminate a greater quantity and quality of information on IC based on its subcomponents (human capital, structural capital, relational capital). In the same way, Aversano et al. [39] showed that the dissemination of IQ in 60 Italian public universities is carried out through human capital in a quantitative way related to the strategic framework and organizational performance. On the other hand, Brusca et al. [40] developed a comparison between the disclosure of intellectual capital (IC) on the web pages of 128 European universities (Greece 22, Italy 58, and Spain 48) and its correlation with the academic classifications of the World Ranking, showing that the universities that reveal the most information about IC are the largest according to the number of students, demonstrating a positive correlation between the level of diffusion of IC on the web and the academic ranking of universities. Ramírez et al. [41] examined the disclosure on the web of 50 Spanish public universities in 2016, showing that human capital was the most publicized category and, to a lesser extent, relational capital, according to the size and internationality of the university with the purpose of satisfying the information needs of their stakeholders. It was recommended that Spanish universities present higher-quality information on their financial relationships, student satisfaction, and collaboration between universities and stakeholders.

Yudianto et al. [42] showed that good university governance and IC positively and significantly influence the performance of state universities–legal entities (SU–LE) and state universities–public service agencies (SU–PSA) in Indonesia, which contributes to developing science and technology, increasing the competitiveness of these institutions. In the same way, Limón et al. found 102 researchers from four state universities in Mexico in the area of business and administration, and they concluded that these institutions are a source of knowledge. Therefore, the IC has greater relevance to obtain a competitive advantage and improve the performance that allows them to generate value for customers.

1.2. Intellectual Capital (IC) on Scientific Production

Scientific production is the direct result of research activity, from which products such as research articles, books, book chapters, patents, utility models and technological products, architecture, and design, among others, are derived [43,44]. Through the literature review on intellectual capital, the following hypotheses (H) were established, taking into account Figure 1:

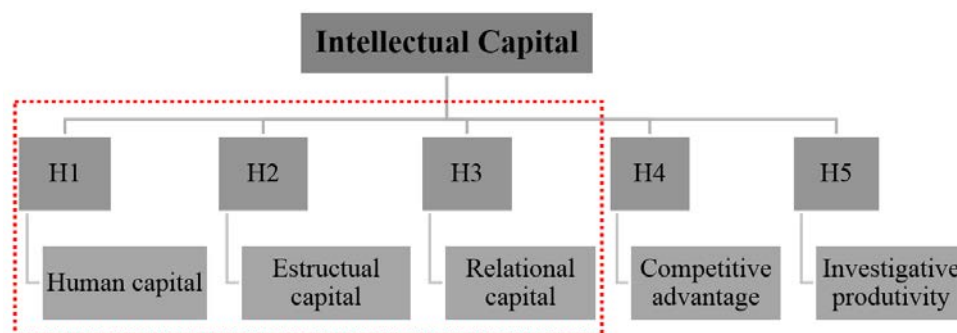


Figure 1. Intellectual capital scheme.

Hypothesis 1 (H1). *Human capital has a positive and significant effect on intellectual capital.*

Hypothesis 2 (H2). *Structural capital has a positive and significant effect on intellectual capital.*

Hypothesis 3 (H3). *Relational capital has a positive and significant effect on intellectual capital.*

Hypothesis 4 (H4). *Intellectual capital has a positive and significant effect on competitive advantage in HEIs.*

Hypothesis 5 (H5). *Intellectual capital has a positive and significant effect on scientific production with the number of authors.*

On the other hand, the main component principals on intellectual capital are H1, H2, and H3 according to the results obtained by Inkinen [45]. A high relation on the IC, according to the interactions, combinations, and mediations in the organization performance and innovation of the organizations, was present.

1.2.1. Human Capital (HC)

Human capital is created by employees by their inherent and acquired knowledge, skills, talents, and competencies. In this way, HC can be considered as a dynamic index and a very important factor for the prosperity of the organization today [46]. On the other hand, HC refers to the knowledge (explicit or tacit and individual or social) that people and groups possess and their ability to generate it, which is useful for the strategic purpose (mission and vision) of the organization. Ultimately, human capital is integrated by what people and groups know and learn and whether they share that knowledge with others. Once codified, they can benefit the organization. Within human capital and appropriate to the characteristics of each organization, elements such as values and attitudes, aptitudes (knowing), and capacities (knowing how to do) can be considered, according to Bueno et al. [47].

From Bontis [20], HC is a production factor in the organization and is a combination of intelligence, knowledge, and skills, which provide each organization its special character. People are elements of the organization that are capable of learning, innovating, thinking creatively, initiating, and making changes. Simultaneously, it is a necessary assumption for successful long-term performance in the market because it acts as a source of innovation and strategic renewal in organizations.

Human capital in higher education institutions, according to Ramirez et al. [33], Casanueva and Gallego [48], and Secundo et al. [49], is the set of explicit and tacit knowledge of the personnel of universities and public research bodies (professors, researchers, managers, and administration and services personnel) acquired through formal and informal education and updating processes included in their activities [50].

1.2.2. Structural Capital (SC)

Structural capital or organizational capital presents the institutional knowledge created and owned by the organization that is stored in databases, manuals, etc. In this type of capital, there are work processes, organizational norms, technological processes, know-how, brand, etc. [46]. According to Bueno et al. [51], structural capital is the set of knowledge and intangible assets derived from action processes that are the organization's property and that remain there when people leave it. It is made up of organizational capital (a set of intangibles of an explicit and implicit nature) and technological capital (a set of intangibles directly linked to the development of the organization technical system).

Structural capital in higher education institutions, according to Casanueva and Gallego [48] and Secundo et al. [49], is the explicit knowledge related to the internal process of dissemination, communication, and management of scientific and technical knowledge in universities. It also integrates the incorporated, internalized, systematized, and processed knowledge of each institution through a succession of organizational routines, evaluating

variables with culture, strategy, organizational structure, intellectual property, technologies, support processes, and recruitment of knowledge and innovation processes.

1.2.3. Relational Capital (RC)

Relational capital, or social capital, presents sets and flows of knowledge resulting from relationships within the organization and outside of it. They are characteristics of the life of society (relationships, norms, expectations, and responsibilities) that allow participants to work together effectively in the achievement of goals. It is related to the institutions, relationships, and norms that create the quality and quantity of social interactions in society [46].

According to Bueno et al. [51], RC can be defined as the set of knowledge incorporated into the organization and the people who make it up as a consequence of the value derived from the number and quality of relationships that are continuously maintained with the different market agents and with the society in general. It is made up of business capital (which refers to the value of the relationships it maintains with the main agents linked to its fundamental business process representing the organization) and social capital (which refers to the value that the relationships represents for the organization). It is maintained with the other social agents that act in its environment.

Relational capital in HEIs, according to Casanueva and Gallego [48] and Secundo et al. [49], establishes the broad set of economic, political, and institutional relations developed and maintained between the university and non-academic partners: companies, NGOs, public authorities, local government, and society in general, and it also collects how the university is perceived: its image, attractiveness, reliability, etc.

1.3. Models for the Measurement of Intellectual Capital

Regarding the measurement of intellectual capital, there are various models according to the strategic–corporate approach for higher education institutions, as shown in Table 1.

Martin et al. [57], Gernard and Nick [58], and Ramirez and Manzaneque [26] have established that the different models of intellectual capital propose different typologies according to the characteristics, needs, and types of organizations, where most of the research carried out highlights three major components concerning human capital, structural capital, and relational capital. In some cases, structural capital is subdivided into organizational capital and technological capital.

Intellectual capital in education has provided evidence of growing academic interest as a relevant field of research. However, in Colombia, there are few related jobs in the higher education sector. The proposed measurement approaches have been developed for the most part in the European context, making their adaptation and application difficult in Colombian universities. Likewise, empirical studies on the nature of the interrelationships between the dimensions of intellectual capital (human, structural, and relational capital) and their effect on the performance of universities have not yielded sufficient evidence [59].

