Science Mapping Analysis Of Intellectual Capital To Comprehend The Future Agenda And Dimensions: Bibliometric Analysis

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Abstract

Purpose- For the organization whose members manage intellectual capital, competencies, and the development of information and communication technologies that have significantly impacted scientific publications. This study's main objective was to summarize all the research on intellectual capital that has been done globally.

Research Methodology- The Bibliometrix library and BiblioShiny platform of the RStudio® software were used to conduct the Bibliometric study utilizing data from the Scopus database.

Results-The publication includes a summary of 1908 papers and editorial remarks written by distinguished researchers from various colleges and universities. The publication gathers the study issues examined throughout the past ten years, from 2010 to 2022. The increasing number of citations this database receives from other respected journals and its impact on creating new study fields are evidence of its preeminence.

Originality/value- In addition to offering a detailed and comprehensive analysis of the domains and research streams Scopus investigated during the past ten years, this report also offers potential study topics that could serve as a stimulus for future scholars and advance science. The study is more in-depth concerning the participants and methodology employed in examining the academic production of publications in Intellectual Capital.

Keywords: Bibliometric Analysis, Intellectual Capital, Network Visualization, Science mapping Analysis, Performance analysis, Cluster Analysis, Thematic Analysis

1. Introduction

After the introduction of the internet, this world has become a tiny place. Regarding academics, the gigantic volume of data published in journals, proceedings, books, patents, etc., must be organized and saved in bibliographic databases. The data and information stored on these databases (i.e., titles, authors, citations, keywords, journals, institutions, etc.) provide an invaluable sample to perform evaluation research using bibliometric techniques.

In-depth bibliometric and content examination of Intellectual Capital from 2010 until 2022 is the goal of this study. This bibliometric analysis shows how the Scopus database has developed along with the concept of intellectual capital.

Scopus is an international repository and database that explores the roles and importance of research work in different dimensions and disciplines. The database's mission statement states that its core research team strives to discover innovative ideas in different disciplines and apply theories in practical circumstances.

It was launched in 2004 by Elsevier's publication house. Since its foundation, the database has covered almost 36,377 titles from different publishers, nearly 11,678. Scopus is duly recognized and notable, covering different sources: journals, trade journals, and book series. All journals covered in the Scopus database are reviewed for substantially high quality each year to ensure quality measures for each title. Cite Score, SNIP (Source Normalized Impact per Paper), H-Index, and SJR (SCImago Journal Rank) are the critical parameter of the quality check of Scopus. Scopus searches also incorporate searches of the patent.

In the early stage, Intellectual Capital has purely measured as an intangible asset for the organization, but nowadays, it has implicit and more structured nuance about the value creation and the sustainability phenomenon. Research on Intellectual Capital started to come into sight in academics in 1994. These research findings rowed for the applicability of Intellectual Capital as an intangible asset for an organization (Edvinsson, 2000; Petty and Guthrie, 2000). Results on Intellectual Capital were examined from the perspectives of sustainability and innovation in the early 2000s and centered on knowledge management research (Serenko and Bontis, 2009; Serenko et al., 2009; Mouritsen et al., 2002). According to McElroy (2002), intellectual capital results from a group effort to foster fresh ideas. The concept of "Social Innovation Capital," which was also examined by "Bueno et al. (2004)," has been spread by it. Further expanding on the idea that intellectual capital is more than just an intangible asset, think tanks have proposed various dimensions such as innovation, emergent nations, virtual environments, virtual environments in higher education, and emerging countries (Jardon and Martos, 2012, Tovstiga and Tulugorova, 2009, Inkinen, 2015, Duodu and Rowlinson, 2019, etc). (Pedro et al., 2019; Tjahjadi et al., 2019). We conducted a bibliometric analysis and analyzed current Intellectual Capital trends to give a peek of Scopus (Di Stefano et al., 2010). Using the Scopus database, this approach provides a glimpse of published Scopus articles between 2010 and 2022.

Through descriptive data and a cross-co-citation analysis, the bibliometric analytical approach can provide insight to identify and assess linkages among various academic disciplines in order to encourage further research (Culnan, 1986, 1987; Tovstiga and Tulugorova, 2009; Gonzalez-Loureiro et al., 2015; Dabic et al., 2019; Kiessling et al., 2019; Marzi et al., 2020). Different dimensions have emerged, each of the dimensions exhibiting a distinct relationship, such as intellectual capital and innovation, disclosure, and human capital. We also studied Intellectual Capital's association with the notion of Knowledge Management, thus adding one more dimension: Intellectual Capital and Knowledge Management. Intellectual Capital is habitually nurtured, grown, and fostered through Knowledge Management progression, enabling innovative firms to go after new sources of the organization's value. Keeping all these in mind, the whole study is framed as follows: the introduction throws light on the existing literature on Intellectual Capital, and the next section justifies the bibliometric analysis. Indicators of Scopus's success are provided in the third part. The key conclusions from the bibliometric analysis of the research on Intellectual Capital are covered in the final section, along with ideas for other areas of future study.

2. Bibliometric Analysis
2.1 Validation

The study's objectives are to trace the development of the scientific works generated by authors who have published their works in the Scopus database between 2010 and 2022 and to identify any new research gaps that future studies should fill. The pertinent literature now provides two methods—qualitative and quantitative—for reaching this objective. The qualitative approach analysis is based on the researcher's views, while the quantitative approach analysis (Di Stefano et al., 2010; Serenko et al., 2009; Gaur and Kumar, 2018) provides an impartial picture of the event and highlights the most important variables (Onwuegbuzie et al., 2012), which typically experiences intellectual bias and is subject to researchers' expertise and interpretations. The evaluation and collection of "quantitative bibliographic data derived from scientific publications" are done through bibliometric analysis (Verbeek et al., 2002). The bibliometric analysis, according to (WuandWu 2017; Marzi et al. 2020), offers a descriptive measurement of the primary authors whose work was published in a certain journal, the most significant topics, and the quantity of citations from the investigated publication.

Additionally, it provides co-citation analysis (Fahimnia et al., 2015; Liu et al., 2015). Its significance is made clear by making it easier to comprehend the trend in citations and enabling connections between various study fields and practical analyses (Ratten et al., 2020). It describes the journal's focus, which depends on actual occurrences and theoretical research. Di Stefano et al. (2010) stressed the need to comprehend citation patterns to find new study areas. A map called a co-citation analysis connects various

intellectual themes through nodes and linkages (Liu et al., 2015). A research connection between documents A and B is established, for instance, if the third research article cites both of them. In order to get insight into academic clusters, it has been found that the more citations there are, the more robust the relationship between them is, and the more clearly, they show a shared subject area (Hjrland, 2013; Fahimnia et al., 2015). Then, after categorizing and looking into the tendencies of intellectual capital, new study areas are suggested by interpreting these findings.

2.2 Progression of Bibliometric Analysis

As earlier stated, we perform bibliometric analysis that depends on bibliographic coupling, co-citation analysis, reference spectroscopy, specific keywords, thematic evolution, etc., and provides accurate analysis of these results (Ratten et al., 2020; Dias et al., 2014; Gonzalez-Loureiro et al., 2014; Martın-de- Castro et al., 2011; Di Stefano et al., 2010). We used a five-step process while doing bibliometric analysis, beginning with a keyword search in the Scopus database that yielded a refined Bibtex file and transformed it into descriptive measurements that illustrated the findings. After analyzing historical and contemporary bibliographic data and research studies in the field of intellectual capital, van Eck and Waltman (2010) and Waltman (2019) used Biblioshiny open-source software with the R package for its capacity to provide the bibliographic data's informative graphical maps and show related topics and approaches. Additionally, the analysis examines prestigious academic journals and offers a clearer picture of how the field of intellectual capital is developing theoretically.

One of the main databases for academic research is Scopus from Elsevier, which we used for our initial investigation (Valenzuela et al., 2017). Selecting all documents pertaining to Intellectual Capital was published in Scopus from 2010 onwards. We track down analogous research performed in the field of Intellectual Capital and overviews of Intellectual Capital accomplishments (Kiessling et al., 2019; Dabic et al., 2020); running a search (Search Query) for the word "Intellectual Capital" in the Source Title led to the categorization of research articles. Search queries yielded 9,924 different types of scientific documents published from 2010 onwards in the Scopus database. After applying the filter of the subject area and keywords, language, and time frame, the search query yielded 1,908 documents. Subject areas, i.e., "Economics, Econometrics and Finance and Business, Management, and Accounting," whereas Keywords, i.e., "Human Capital, Relational Capital, Structural Capital Social Capital, Intellectual Capital Disclosure, Intellectual Capital Management, IC, Green Intellectual Capital, Intellectual Capital Reporting, Intellectual Capital Efficiency, Value Added Intellectual Coefficient, Human Capital Efficiency, and Intellectual Assets," language "English" and time frame "2010 onwards" were used to fetch the relevant documents for the research. For an overview of Intellectual Capital's last 12 years of Scopus growing trend and its publications accomplishment indicators, see Figure 1 and Table 1
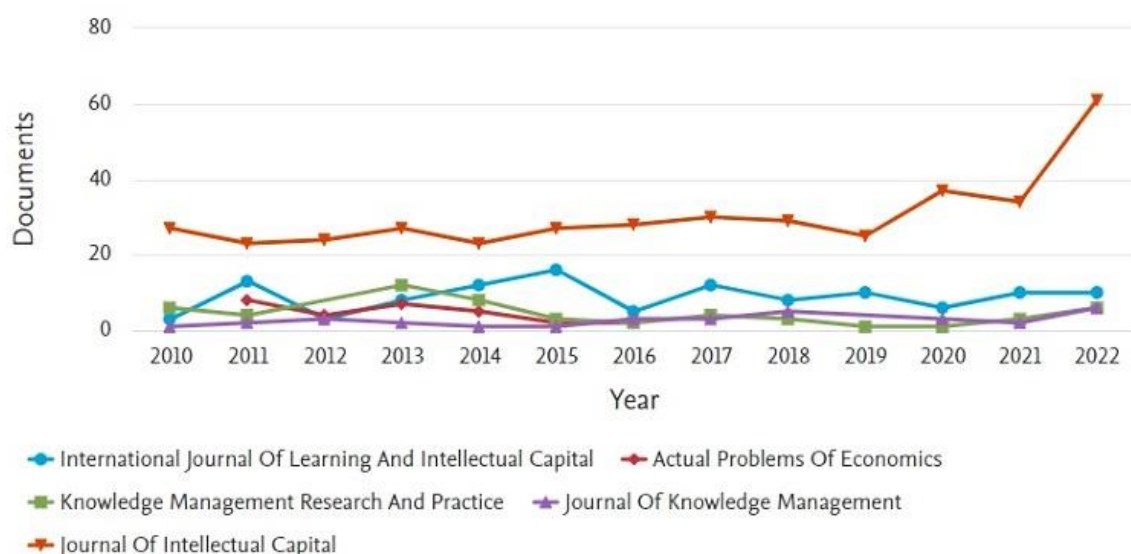

Figure.1 Overview of top journal annual publication in Scopus

Description	Results
Documents	1908
Sources (Journals, Books, etc.)	479
Keywords Plus (ID)	1176
Author's Keywords (DE)	3882

Period	2010 - 2022
Average citations per document	19.64
Authors	3746
Author Appearances	5252
Authors of single-authored documents	242
Authors of multi-authored documents	3504
Single-authored documents	291
Documents per Author	0.509
Authors per Document	1.96
Co-Authors per Documents	2.75
Collaboration Index	2.17

Table:.1 Scopus evolution between 2010-2022

3. Scopus achievement gauges

By evaluating the trend of Intellectual Capital since 2010 of Scopus and commissioning the following international indicators: Academic Journal Guide (AJG) by Chartered Academic Business School Ranking (CABS), Impact Factor (IF), and SCImago Journal Rank (SJR); and, it emerged as a most prominent and reliable database across worldwide.

Following up on the success parameters of the Scopus database, in Figure 1, we exhibit a gestalt of the total number of Scopus scientific production per year. With the help of the amount of citations we received from the academic community, we were able to identify the emerging attentiveness in Intellectual Capital scientific creation in Table 1. Given the obvious delay before an item is mentioned, our selection of 2022 as the final year of the era is a valid depiction (Lopez-Duarte et al., 2016).


Calculations last updated: 09 Oct 2022

Figure.2 Overview of top journal annual citation in Scopus

4. Bibliometric methodology in Intellectual Capital research: prima facia findings

The most prolific authors were subjected to the scrutiny as well. This meticulous cycle provides a bird's-eye view of the research conducted by academic practitioners and scholars from various nations throughout the world, displaying the additional aspect of intellectual capital. Figure 4 displays graphically the Co-Citation analysis of the most productive authors (those with more than 50 citations). In addition, Figure 5's three-plot graph shows how the authorship with author's keyword of scientific publications in Scopus by the nations and their universities. The authors who are most frequently mentioned tend to come from Anglo-Saxon nations, according to their affiliations or universities. The top three universities on the list are from Iran, Australian universities, a Canadian university, and a Spanish institution. Universities from Italy, the USA, Malaysia, India, Taiwan, Sweden, and Denmark are among the other nations on the list. The exponential growth around the world is portrayed, and the diversity of affiliated writers is registered in the Scopus database. We narrowed our bibliometric data and selected the top 50 scientific publications from the database that were most frequently cited. The top 50 articles comprise the database's core and can be viewed as its foundation, outlining the database's and its study field's future (Rialp et al., 2019). Primarily, Intellectual Capital has been explored only in financial firms, emphasizing the association between the concept of Intellectual Capital, knowledge, and its disclosure and reporting practices. For illustration, one of the most cited publications discusses reporting and the disclosure of Intellectual Capital.

Figure. 3 Trend Topic
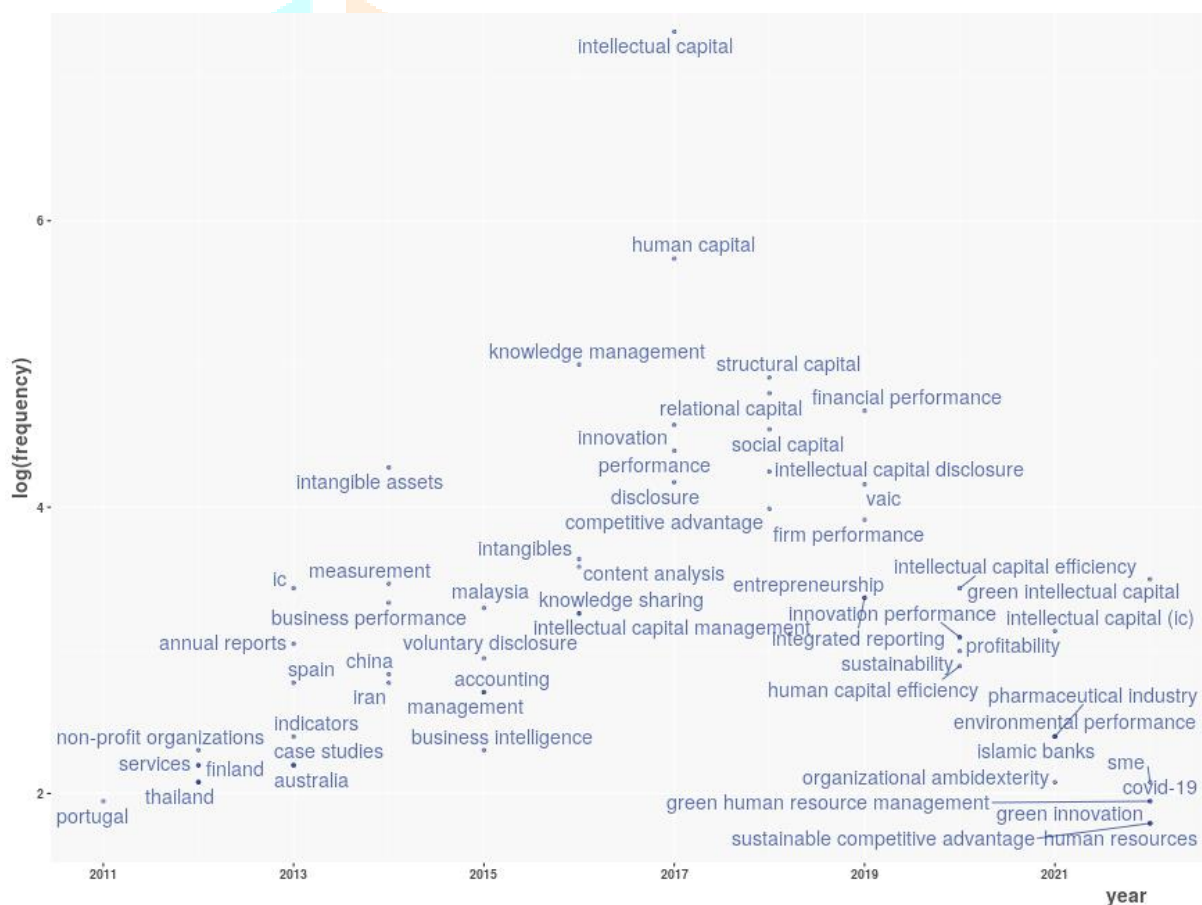
Recent topics have also been closely associated with Intellectual Capital, such as knowledge management, social capital, human capital, innovation, financial performance, disclosure, and others (Figure. 3). Moreover, the foundations of the most cited publication throw light on an A co-citation analysis of references referenced in the most cited scientific work reveals a considerable correlation between the new dimension of knowledge and Intellectual Capital, giving an advantage in comprehending other dynamics of Intellectual Capital. The conclusion and the idea that Intellectual Capital is promoted and sustained through knowledge management methods are consistent with similar study themes.