In this review article, a Bibliometric analysis was carried out considering the data collected directly from the *Scopus* database on the topic of intellectual capital, and thus it analyzed growth trends over the years about the publication of scientific material (articles and books mainly), journals in which the authors publish, the main countries of publication, and collaboration networks. Likewise, this study provides perspectives and trends on this important field in the social sciences regarding the implications of human, relational, and social capital and structural elements involved in intellectual capital.

Table 1. Intellectual capital models of the strategic–corporate approach.

Model	Reference	Objectives	Components
Intellect.	[52]	Evaluate the market value of the company and report on the organization’s ability to generate sustainable results, constant improvements, and long-term growth.	HC SC RC
Strategic management by competence.	[53]	It studies the generic attitudinal and evaluative competencies that the members of the organization develop in the work of the company and the projection of what it is capable of doing.	HC OC TC RC
Intellectual Capital—Benchmarking System (ICBS).	[54]	Determines the most relevant competitiveness factors and criteria in specific business activity (competitiveness inducers) of intellectual capital.	HC SC RC
Roos.	[55]	It proposes an index of indicators for each of the components of intellectual capital.	HC SC
Intellectus.	[51]	Intellectual capital presents a strategic sense from its consideration as a practical tool that allows the identification and measurement of intangible assets that add value to the organization.	HC OC TC NC SC
Intellectual Capital Model	[20]	Intellectual capital would be a multidimensional second-order construct.	HC RC SC
ABC—Cluster of Knowledge of the Basque Country	[56]	Exchange of ideas, experiences, and actions on knowledge in business management, which facilitate learning and dissemination of knowledge, contributing to improvement in the competitiveness of companies and their managers.	Creation of knowledge. Modeling, adaptation, and elaboration. Diffusion—transmission. Empirical knowledge application.

2. Materials and Methods

2.1. Bibliometric Analysis

The Bibliometric analysis was carried out using the Bibliometrix library and BiblioShiny platform of the RStudio® software [60]. Besides, the VOSviewer software was used to obtain the relationship between countries and keywords. Figure 2 shows the principal steps of the workflow applied to the data analysis obtained from the *Scopus* database.

2.2. Data Collection

The data was compiled on 19 January 2021 directly from *Scopus* database scientific publications on intellectual capital in higher education institutions for documents published from 1947 with the following search equation in general way: (capital AND intellectual AND research AND institutions), as nowadays it is one of the important data sources to obtain scientific publications [64]. The results of the Bibliometrix analysis were used to expose the most relevant topics across the time using specific keywords and quantitative information of the publications and journals (title, abstract, author, keywords, total citation per document, and filiation, among others).

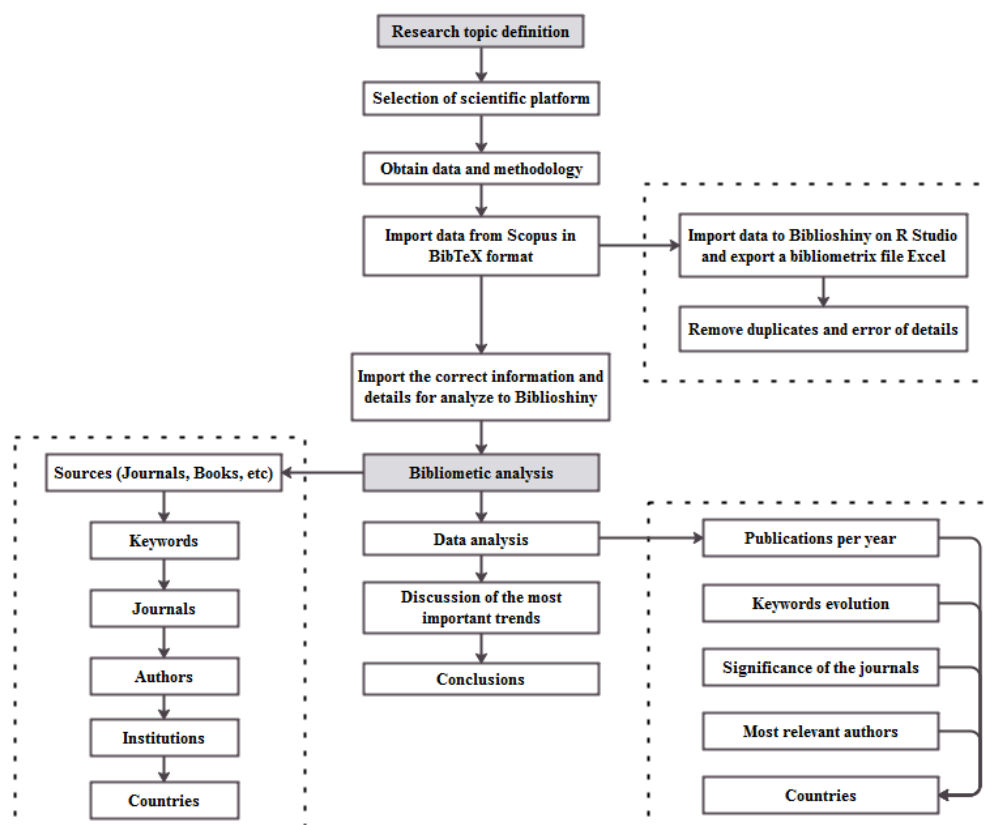


Figure 2. Workflow of the Bibliometric analysis obtained from García-León et al. [61–63].

3. Results and Discussions

3.1. Statistical Results

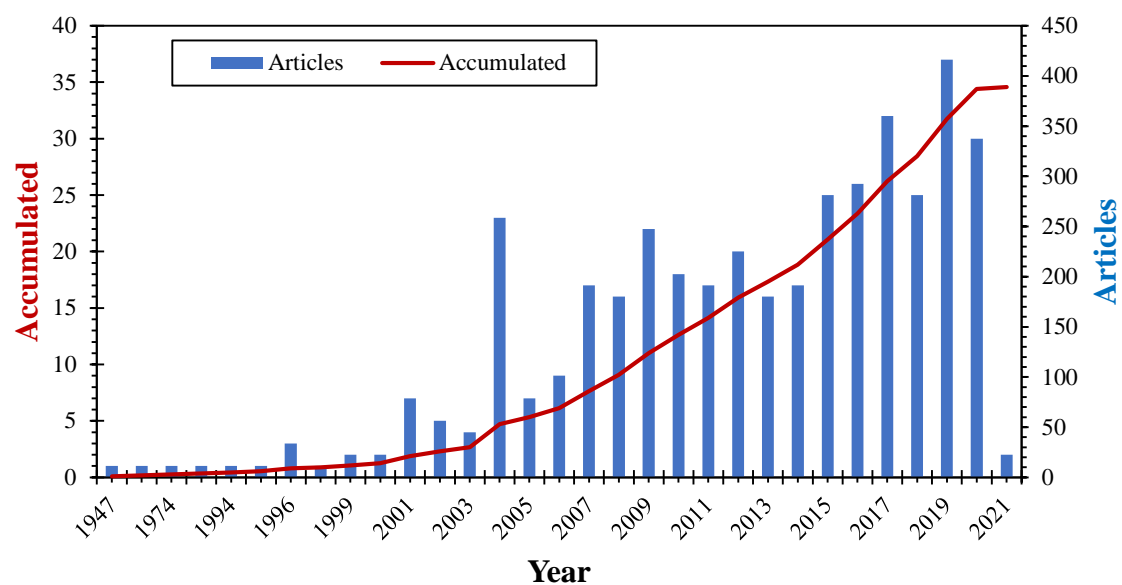
Table 2 shows the general results that were analyzed in the R studio software. Considering the methodology of Figure 2, a publication time from 1947 to 2021 was observed with an annual growth rate: 2.34%. Additionally, the types of documents, the authors, and the collaboration between authors for the period of time were studied.