Surprisingly, Intellectual Capital has been tightly linked with knowledge management, as shown by the overview of the most popular author keywords from 2010 onward. We can recognise research patterns and their dynamics by looking at the most popular terms over the relevant time periods. Intellectual capital is the most frequently used keyword in each of these time periods, followed by human capital, knowledge management, and structural capital. The terms "disclosure," "innovation," "financial performance," and "intellectual property" cast a shadow on them on a global scale. New research fields have been opened up as a result of these keywords; these will be covered in the paragraph that follows. The co-occurrence of author keywords in publications in the Scopus database is visually represented in Figure 3. As expected, "Intellectual Capital" is dominant; however, the remaining terms yielded interesting in the last decade.

Figure. 4 Co-Citation Network (Bibliographic coupling network authors)
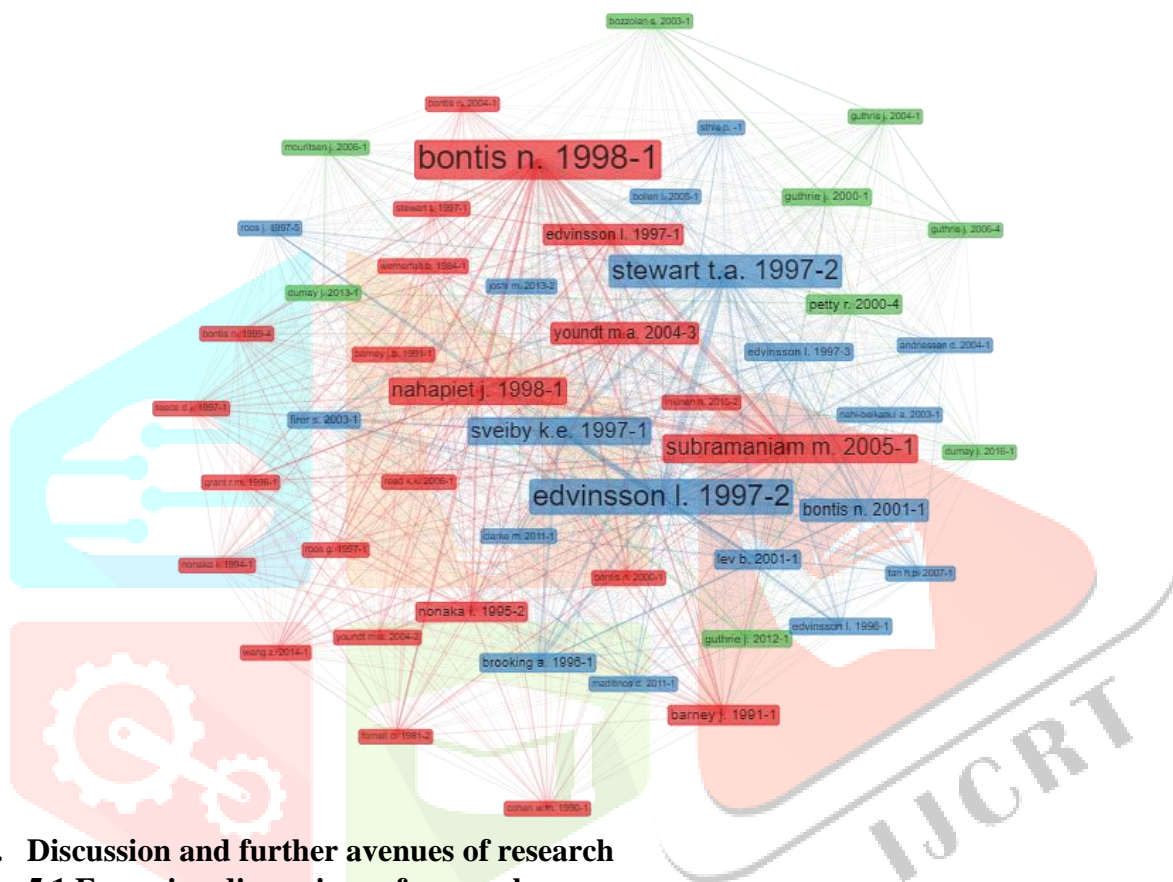
5. Discussion and further avenues of research
5.1 Emerging dimensions of research

An approach for doing a literature review known as "bibliometric analysis" involves analyzing published studies statistically and quantitatively (Broadus 1987). Bibliometrics is "more impartial and trustworthy" than other literature review methods (Aria and Cuccurullo 2017). Bibliometrics reviews are "systematic, transparent, and reproducible" when adequately carried out and reported (Aria and Cuccurullo 2017). The dimension of bibliographic statistics provides a theory that will enhance the tenacity of various practical difficulties. The prophecy of bibliometrics states that related statistical distributions, such as author productivity and literature growth rates, can be used to assess disciplines, manage collections and appraise authors.

5.2 Keywords, Author, and Country Collaboration

Using the Pons and Latapy (2005) proposed Walktrap clustering algorithm, we demonstrate author and university collaboration. This network analysis algorithm has a definite benefit in terms of the reliability of the computed partition and the processing time for extensive networks (Pons and Latapy 2005). Additionally, we employ a 3 field plot based on a "Sankey Diagram" to visualize the relationships between nations, journals, and keywords.

Figure 13 depicts the countries-authors-keywords Three-Fields plot; it is clear that almost authors stressed heavily on the topics of Intellectual Capital, Knowledge Management, and Human Capital in their publications. These were featured in publications created after 1994 that attracted much interest and were pertinent to this significant administrative field, especially in countries like Australia, Italy, Spain, and Finland.
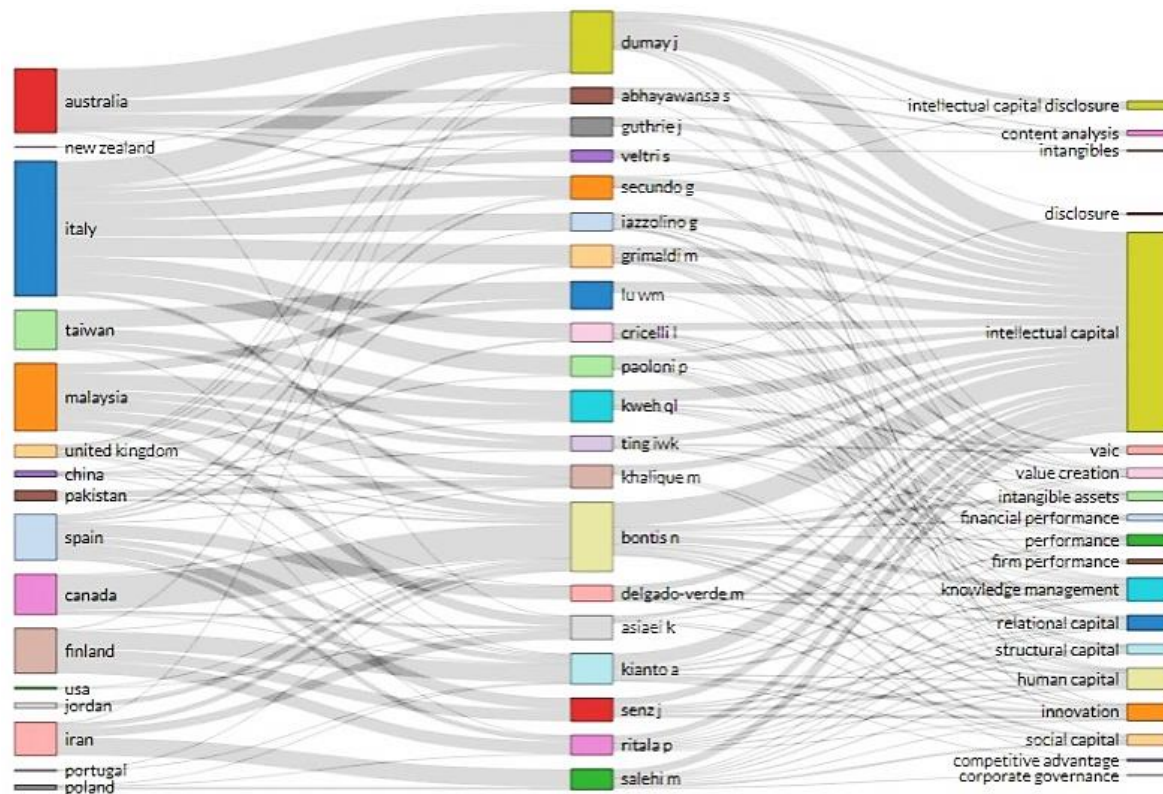
Figure. 5 Three Plot Map