The historical development of scientific production related to intellectual capital, as shown in Figure 3, is evident given that the first publication on the topic studied was in 1947 with fluctuations and few publications until 2005. Still, in 2015, the increase in publications on this topic increased considerably, with an average of 25 articles per year. On the other hand, 389 documents were published by 866 authors from different countries globally, with an average citation per year of 1.39 according to the statistical analysis established in Table 2. Note that this number of documents included mainly articles, books, and book chapters.

Throughout history, there have been events that have negatively and positively affected the development of publications related to the topic of IC, such as the case of the Second World War (1939–1945), where there was a reduction in scientific publications in almost all countries in all areas of knowledge; while in the years 1972 to 1974 publications on issues related to organizations and human capital increased. The appearance of the COM and the strengthening of technology and research companies between 1997 and 2001, which promoted the development of science and technology in this important area of organizational administration. It can be observed that from this period scientific publications related to IC increased considerably.

Table 2. Main information about the data analyzed.

Description	Results
Timespan	1947–2021
Sources (journals, books, etc.)	276
Documents	389
Average years from publication	8.95
Average citations per documents	16.47
Average citations per year per doc.	1.396
References	15,783
Document types	
Article	253
Book	7
Book chapter	21
Conference paper	78
Conference review	1
Editorial	2
Review	27
Keywords Plus (ID)	1431
Author's Keywords (DE)	1094
Authors	
Authors	866
Authors of single-authored documents	111
Authors of multi-authored documents	755
Author's collaboration	
Single-authored documents	118
Documents per author	0.449
Authors per document	2.23
Co-authors per document	2.4
Collaboration index	2.79

**Figure 3.** Accumulated articles across time for intellectual capital.

On the other hand, the conceptualization of knowledge management is of recent creation, taking into account that from the 1950s onwards, studies and definitions of the most relevant theories on the subject began, where it can be specified that its origin begins to take shape from the management by competencies and the development of information

and communication technologies (ICTs), thus generating a competitive advantage in the knowledge society, especially in economies where importance was given to learning and knowledge [65]. Scientific production and the dissemination of knowledge occurred mainly at the end of the 1980s, with the development of scientific research and the advancement of science, where new means were created for the dissemination of knowledge coupled with the significant advance of the ICTs and the internet, as drivers of growth in productivity and the economy, establishing networks for the global connection of knowledge.

Taking the above into account, the first companies to adopt knowledge management practices were those of audit services such as Andersen Consulting or Ernst and Young and manufacturers such as General Electric or Hewlett-Packard [66]. In this way, Millares and Puerta [67] suggest that in these companies, the knowledge of human talent is the basis for generating competitive advantages in this type of organization, as well as later an accelerated increase in knowledge management practices in various sectors of the economy and mainly in large companies and higher education institutions.

3.2. Keyword Evolution

Keywords were analyzed directly from the published documents, taking into account the frequency of appearance of the most used keywords, as shown in Figure 4. In this way, it was evident that the three most used keywords were “societies and institutions”, “knowledge management”, and “intellectual capital” with an average frequency of 80 times, which is of interest considering the analysis of this topic for higher education institutions, which involves different topics of knowledge.

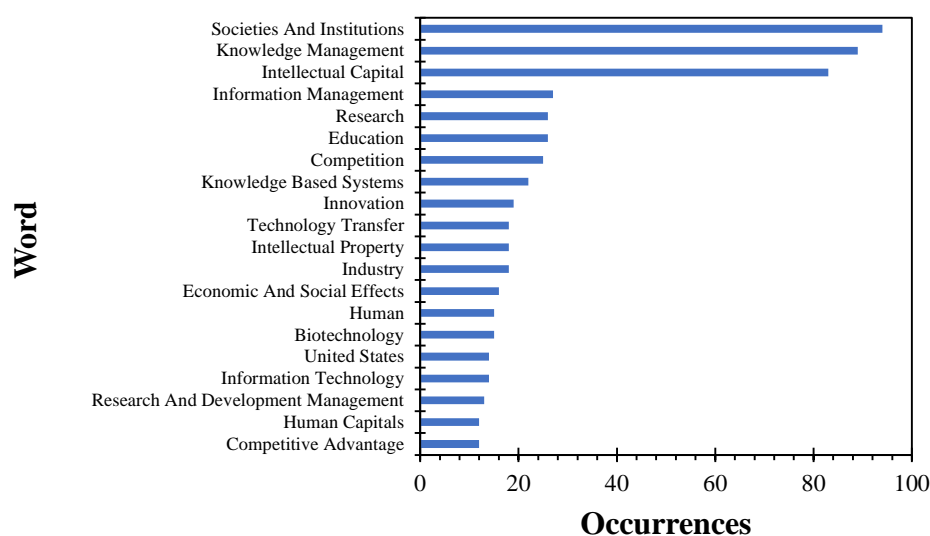


Figure 4. Common occurrences of keywords.

Taking into account the antecedents on knowledge and intellectual capital, it was considered that this subject of study is of recent creation, because from the 1950s onwards studies and definitions on knowledge began to be carried out by Drucker [68], with the term “knowledge workers” in organizations in 1959 and “Personal Knowledge” in 1967. In the same way, there are the beginnings of intellectual capital in 1963 where the term “accounting of human assets” appears [1], and, in 1967, the term “intellectual capital” was used for the first time [2]. In the 1980s and 1990s, significant contributions were obtained on knowledge management where conferences, book publications, and knowledge business practices began to be held, as was the case of the first three conferences on the subject held in 1987, 1992, and 1993 and the publication of the book “The Knowledge-Creating Company” in 1995 by Nonaka and Takeuchi [4]. Similarly, companies such as Dow Chemical and Skandia, as well as consulting firms such as McKinsey, Ernst & Young, and IBM Consulting, appointed “knowledge managers” and “directors of intellectual capital”.

Dumay [69] made a critical reflection on the future of intellectual capital, concluding that different authors should focus on revealing what was “previously secret or unknown” in organizations, which implies abandoning reporting so that stakeholders understand how an organization considers ethical, social, and environmental impacts by an ecosystem approach to IC. Inkinen [45] developed a literature review to measure the influence of IQ on the performance of the company, obtaining as a result that IQ influences significantly through interactions, combinations, and mediations in the performance of the organization. In the same way, IQ is significantly related to the innovation performance of companies.

Figure 5 shows the co-occurrence between the keywords. Five clusters of keywords can be observed, the most important being in the central point, intellectual capital, followed by knowledge management (red color), societies and institutions (color green), and, to a lesser extent, a cluster related to competition and education and universities, (colors: purple, blue, and yellow, respectively). This figure determines the importance of the thematic areas or topics related to the analyzed documents and thus relates to the concept of intellectual capital.