5.3 Bibliographic Coupling

Kessler (1958) developed the bibliographic coupling approach, which is used to map current research trends and find the cluster of the underlying research. Two or more published studies are said to be bibliographically related if they have at least one citation in common (Kessler, 1963). Therefore, bibliographically related studies will probably have the same overarching study theme. According to (Aria and Cuccurullo 2017), we may represent a network of published studies' bibliographic coupling using the following general formula:

$$B_{coup} = A \times A'$$

Here, *A* is a document multiplied by the matrix of references cited, and B_{coup} is made up of the matrix *bij*, which shows the number of references that are common among the articles.

We employed the open-source Bibliometrix package based on R programming software to evaluate bibliographic coupling (Aria and Cuccurullo 2017). Although Bibliometrix provides a few alternatives, we used the Louvain algorithm clustering (Blondel et al. 2008) to find communities in networks and the multidimensional scaling (MDS) approach (Cox and Cox 2000) for information mapping. Blondel et al. (2008) showed that the Louvain clustering algorithm excels all other methods in terms of computation speed, memory-efficient manner, and quality of the communities discovered and makes networks of hitherto unimaginable size accessible to the computational investigation. Normalization techniques in cluster analysis try to compensate for disparities in item occurrence levels, and MDS also improves from normalization (Zupic and Toma, 2015). As a result, we used the "association" metric to normalize the data from bibliographic coupling (Van Eck and Waltman).

The Intellectual Capital research in the fields of business and finance was broken down into four fundamental research clusters by the bibliographic coupling analysis. We considered the 50 most closely cited studies while identifying research clusters. We looked at alternative study counts (such as 100, 150, 200, and 279) for robustness and came up with the same four clusters but in more depth. We, therefore, continued with 50 studies to give them wider prominence.

The bibliographic coupling of the node size and authors indicates the total number of citations of each research documents. Niknejad et al. (2021) argue that the distance or proximity of the studies in the network signifies to what degree the nodes/papers are bibliographically coupled.

5.4 Conformity of Lotka's Law with the study

Lotka's Law is a bibliometric authorship concentration statistic that quantifies the authors' publication in scientific journals.

One of the three fundamental bibliometric rules, Lotka's Law, was created for the first time by him (Lotka, 1926). He proposed the following generic formula:

$$x^n y = k \qquad (1)$$

where y is the frequency of authors making *"n"* contributions each, and k is a constant.

Lotka's Inverse Square Law can be mathematically written as,

$$g(x) = \binom{6}{p}\left(\frac{1}{x^2}\right) \quad x = 1, 2, 3, 4 \qquad (2)$$

where $g(x)$ is the proportion of authors making x contributions.

A generalized form of Lotka's Law was formulated by Bookstein (1976),

$$g(x) = kx^{-n}, \text{ where } x = 1, 2, 3, 4 \ldots \ldots \ldots \ldots x_{max}, k > 0 \qquad (3)$$

where $g(x)$ represents a fraction of authors publishing x articles, k and n are the parameters to be estimated from the data, x_{max} represents the maximum size or value of productivity variable x, and n is usually greater than or equal to 1.

The fundamental premise is that while a sizable number of authors produce just one article, few authors are highly productive in any particular topic. According to Lotka's Law, there are approximately $I = x^b$ authors for every x number of authors that publish a single article. Thus, in a given scientific discipline, a low b value denotes the absence of a committed group of writers, and a high value denotes a higher degree of authorship concentration. Lotka's Law's general formula is as follows:

$$f(y) = \frac{C}{x^b}$$

Here, $f(y)$ represents the frequency with which each author has published a scientific study, and C stands for research field-specific constants. According to this, only one publication will be made by 60% of authors in a given field, followed by two from 15% of authors (1/2² x 0.60), three from 7% of authors (1/3² x 0.60), and so on. Lotka's Law of Scientific Productivity states that just 6% of authors in any discipline will publish more than ten publications. The discontinued line represents the graph that should be comply with Lotka's Law

The study uses Lokta's law to quantify the number of author articles in the Scopus database between 2010 and the present. According to Lokta's law, there is a inverse correlation between the quantity of articles and the frequency with which they are produced (Sun, 2021). According to Lokta's law, 80.3 percent of authors contribute just one article, 11.8 percent contribute two articles, 3.6 percent publish three documents, and 0.5 percent publish four documents, as shown in Figure 6. It also shows that from 2010 onwards, 0.1 percent of
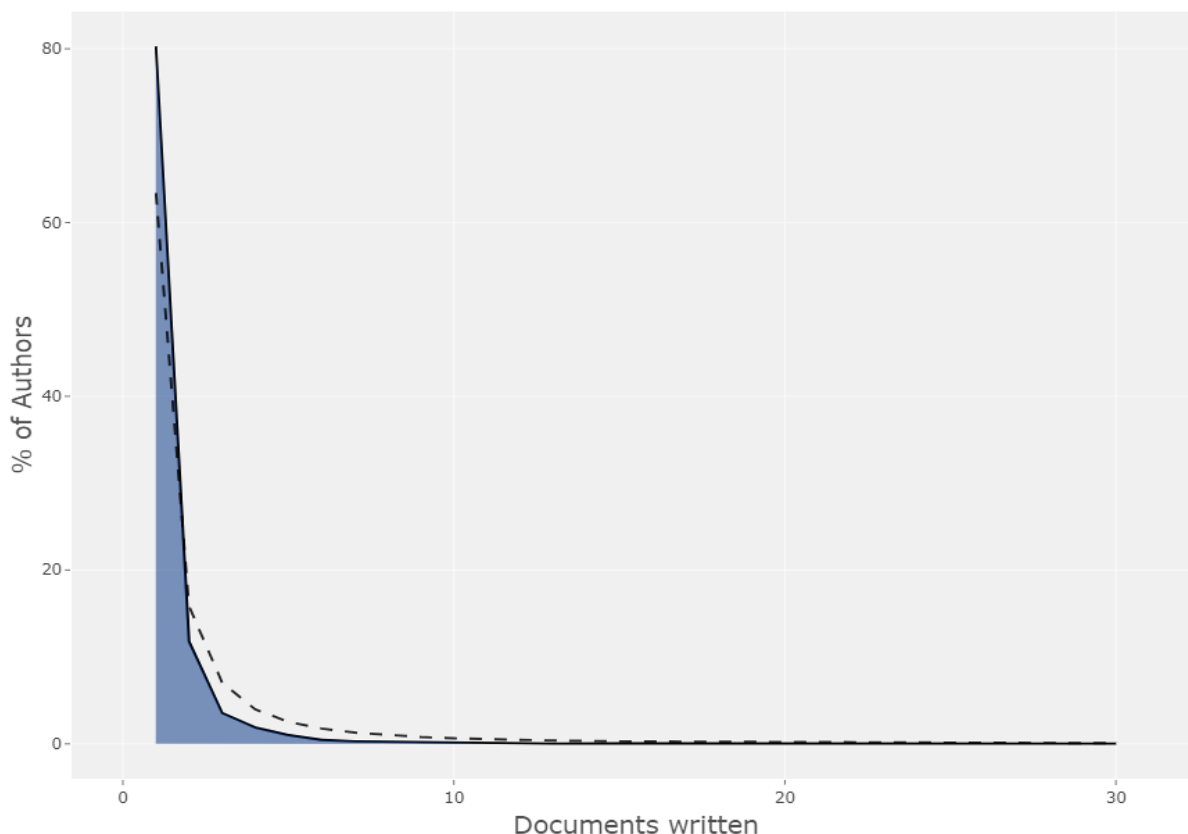
authors published ten articles in the Scopus database.

Figure. 6 Frequency distribution of scientific productivity (**Lotka's Law**)

5.5   Source   Dynamics   and   Bradford's   Laws   application

According to Bradford's Law, "successive zones of the journal holding the exact number of scientific documents on the subject area form the simple geometric series $1: n: n^2: n^3$ if the periodical comprising scientific documents pertaining to the specific subject area are placed in descending order of the number of scientific documents they carried on the subject area" (S. C. Bradford 1948). There are roughly equal numbers of items in each zone overall, and the number *'n'* is nearly 5. Bradford referred to this as the first zone, the "Core" of journals that are primarily focused on the relevant subject. A second zone has the same number of articles as the first zone but more journals, where the relationship between the core and the first zone's number of journals is *'n'*, whereas that between the core and the second zone's number of journals is *'n^2'*.

Bradford is a semi-log graph called distribution that is used to show data in an exponential relationship. This semi-log graph is a lin-log graph that uses a linear scale on the y-axis and a logarithmic scale on the x-axis. As seen in Fig. 7, the distribution's later portion has a close-linear connection

Suppose $ox_1 = r, x_1x_2 = x_2x_3 = s$,

and log values of α, β, γ correspond to ox_1, ox_2, ox_3,

then $\log\alpha = r$, $\log\beta = r + s$, $\log\gamma = r+2s$.

Let $10^s = n$, then $\alpha: \beta: \gamma = 1: n: n^2$
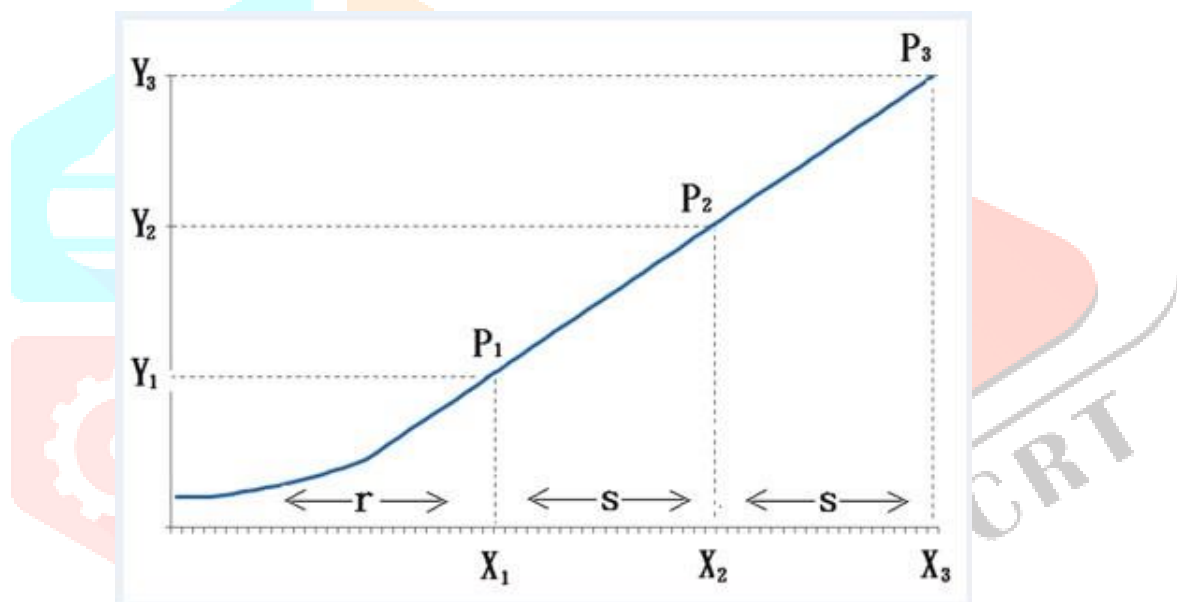

Figure. 7 Bradford distribution. X: log of accumulated journal count Y: accumulated article count

[Source: Bradford, S. C.: Sources of Information on Specific Subjects. Engineering]

As an example, using the Law made it possible to ascertain how frequently pieces on a particular topic appear in journals with a variety of topics. However, in Bradford's opinion, it is normal for a periodical devoted to a particular topic to include a non-subjective article intended for a different topic.

The primary publications that disseminate works on Intellectual Capital in the field of social science are identified using Bradford's Law. The journals are split into three Zone by Bradford's Law (Von Ungern-Sternberg 2000) and the primary source for articles about Intellectual Capital is Zone 1. This zone is the nucleus representing journals with vital publications.

The study uses Bradford's law to explain how titles on a specific topic are distributed among journals. According to Singh et al. (2016), the law is based on the idea of central production zones, showing that there are diminishing returns when the research article is exhaustively published.

The law classifies three zones, with Six of the 479 journals were determined to fall under core zone 1; the remaining journals were found to be in zones 2 and 3. As a result, the top 10 journals serve as the primary publishing platforms for works on Intellectual Capital. Bradford's law of scattering indicates that the Journal of Intellectual Capital, International Journal of Learning and Intellectual Capital, Knowledge Management Research and Practice and Journal of Knowledge Management are the core sources of Intellectual Capital, as shown in Figure 8. The growing output of journals from one zone to the next zone is predicted by Bradford's law of scattering (Bradford, 1985; Swain, 2013).
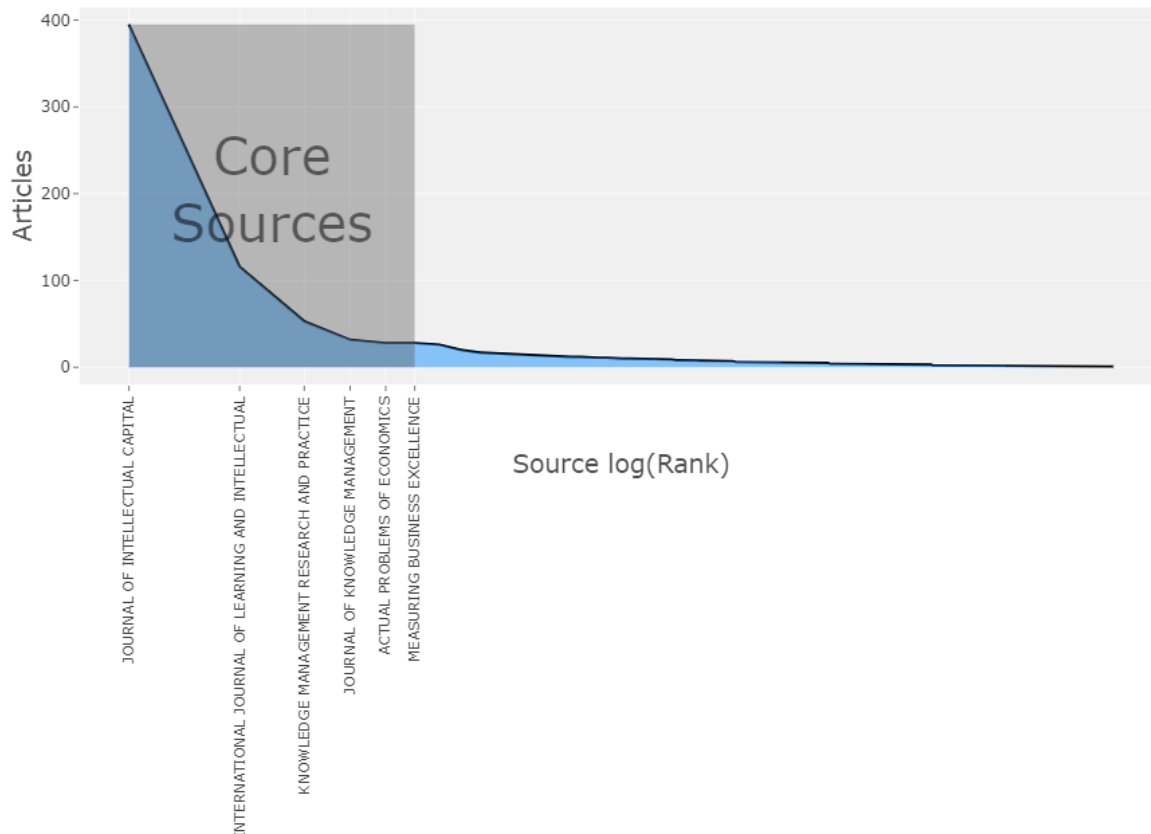
Figure. 8 Bradford Law