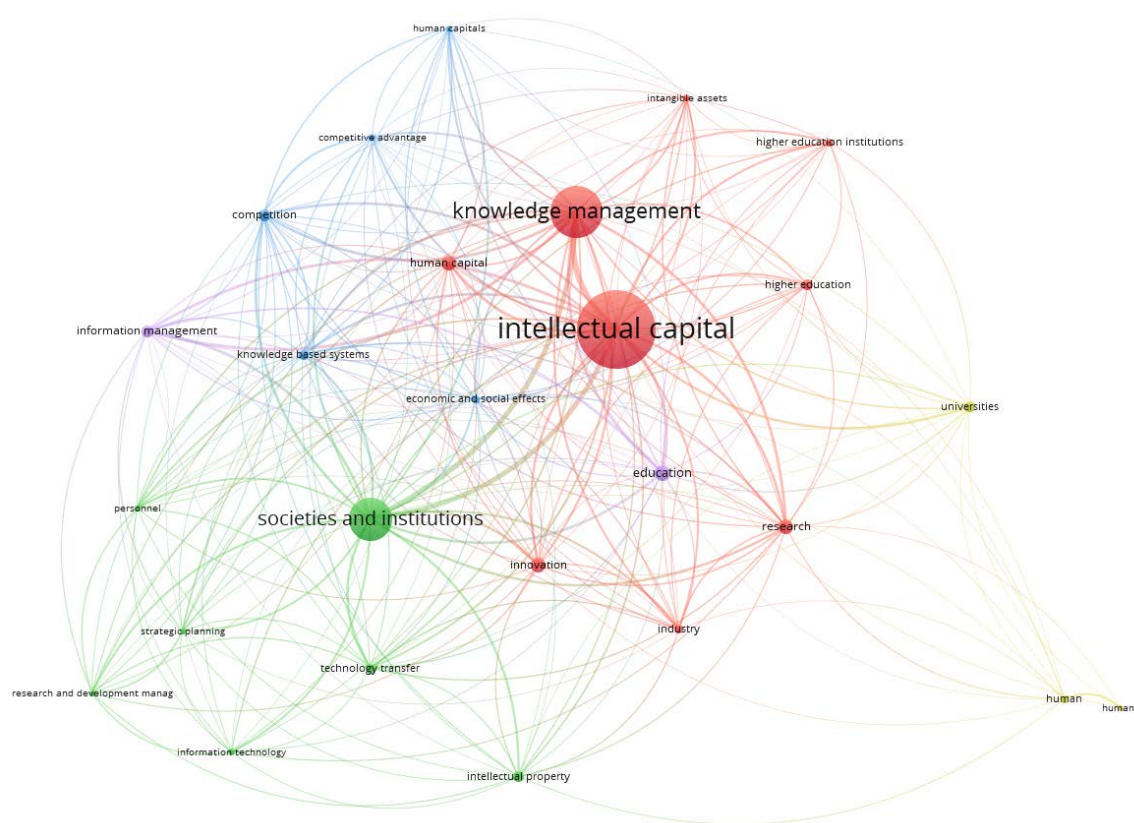


Figure 5. Co-occurrence between the keywords.

Figure 6 shows two specific dendrograms for the keywords, which relate areas on human resources and organizations (blue lines) and everything related to intellectual capital and knowledge management (red lines).

There are various approaches or classifications on intellectual capital, of which the most appropriate for the education sector is the strategic–corporate approach, which is immersed in the mission of higher education institutions. In this sense, it must be strategically linked to the fulfillment of the mission of research and generation of knowledge, based on the capacity of these institutions to produce and transfer knowledge to society. Therefore, it is viewed as a dynamic system of intangible assets essential for scientific production by Leitner and Warden [24] Sanchez and Susana [70]. In this way, the management of intellectual capital as a tool provides added value to institutions, as well as to their impact

and positioning strategy, thus contributing to the scientific performance of human capital and the codification of knowledge through scientific publications in universities [59]. For Bueno [71], the arrival of the information society and its evolution towards that of knowledge have placed intangible resources in one of the primary sources of creating a sustainable competitive advantage for organizations and generating value and future performance. In this context, intellectual capital is a strategic perspective of the “account and reason” of organization intangibles.

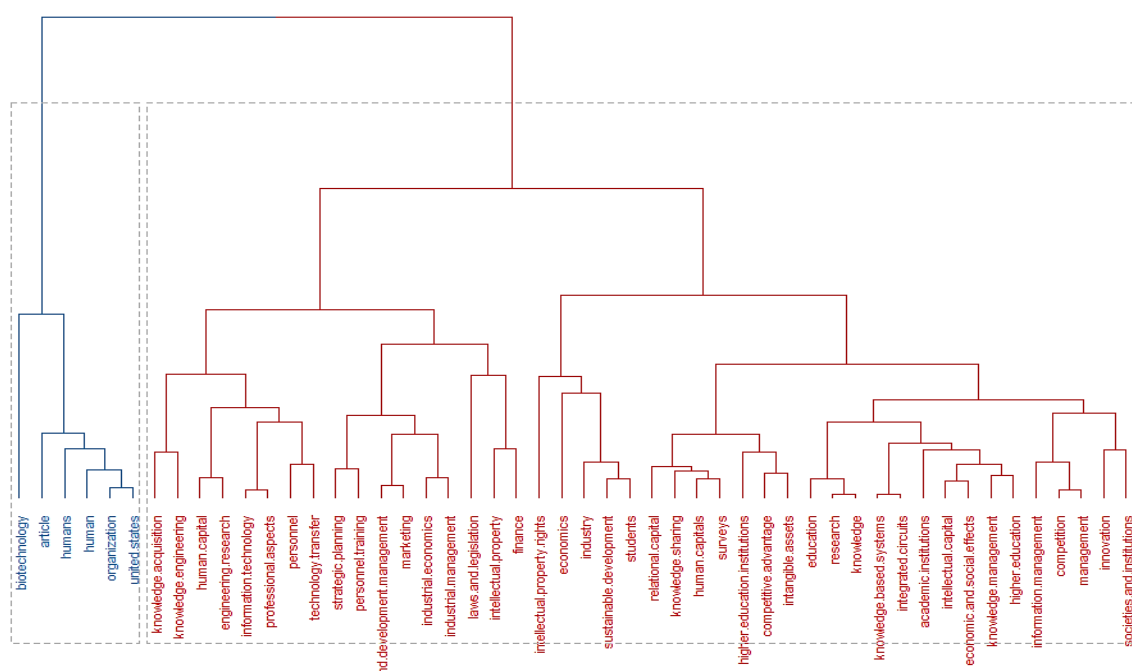


Figure 6. Topic dendrogram for keywords.

Figure 7 shows the clusters of keywords by appearance; it should be noted that the conceptual structure tries to explain the main themes and trends in the scientific world in a specific area, that is, what science talks about. Figures 6 and 7 show that the keywords used by the authors defined two conceptual clusters (or themes). These clusters show a minimum cluster frequency of five per thousand documents and a minimum number of 250 repetitions per keyword.

3.3. Source's Significance

Figure 8 shows the most important journals in which articles on the subject of intellectual capital have been published. Note that the “Journal of Intellectual Capital” is the most relevant journal because it has an h-index of 18 with an impact factor of 1.18 being its quartile Q1. Subsequently, it is followed by the journal of the “Proceedings of the European Conference on Knowledge Management” with a lower impact factor but with the highest number of publications on this topic studied in the Bibliometric analysis.

Taking into account the results of the significance of the 20 most important journals, Figure 9 shows the 20 most-cited journals; in the same way, the “Journal of Intellectual Capital” prevailed among the others, thus corroborating the importance of this journal in this area of knowledge, which helps to strengthen institutions and companies.