5.6 Thematic Analysis and Evolution

In this section, we concentrated on the conceptual structure of Intellectual Capital's publications. As we previously stated, this kind of analysis aids in understanding the subjects the journal covers and identifying which are the most significant and recent. Finding the conceptual structure may also be helpful for tracking the development of the research topic through time (Dumont Oliveira 2018).

The fundamental concept is that a term co-occurrence network can be used to visualize phrases that co-occur in a document, such as keywords, terms derived from titles, or terms found in abstracts. The similarity of two terms defined as equivalence is present in each cell outside the primary diagonal of a co-occurrence matrix, which was the starting point for our analysis (Callon et al. 1991):

$$eqv_{ij} = \frac{n^2_{ij}}{n_i \times n_j}$$

With 'n_{ij}' as the quantum of scientific publications in which two terms, 'i' and 'j' co-occur, 'n_i' and 'n_j' are the quantum of scientific publications in which each one appears. This measurement assesses the degree to which two terms are related using values in the interval [0;1]. The co-occurrence matrices can be represented graphically as undirected weighted networks and can be thought of as adjacency matrices. We performed a community detection based on the straightforward center algorithm technique for each subperiod co-occurrence matrix (Coulter et al. 1998). With the use of this analysis, it is possible to identify subgroups of strongly related terms, where each subgroup relates to a particular area of interest or study theme/topic of the examined collection. Following completion of the research, the findings can be represented in a so-called strategic or thematic diagram (Cobo et al. 2011), where the Callon centrality 'ct' and Callon density 'dt' of each cluster/theme 't' are taken into account:

$$C_t = 10 \times \Sigma eqv_{i_t h_{t`}} \qquad\qquad d_t = 100 \times \sum \frac{eqv_{i_t j_t}}{k_t}$$

'i_t' and '$h_{t`}$' are terms from distinct topics, while it and '$h_{t`}$' are terms from the same topic. 'k_t' is the total number of terms in a topic. Callon density can be seen as a measure of the topic's evolution, while Callon centrality can be interpreted as the topic's relevance within the entire collection. Depending on the quadrant they are positioned in, the graphical representation enables the definition of four typologies of themes (Cahlik 2000):

- Themes in the upper-right quadrant are known as the motor themes, characterized by high centrality and high density, meaning that they are developed and essential for the research field (Akter et al., 2021);

- Themes in the lower-right quadrant are known as primary and transversal themes, characterized by high centrality and low density, meaning that these themes are essential for a domain and they deal with broad subjects that cut throughout the field's various research areas;
- Themes in the lower-left quadrant are known as emerging or declining themes, with low centrality and low density, meaning that they are weakly developed and marginal;
- The themes in the upper-left quadrant are referred to as the highly developed and isolated themes, with well-developed internal ties (high density) but insignificant exterior links (low centrality), indicating that they are of minimal value for the field.

The themes in the upper right quadrant, "Human Capital" represent high centrality and high density, meaning that they are developed and essential for the research field, as indicated by the node size. Whereas the themes in the lower right quadrant, that are "Intellectual Capital Disclosure" and "Intellectual Capital" represent high centrality and low density, meaning that these themes are essential for a domain and they deal with broad subjects that cut throughout the field's various research areas, as indicated by the node size. If we move toward the lower left quadrant, "Green Intellectual Capital" represent low centrality and low density, meaning **Figure. 9** Thematic Mapping of Intellectual Capital (2010-2022)
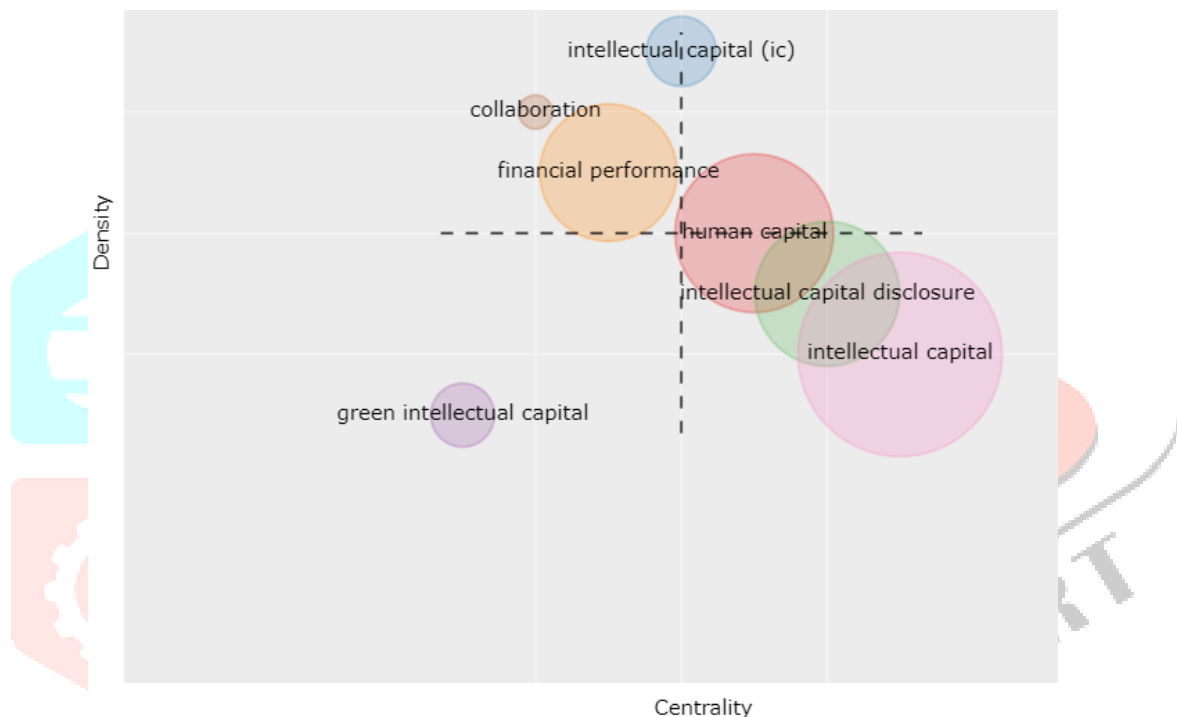
they are an underdeveloped and marginal research area. In contrast, in the upper left quadrant, "Financial Performance" and "Collaboration" referred to as the highly developed and isolated themes, with well-developed internal ties (high density) but insignificant exterior links (low centrality), indicating that they are of minimal value for the field, as indicated by the node size.