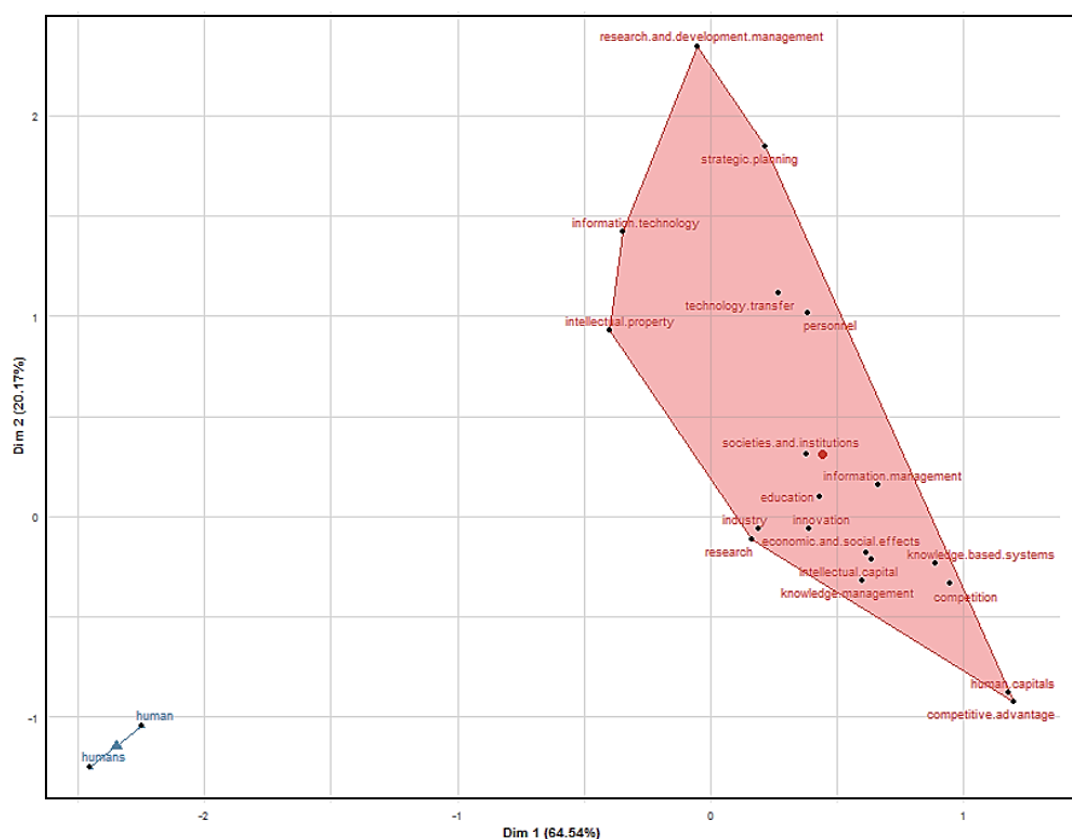


Figure 7. Keyword clusters by appearance.

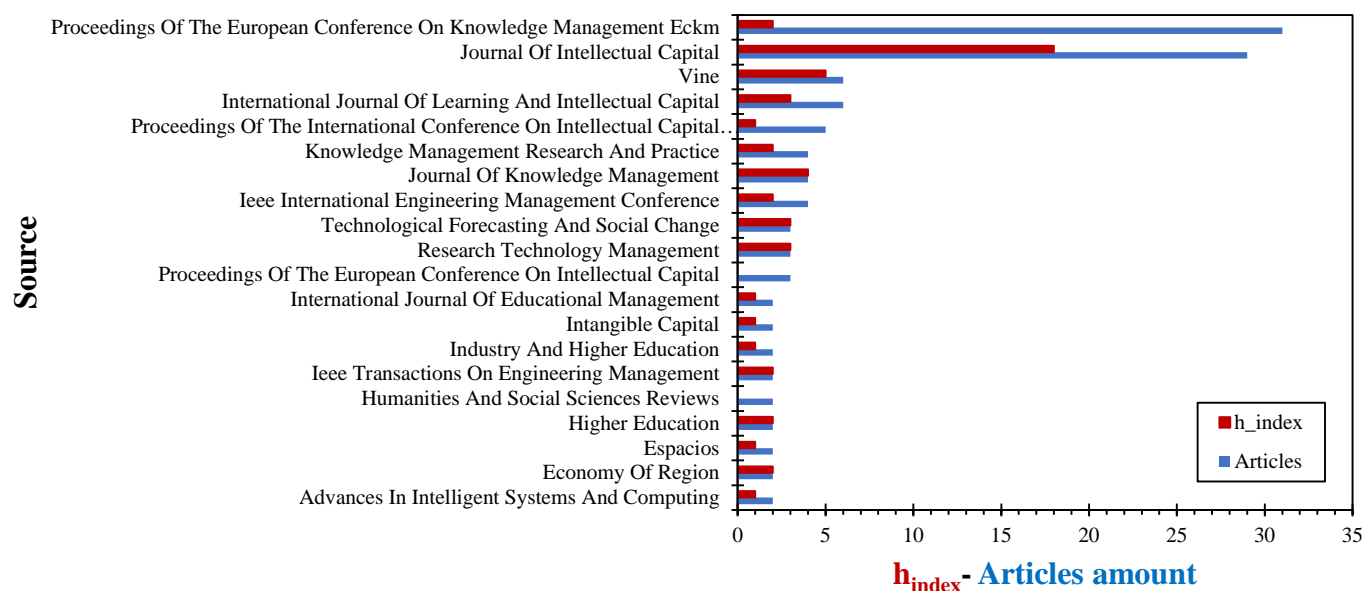


Figure 8. Importance of the 20 main sources.

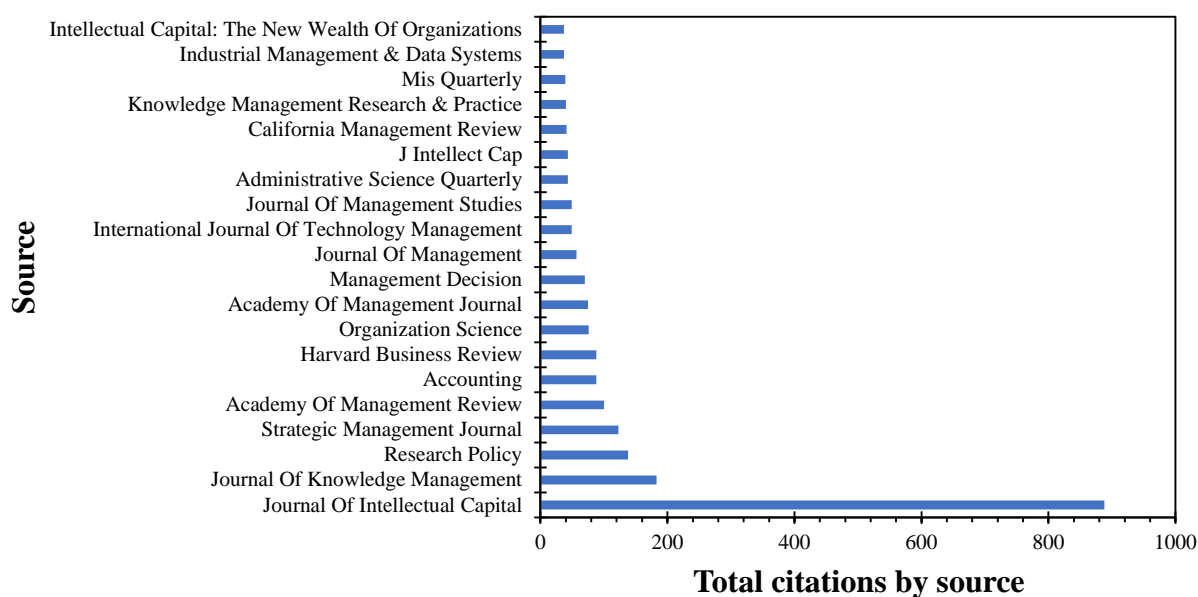


Figure 9. Total citations by source.

3.4. Top Authors

In the collection of documents, there are 369 authors, where 30.1% (111) had only one publication. However, Figure 10 shows the top 20 authors in the intellectual capital topic. Bontis, Edwinsson, and Dumay presented the highest citations on the subject, with around 240, 136, and 128, respectively, for the period of time analyzed.

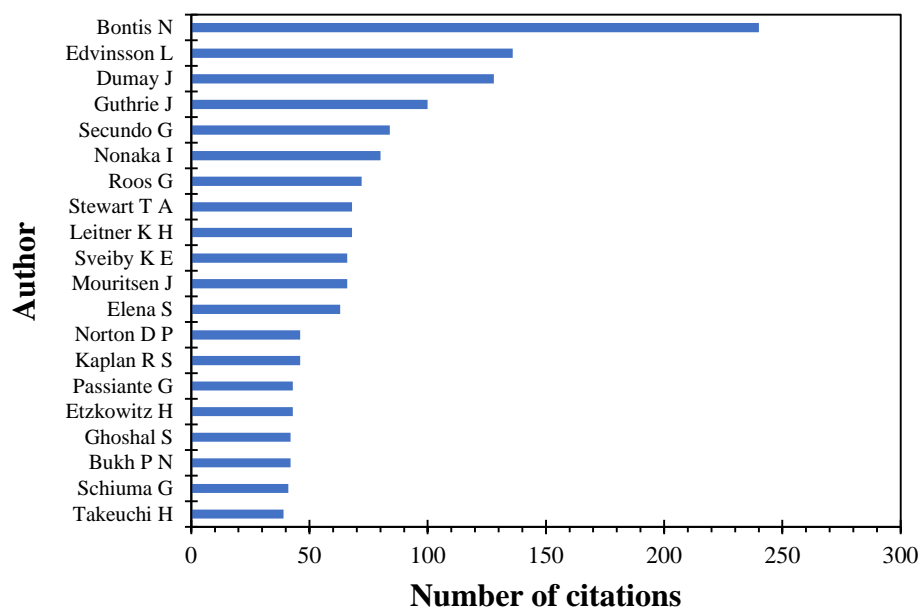


Figure 10. Relevance of the author by the number of citations.

The most important journal on the topic of intellectual capital is the “Journal Intellectual Capital”, which presents a large number of citations for the 20 most important articles, which are related to study topics such as performance, transformation, knowledge, advantages, competitions, and reviews on intellectual capital in countries, as shown in Table 3. It is evident that both the H_index and the citations of the publications are influenced by the HC and EC of the organizations, as well as the impact that the subject can have in this area of knowledge for IC management in institutions and organizations worldwide.

Table 3. Most relevant authors.

Author	H_Index	Source	Year	Total Citations
Lockett A	47	<i>Res. Policy</i>	2005	464
Mcafee K	13	<i>Environ. Plann. D Soc. Space</i>	1999	449
Zucker LG	27	<i>Proc. Natl. Acad. Sci. USA</i>	1996	371
Bontis N	45	<i>J. Intellect. Cap</i>	2004	305
Serenko A	33	<i>Knowl. Process Manag.</i>	2004	210
Bose R	27	<i>Ind. Manag. Data Sys.</i>	2004	199
Ting IWK	25	<i>J. Intellect. Cap</i>	2009	162
Dumay JC	35	<i>J. Intellect. Cap</i>	2009	162
Whitley R	33	<i>Account Organ Soc.</i>	1986	157
Willcocks L	47	<i>Inf. Syst. Manag.</i>	2004	141
Erikson T	23	<i>J. Bus. Venturing</i>	2002	141
Shih KH	11	<i>J. Intellect. Cap</i>	2010	122
Lengnick-Hall CA	19	<i>J. Eng. Technol. Manag. Jet M</i>	2004	115
Yoshikawa T	37	<i>Corp Gov.</i>	2009	111
Sanchez MP	22	<i>J. Intellect. Cap</i>	2006	107
Joshi M	34	<i>J. Intellect. Cap</i>	2013	101
Mention AL	11	<i>J. Intellect. Cap</i>	2013	93
Rindermann H	25	<i>Psychol. Sci.</i>	2011	93
Kamukama N	6	<i>J. Intellect. Cap</i>	2011	92
Rezgui Y	36	<i>Adv. Eng. Inf.</i>	2010	92

Figure 11 shows the evolution over time of the authors related to the subject of intellectual capital. It can be observed that the growth between the number of authors per document and citations was relevant since 2002. The authors Bontis N of the DeGroote School of Business, Hamilton, Canada and Matos F of the Instituto Universitario de Lisboa (ISCTE-IUL), Lisboa, Portugal, Instituto Universitario de Lisboa were the most active authors related to the 20 most important articles in terms of the publications analyzed as a result of the bibliometric analysis.

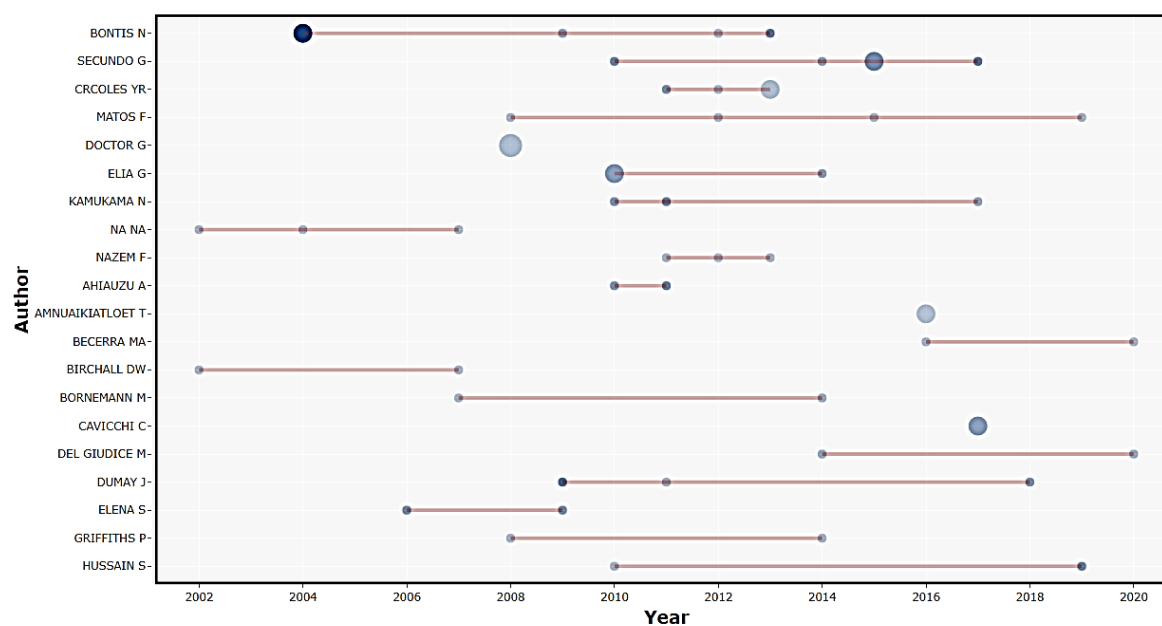


Figure 11. Time evolution of the 20 top authors in intellectual capital.

The studies carried out on the influence of intellectual capital on scientific production and the dissemination of knowledge at a global level in higher education institutions are very scarce. Similarly, there are many empirical studies in the Scopus database in the

period of 2015 to 2020 whose level of importance is reflected in the number of citations of these publications and the H_index of the authors. The five most important published documents on intellectual capital at the international level are described below.

Dumay [70] is the most relevant author about the subject of intellectual capital in institutions with 162 citations, and they made a critical reflection on the future of intellectual capital, concluding that the different authors should concentrate on revealing what “was previously secret or unknown” in organizations, which implies abandoning reporting so that stakeholders understand how an organization considers ethical, social, and environmental impacts according to an ecosystem approach to IC, taking into account that IC currently expands its limits to the broader ecosystem to “go beyond IC reporting”.

Kianto et al. [21] demonstrated that IC in 180 Spanish companies positively influences human-resource-management practices based on knowledge and performance in innovation. In this way, it favors structural and relational capital partially through human capital, and, in turn, human capital favors innovation performance by improving structural and relational capital. Sirinuch [72] conducted a study on 213 technology companies listed on five stock exchanges in the countries of the Association of Southeast Asian Nations (ASEAN), showing that IC is positively related to market value, which indicates that companies with a higher IC have a higher market value. Khaliq et al. [23] showed in 247 Pakistani SMEs in Gujranwala and Gujarat that the components of intellectual capital referring to client capital, structural capital, social capital, technological capital, and spiritual capital are positively related to the organizational performance of SMEs operating in the electrical and electronic products manufacturing sector in Pakistan.