Figure. 10 Thematic Map Network
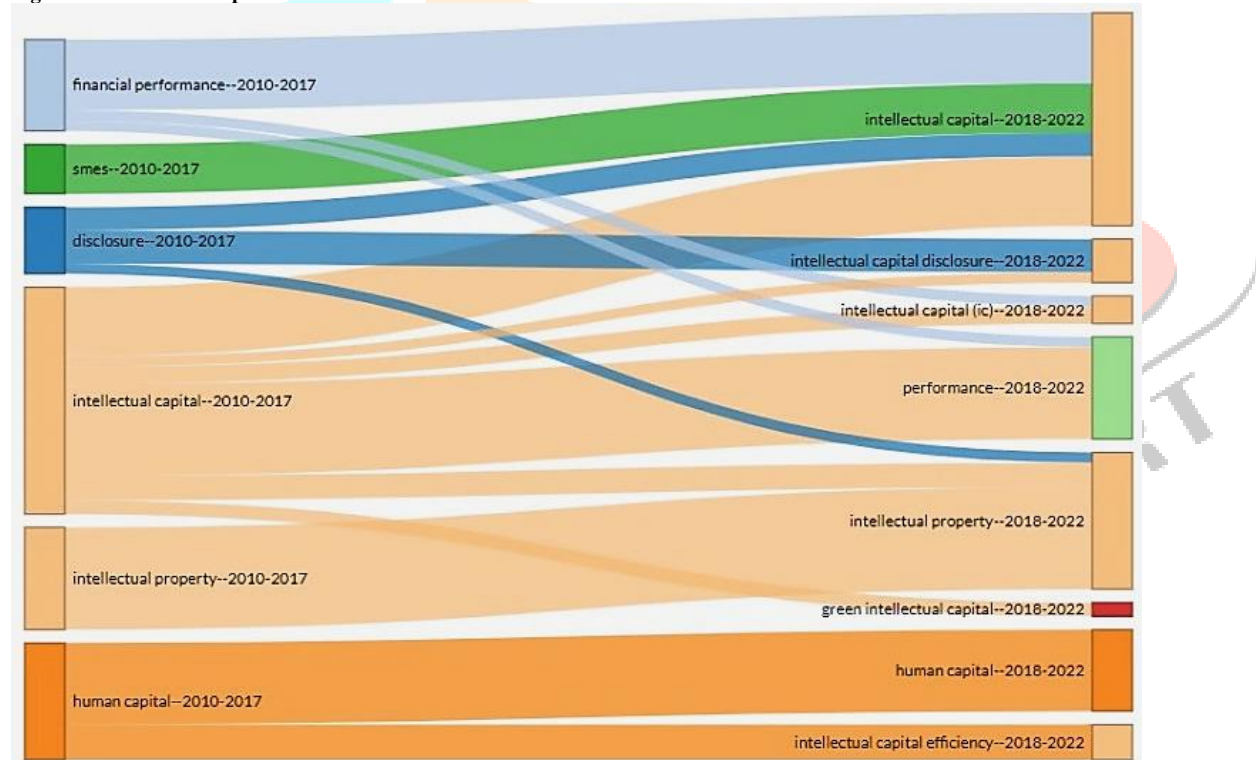
Figure. 11 Thematic Evolution

The chronological history of the study themes on intellectual capital can be seen in Fig. 11, where we evaluate each sub-period independently. A so-called Sankey diagram is utilized to show how the many themes were connected and developed over the years. A modified version of the Inclusion Index (II) (Rip and Courtial, 1984) was used to weight the various themes, accounting for the frequency per decade of each keyword that appeared in a theme.

More so than the creation of new lines, the problems developed in past decades have become specialized in recent years. For instance, studies on intellectual capital focused on the company's financial performance and the idea of intellectual capital's multidimensionality. From a methodological standpoint, in addition to empirical research.

5.7 Conceptual Structure Map developed from the Multiple Correspondence Analysis (MCA)

The bibliometric study includes looking at the essential terms in the titles and abstracts of the papers as well as the keywords. In order to accomplish so, it either employs network analysis, correspondence analysis (CA), or multiple correspondence analysis (MCA). Visualizations of the conceptual layout of a two-dimensional plot are provided by CA and MCA (Aria & Cuccurullo, 2017). Here, MCA is used to construct

a conceptual framework of the subject area in order to identify clusters of documents that express common themes, and the outcomes are exhibited on a two-dimensional map (Aria & Cuccurullo, 2017).

The multiple correspondences analysis-derived conceptual structure map groups the keywords while considering their homogeneity within the network. The partitioning of the popular keywords into two groups is shown in Figure 12. The keywords that are most frequently used in research publications with common research themes are displayed in Cluster 1 in the lower part of the conceptual structure map.

Figure. 12 Conceptual Structure Map

Keywords such as "Knowledge Based Management" and "Human Capital" and "Decision Making" and "Performance Assessment" and "Innovation" and "Sustainable Development". The necessity for a thorough study of knowledge base management, human capital, and other important areas of intellectual capital is discussed in these articles with a larger perspective on the phenomena of intellectual capital based on the triviality of its effects on financial performance. On the other hand, cluster 2 on the top of the conceptual structure map presents the keywords such as "Knowledge Economy" and "Investment" and "Competitive Advantage". These keywords indicate that the microstructure of Intellectual Capital is to provide valuable information and insight to the stakeholders so that the best possible sustainable development and gamesmanship are captured.

The keywords in both clusters that are close to the center show that they have recently attracted a lot of study attention; the research theme is narrower when the keywords are closer to the edges of the clusters (Aria & Cuccurullo, 2017).

5.9 Historiographical Analysis

According to Garfield (2004), bibliometrics also conducts historiographic analysis [histResults – histNetwork(M, n = 20, sep = ;)]. As seen in Fig.13, the histPlot function plots a historiography, which is a network of chronological citations, which displays a [histPlot(histResults,size=FALSE)] chronological map of the most pertinent citations from a bibliographic collection.

Historiography, according to Encyclopedia Britannica, is the writing of history based on a critical analysis of particular knowledge sources. A historiographic map, or articles in the current section, illustrates how ideas flow over time from one source of information to another (see Sarnecky's work from 1990 in the context of nursing as a research topic). To better comprehend and visualize the historical development of research ideas in Scopus, we have created a historiographic map of the most important publications of the journal.

Figure. 13 Historiographic Network

The historical map of the top 50 articles in Scopus is displayed in Figure 13. Our analysis of the map reveals two major research streams. An area of study that primarily focuses on the connection between intellectual capital and firm performance and/or competitive advantage is that of (Bontis et al. 2000; Bontis and Fitz-enz 2002; Clarke et al. 2011; Chen et al. 2005; Pew Tan et al. 2007; Joshi et al. 2013; and D zenopoljac et al. 2016). In addition to such empirical investigations of the aforementioned relationship, review-based research is also being done to increase funding for this field of study (Inkinen, 2015). The measurement of intellectual capital is a significant sub-theme of this area of research (Nazari and Herremans, 2007; Keong Choong, 2008).

The reporting of intellectual capital is the main subject of the second research stream in the Scopus research corpus (April et al., 2003; Dumay, 2009). In this line of research, we noticed a trend toward topicality that involves reporting on the disclosure of intellectual property (Abeysekera, 2006; Dumay, 2016). Value addition and value creation were other significant subthemes that emerged as a research topic (Bismuth and Tojo, 2008; Marr et al., 2004). Figure 12 also implies that there is a subset of knowledge sources inside the Scopus corpus that connects these two primary streams of research (Abdolmohammadi, 2005; Bounfour, 2003). In conclusion, the historiographic map demonstrates that there are two primary research streams with each stream having a single subtheme.

Although these two streams have grown concurrently, the second stream has gained more scholarly attention than the first, leading to a stronger concentration on it. Another finding is that between 2004 and 2006, few Scopus publications connected these two important research streams.

5.10 Factorial Analysis of Document

The topic dendrogram in Figure 14 represents the hierarchical order and the relationship between the keywords generated by hierarchical clustering. The cut in the figure and the vertical lines facilitate an investigation and interpretation of the different clusters. As stated by Andrews (2003), does not intend to find the perfect level of associations between clusters, but it aims to estimate the approximate number clusters in order to facilitate further discussion.