Regarding the collaboration networks between the authors on intellectual capital, Figure 12 shows two collaboration networks: the green network led by Matos F from the Instituto Universitario de Lisboa, which works with Secundo G from Universita del Salento, Lecce, Italy, which is related to the red collaboration network. These collaboration networks increase the visibility of scientific publications in different areas of knowledge and, in this way, reduce knowledge gaps from different points of view and perspectives.

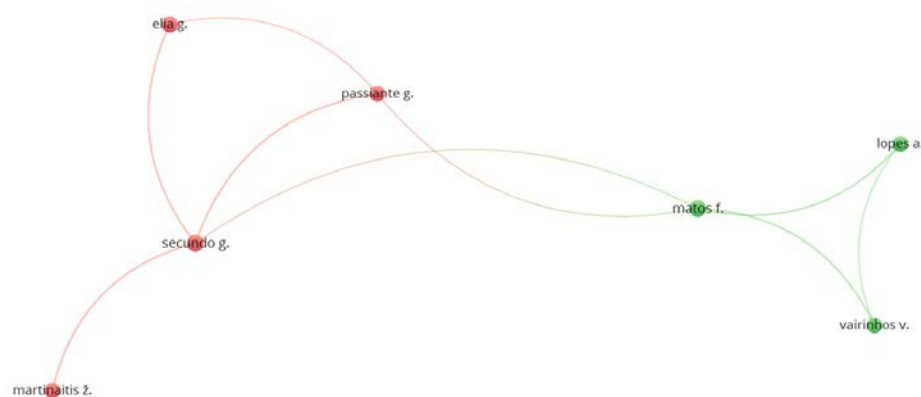


Figure 12. Collaboration networks between authors.

Figure 13 shows the Three-Fields plot for the reference–authors–keywords; it was evident how all the authors included the subject of intellectual capital in their articles as well as, secondly, knowledge management and, thirdly, universities. These were included in publications that were developed since 1997, which have taken great interest and have been relevant to this important area of administration.

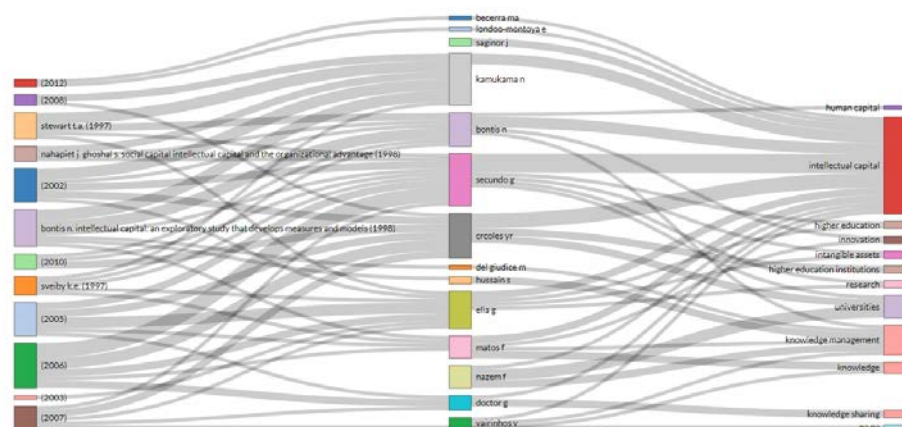


Figure 13. Three-Fields plot for the reference–authors–keywords.

3.5. Top Institutions and Countries

In order to identify the most important institutions worldwide on the topic of intellectual capital, Figure 14 shows the top 20 institutions, taking into account the affiliations of the authors. Islamic Azad, McMaster, and California Universities are the most relevant institutions with 23 articles in total. For the specific case of Colombia, the Atlantic and Medellín universities reported very few articles on this topic, at around six. Thus, it was observed that the analyzed topic presents few publications by institutions; however, according to Figure 3, the growth rate has been increasing, which is significant for this area of study.

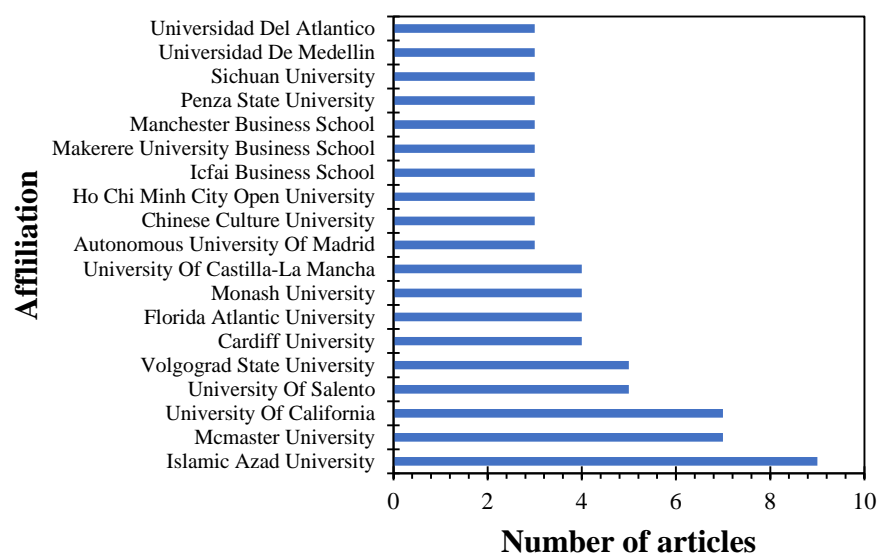


Figure 14. Top affiliation of institutions by authors.

From the Bibliometric analysis and the results shown in Figure 15, it was obtained as a result that the United States, Canada, and the United Kingdom are the most cited countries in the topic studied, with 1468, 731, and 727, respectively; they were followed by other countries such as Spain and Australia with 321 and 311 citations, respectively, which were approximately 50% less than the first three countries. It was determined that, regardless of the number of publications in a country, these articles are cited by the works that are being developed, thus being the importance and quality of the documents studied.