The factorial analysis of the documents using correspondence analysis as topic dendrogram is shown below. The topic dendrogram shows the clustering of documents on Intellectual Capital over the past decade. The evolution of research for Intellectual Capital shows positive trends. The count of publications indicates considerable growth of publications on this subject. The topic dendrogram presented in Figure 14 indicates the use of Value-Added
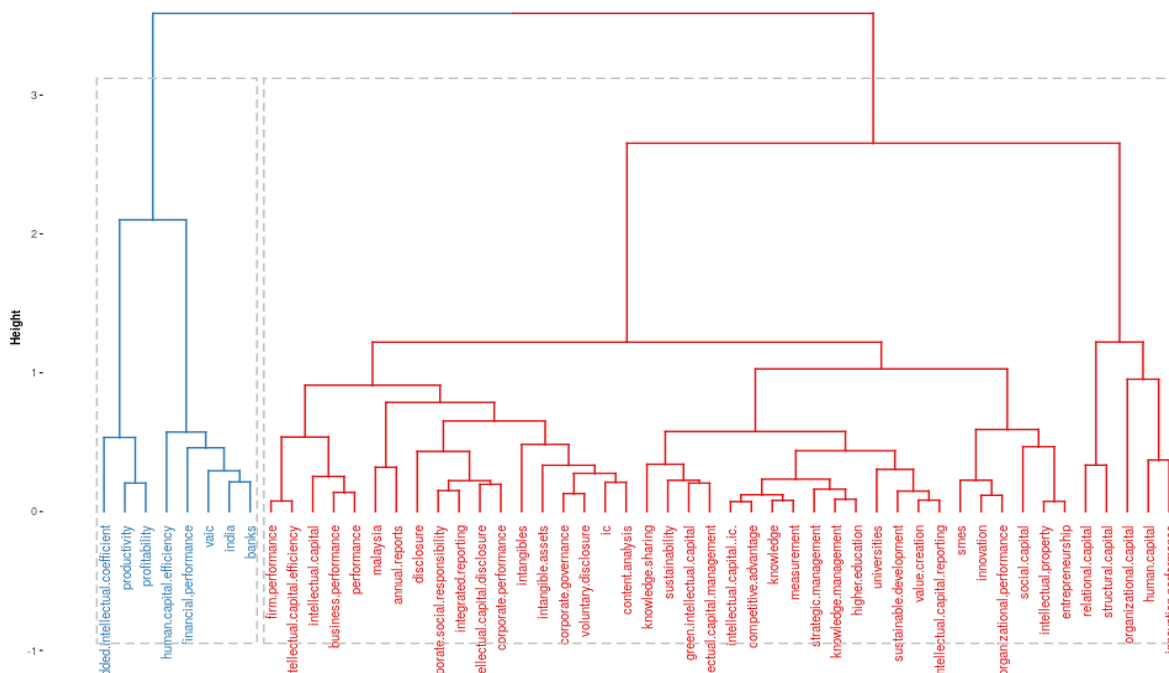
Figure. 14 Topic Dendrogram

Intellectual Coefficient (VAIC), Financial Performance, Human Capital Efficiency, and Bank in very few researches. This implies a critical research gap and provides crucial space for future researchers to investigate Intellectual Capital, with a prominent avenue for future research being VAIC and Human Capital Efficiency.

The geographical analysis implies that most research efforts for addressing Intellectual Capital are concentrated in Italy, followed by Australia, and very minimal efforts are made in the Indian sub-continent.

6. Conclusion
6.1 Contribution

It is only recently that bibliometric analysis has been used to Intellectual Capital, and techniques like performance analysis and scientific mapping analysis have simplified statistical analysis of scholarly publications across disciplines. The study makes an effort to examine the 1,908 documents that were published in different publications between 2010 and 2022. Journals like the Journal of Intellectual Capital, International Journal of Learning and Intellectual Capital, Knowledge Management Research and Practice, and Journal of Knowledge Management, among others, have made contributions to the subject of knowledge management, according to the study. The study can assist intellectual capital scholars in identifying new patterns and trends in publishing. The study can help people understand how bibliometric analysis can be used in other domains utilizing a variety of techniques, including

The findings indicate that Knowledge Management and the concept of Intellectual Capital are related, but less so than in the past. In addition, the following three categories of new research trends can be suggested:

(A) Intellectual Capital and Human Capital;

(B) Intellectual Capital and Disclosure and

(C) Intellectual Capital and Intangible Assets,

additionally, new fields of study including cybersecurity and intellectual capital, as well as business research techniques.

The field of intellectual capital research is still developing. As previously stated, the field has shifted from a management focus on the production and preservation of Intellectual Capital, including leveraging, away from a focus on the valuation of Intellectual Capital and other accounting viewpoints.

(A) Knowledge Management,

(B) (ICT) information and communication technologies and

(C) emerging ICT-enabled business structures and capabilities.

Businesses that build and retain high levels of intellectual capital frequently do so by utilizing innovative people resources and interpersonal connections to produce new technologies that open up fresh revenue streams.

6.2 Managerial implication and conclusion

For managers and scholars, the report makes a number of recommendations and consequences. To begin with, managers can utilize the data to comprehend the issues faced by knowledge management specialists and the solutions provided by scholars in knowledge management journals. The study can also assist managers in learning about the most recent advancements in the fields of intellectual capital and knowledge management as well as how these advancements are crucial to the success of knowledge management. Third, this study can be used by academics to comprehend how to assess academic outcomes using different metrics. Fourth, the study can help academics and researchers in the field of intellectual capital better comprehend the topics, trends, and patterns that are currently emerging in this field. Fifth, the study examines the collaboration of writers and nations in the field of intellectual capital. The researchers can utilize this information to work specifically with the authors and nations that are the most productive.

This paper provides an overview of previous and present themes connected to intellectual capital using bibliometric analysis. For instance, one of the hottest subjects right now is human capital. This issue is current in the age of digital transformation since it involves the growing use of robotics and artificial intelligence, which changes how human resource management is done.

On the management side, over the past 10 years, a lot of practitioners have been interested in intellectual capital as they get more familiar with its practical applications in the real world. Large corporations have been well studied, but higher education institutions and small and medium-sized businesses (SMEs) haven't been looked into as thoroughly in this context. A significant research opportunity is provided by this. For instance, how do large enterprises, SMEs, and higher education institutions use intellectual capital while creating value? Large publicly traded corporations continue to practice intellectual capital disclosure, and they are becoming more eager to share their information with prospective stakeholders.

Another subject that has been covered in writings is the disclosure of intellectual capital. Despite the fact that this subject has been studied in several nations, it stands to reason that revealing this information can raise a company's value. The value produced by intellectual capital has been the focus of managers' attention and practical efforts. The three basic components generally regarded as the foundation of a successful company—human capital, structural capital, and relational capital—have been broadly acknowledged by scholars to make up intellectual capital. This shows that studies could spark discussions about Intellectual Capital disclosure and whether it ought to cover all three pillars or just one. Future studies might also compare how Intellectual Capital is disclosed in large firms, SMEs, and higher education institutions.

In a business and managerial setting, intellectual capital disclosure takes place and invokes a combination of tangible and intangible assets. Intellectual capital used to be viewed as only an intangible asset, but as the economic system has developed, these two words are no longer seen as being equivalent. Since the economy is transitioning from a knowledge-based economy to an era of digital transformation, intangible assets are currently essential for a corporation. Although knowledge was once seen to be the key to every organization's success, technology is now used in tandem with knowledge in more and more situations. The definition of intellectual capital is also more nuanced.

It can be recognized as the intertwined combination of tangible and intangible assets. Managers are still focusing on human beings - employees and customers - but are also encouraging the use of new technologies to facilitate their tasks.

The border between human and artificial intelligence is too unpredictable to allow us to question the role of Intellectual Capital in this realm. However, by connecting technology and AI with

business management scholars, new research could be conducted on this topic. This is the new research basis of the future, which involves more interdisciplinary projects and further

Limitation

It is important to talk about the bibliometric study's shortcomings. The information for the study was first taken from Scopus. Despite being the largest abstract and citation database for papers from a variety of subjects, Scopus does not include information on the Social Science Citation Index or impact factor (SSCI). In order to cover the important papers for evaluation, future studies should just extract the bibliometric metadata from Scopus. Second, the study rejected additional tools like VOSviwer, CitNetExplorer, and SciMat to produce better data visualizations and instead chose Biblioshiny as a software tool to undertake science mapping and performance analysis of the Intellectual Capital literature. Third, the production of articles may have varied during the course of the 2010–2022 bibliometric analysis; Therefore, future studies should examine the bibliometric data for each time period independently. Fourth, the study was restricted to a small number of keywords, including "Human Capital Efficiency, Relational Capital, Structural Capital Social Capital, Intellectual Capital Disclosure, Intellectual Capital Management, IC, Green Intellectual Capital, Intellectual Capital Reporting, Intellectual Capital Efficiency, Value Added Intellectual Coefficient, Human Capital Efficiency, and Intellectual Assets, including Knowledge Acquisition, Organizational Learning, and Knowledge Creation, among many others have been."

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