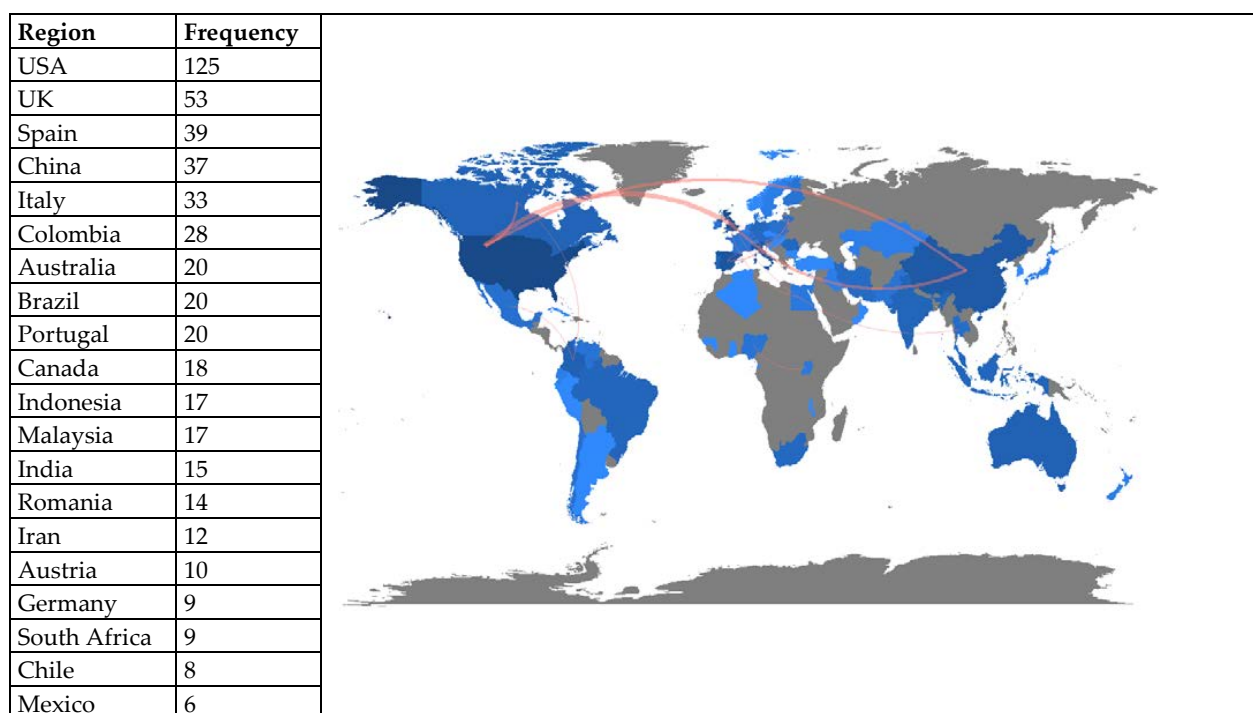


Figure 15. Frequency of appearance of countries and collaboration.

The productivity of knowledge workers is the most significant contribution to be made in the 21st century. In this way, Druker [68] argues that in the 20th century, production equipment was considered the most valuable asset of a company. In contrast, for the 21st century, the most valuable asset of an institution is human resources and productivity. That is, knowledge makes organizations more productive (IC and HC). According to the above, in developed countries, the main challenge is to make knowledge workers more productive and not manual workers. This is becoming the central challenge for organizations, bearing in mind that such knowledge workers are rapidly becoming the largest group in the workforce of all developed countries, where productivity is most often dependent on future professionals and, indeed, the future survival of developed economies.

Figure 16 shows the collaboration networks between countries, where six collaboration networks were observed (yellow, red, purple, blue, light blue, and green), the most important being the USA, the UK, Spain, and Italy. This shows that the subject of intellectual capital has been studied by relevant countries, which reveals the importance of analyzing the aspects that this subject involves in institutions and universities worldwide. In the case of Colombia, collaboration networks are presented mainly with Mexico, Canada, and Spain, where the most important publications related to IC have been generated.

On the other hand, in Colombia, the study on the influence of intellectual capital on scientific production and disseminating knowledge has occurred to a lesser extent. Research has been carried out independently from the 1980s and 1990s, thanks to the rise of information and communication technologies. Still, articulation is not visualized in said study variables. Simultaneously, in higher education institutions, there is an absence of documents published on said topics studied, reflecting a lack of interest on the part of the national scientific community.

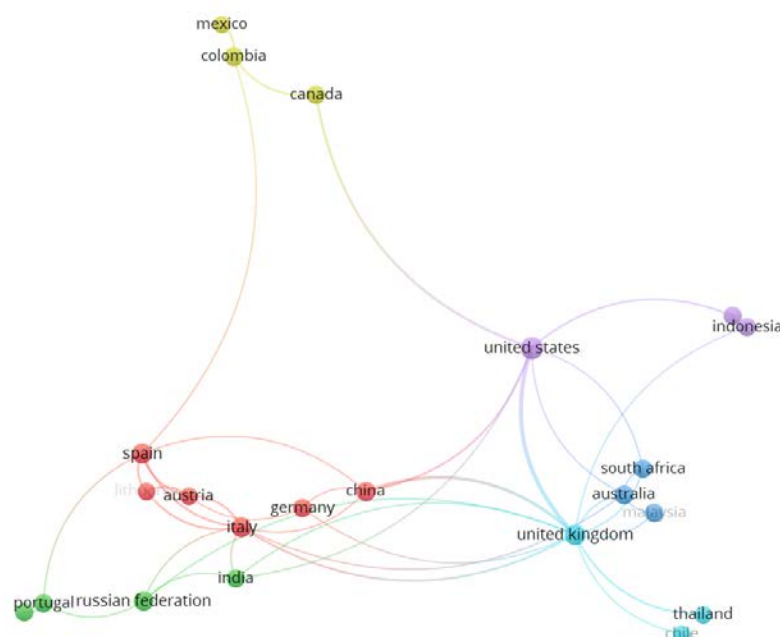


Figure 16. Networks of collaborations by countries.

4. Conclusions and Trends

The scientific publications associated with intellectual capital were reviewed with the aid of advanced data analysis and graphics across time using Bibliometric analysis. It was found that research in this field topic has entered a stage of accelerated increase from 2015, and therefore, the values are still growing. The major contribution to this research topic predominates in the USA, the UK, Spain, and many other countries that appear on the statistical results of the sources of data analyzed.

The analysis of the keywords showed that various aspects of intellectual capital have been developed and analyzed over the last 74 years, and the latest top studies are associated with intellectual capital and knowledge management, followed by societies and institutions, and, to a lesser extent, clusters related to competition, education, and universities. Moreover, time evolution in keywords research showed that intellectual capital is still predominant.

The quantity and quality of intellectual capital are related to scientific publications, which are directly associated with the quantification and qualification of the personnel working in public institutions of higher education. In this way, it was established that the greater the number of authors, the greater the publications that will be substantial to their number.

The study of intellectual capital has occurred mainly in the business sector and, to a lesser extent, in the education sector, where there were only eight scientific publications in the 2015–2020 period in the Scopus database, thus reflecting a lack of interest in the study of this topic by the scientific community in higher education institutions. This takes into account that it is considered as one of the important tools for the development and strengthening of public or private organizations.

The IC in higher education institutions (HEIs) contributes significantly to their competitiveness and corporate image, in the sense that these institutions are measured by their academic products in terms of the mobility of students and graduates; in research through the categorization of researchers and research groups, and the production and dissemination of knowledge at the national and international level; and also by extension programs and products. Therefore, the HEIs, having high levels of IC contained in trained and innovative human resources; a robust structural capital in organizational, technological, and research processes; and relational capital with academic and research networks with its stakeholders, generating an impact on the academic community and society in general, pro-

vides these institutions with better organizational learning, more efficient performance, and higher quality in their academic and research processes. Therefore, both these educational organizations are more competitive locally, nationally, and internationally.

The theoretical implications of this study offer a general review of the literature on the development of intellectual capital research around the world at a general level and its consequences in HEIs through a bibliometric analysis in the *Scopus* database. This allows identification of the components of the main concept, and models of capital also determine the level of growth of the research carried out historically, the concurrence of the keywords through clusters, prominent journals, institutions, countries, and scientific collaboration on this topic of study. Therefore, the main practical implications of this study fall directly on researchers, teachers, and students of higher education institutions, regarding the theoretical foundation and historical development of intellectual capital research. In addition, the methodology used in this study may be used to obtain similar results in other contexts and organizations.

The limitations of this research are oriented to the bibliometric analysis, which was carried out using only the *Scopus* database, which has great academic and scientific prestige with wide coverage in the publication of scientific articles. There are other databases with other publications on the subject studied that can serve as a basis for other research of this type.

Future research directions in this topic of study could focus on the relationship of intellectual capital with other study variables such as scientific production, knowledge management, and innovation since most current studies only focus on the measurement of intellectual capital from its three main components such as human capital, structural capital, and relational capital in commercial and academic organizations. In addition, it is proposed that future research study intellectual capital as a strategic resource in HEIs as creative organizations and disseminators of knowledge, where the identification, measurement, and development of IC generate value and sustainable competitive advantage from the strategic direction to make better decisions for the future.

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