Intellectual capital and the firm: evolution and research trends

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Abstract

Purpose – The phenomenon of intellectual capital in the firm has been deeply researched and immensely debated in the management literature in recent years. After three decades of evolution, it has become established as a mature field of research. At this point, a review of its theoretical foundations and current and future evolution provides us with the state of the art of intellectual capital in the firm. The purpose of this paper is to present a quantitative review of the existing literature on intellectual capital in the firm.

Design/methodology/approach – In this paper, the authors present a quantitative review of the existing literature on intellectual capital in the firm. To do so, the authors searched the JCR-SSCI database from 1990 to 2016 and identified 553 citing documents; these were split into three main periods in order to identify the interactions and path dependencies existing between different foundations of research. In addition, areas of current and future research connected with the theoretical foundations were identified. For these purposes, the authors used both co-citation analyses as well as bibliographical coupling.

Findings – In this paper, three main stages of IC evolution have been identified with the main topics and research frames, as well as their path dependencies. Additionally, four main areas of current and future development of IC have been identified: IC measurement, IC in new business models, IC disclosure, and its role in social capital and human resource practices.

Research limitations/implications – The present bibliometric study is a quantitative review of papers published in the Web of Science database.

Originality/value – By its dimensions – broad academic disciplines and longitudinal character – this bibliometric study constitutes a new quantitative review of the IC discipline, both drawing its intellectual evolution in the last decades, and showing current and future research trends in IC and the firm.

Keywords State of the art, Co-citation analysis, Path dependence, Bibliographical coupling,
Quantitative review

Paper type Literature review

1. Introduction

Intellectual capital has become a vibrant topic in the management research field and more specifically in strategic management and accounting. Originally coined by Galbraith (1969) and disseminated by Stewart (1991) among management scholars during the nineties of the twentieth century, the use of the word “capital” to denominate all of these types of intangible or knowledge assets was a result of the economic roots of the concept, which was used to describe the company’s value-creation process based on this bundle of assets. Nevertheless, the term “capital” has proven controversial (Martin-de Castro et al., 2011).

The rise of a “knowledge-based economy” (Teece, 1998; Dean and Kretschmer, 2007) or a “post-capitalist society” (Drucker, 1993) in the last decades of the twentieth century put the focus on knowledge and intellectual capital as major production factors responsible for the economic and financial prosperity of nations as well as key drivers of companies’ sustained competitive advantages. In this way, the management of IC has become a key management task.
Especially coming from the resource-based view (Barney, 1991), scholars highlighted the strategic character of IC responsible for sustained competitive advantage due to its rareness, value, as well as difficulties in its imitation or substitution.

Considering IC and the firm as a research tradition, two main features can be highlighted. The first one is its eclectic character in which different disciplines in the management literature frame it from very different perspectives (Carayannis et al., 2014) and units of analysis (Pedro et al., 2018). The second one is its recently reached maturity stage, as stated by some scholars from different traditions (Martin-de Castro et al., 2011; Martin-de Castro, 2014; Secundo et al., 2018). Following Vogel and Güttel (2013), previous IC features recommend the development systematic and quantitative literature research in order to structure IC research stream evolution and recent trends to current IC academic eclectic debate, as well as to provide some useful management orientation and practice.

In this vein, qualitative and quantitative review and analysis of the existing literature have shed some light on this research field (see e.g. Serenko and Bontis, 2004; Serenko et al., 2010; Inkinen, 2015; Pedro et al., 2018). However, there are no previous studies that have presented a comprehensive and structured look at the evolution of and future trends in IC. This is due to their narrow focus on a few academic journals in the intellectual capital/knowledge management fields or only on empirical research and their descriptive analysis of only the most prominent publications, authors, journals, etc.

Research on IC is still fragmented and far from conclusive. As Serenko and Bontis (2004, 2013) and Dean and Kretschmer (2007) state, although the interest in and popularity of IC have increased exponentially over the last two decades for both academics and practitioners, some of the initial general reviews of IC, as Martin-de Castro et al. (2011), were sometimes subjective or based on personal impressions. Nevertheless, more recent works such as Dumay et al. (2015), focusing on the IC and the public sector, or Buenechea-Elberdin (2017), focusing on IC and innovation, offer rigorous, systematic and structured literature reviews, however; they are narrow in scope. Consequently, there is a need to identify the dominant factors and the intellectual evolution over time of this important management research stream.

In that sense, our research proposes a quantitative, structured, longitudinal review of intellectual capital incorporating different theoretical foundations coming from different disciplines and their interactions and evolution over time. This provides a very useful and novel framework for understanding the nature and implications of intellectual capital in the firm. In addition, an analysis of the main areas of future development in the field can give the scientific community an opportunity to continue analyzing future lines of research into intellectual capital. As indicated by Ramos-Rodriguez and Ruiz-Navarro (2004) and Vogel and Güttel (2013), studies offering this kind of quantitative review are appropriate and relevant when disciplines and research fields reach a certain degree of maturity.

The aforementioned necessity to focus on the evolution and the main recent trends in the field of IC is a generalized claim in strategic management. There is an excessive fragmentation of research that impedes the appropriate consolidation and advancement of this relatively new discipline, which suffers from a lack of integration and coherent theoretical frameworks, organizational phenomena and scope.

Thus, a longitudinal and more comprehensive approach is needed that includes a complete and updated period of time (1990–2016). Using different perspectives of social sciences, such as management, business, economics and accounting, and analyzing their interactions over time could provide a useful framework for understanding the nature and effects of intellectual capital management in the firm.

The aim of this paper is twofold. First, we provide a comprehensive overview of the field of intellectual capital. To do so, we conduct a quantitative review of the existing literature on IC in the firm, identifying its intellectual foundations from a longitudinal perspective and analyzing the existence of interactions between different research traditions in the same
period and subsequently over time. Second, we identify the major areas of future research that are connected to the theoretical foundations identified. To this end, we use two bibliometric techniques: co-citation analysis to show how the combination of different perspectives has developed research areas and how these different areas are conceptually linked, and bibliographic coupling analysis to study future research trends in IC. As Jones and Gatrell (2014) remarked, this bibliometric work helps to critically evaluate the understandings within the field of intellectual capital in the firm, showing current and new avenues for future research in the area of Management.

The following section of this paper explains the data gathering and bibliometric and statistical methods used to obtain the documents used in the bibliometric analysis. Section 3 shows the main results obtained, and Section 4 analyses and discusses in its first sub-section the theoretical foundations of intellectual capital in the firm identified with the co-citation analysis. The sub-section following that presents and discusses the future research trends identified in the field, based on the bibliographical coupling carried out in the last six years (2010–2016). Finally, a discussion, conclusion, limitations and future research section is included.

2. Data and method

The degree of maturity reached by IC as an academic discipline, combined with its multidisciplinary approach and the heterogeneous nature of the topics included, made it advisable to perform quantitative and integrative bibliometric reviews and analyses of intellectual capital in the firm. We included a variety of academic journals from different social science perspectives, from 1990 to 2016, which provide the research community with a better understanding of the evolution of intellectual capital, its main currents and its future trends, as stated by some authors (Durand et al., 2017; Martín-de Castro, 2014; Serenko et al., 2010).

Although the utilization of bibliometric reviews in management is relatively new, the origin dates back to mid-20th century (Garfield, 1964; Kessler, 1963), the usefulness and relevance of this type of studies has grown because the majority of academic disciplines have since evolved rapidly and have generated huge amounts of research outputs and publications. As Vogel and Güttel (2013) highlighted, bibliometric reviews overcome some of the drawbacks of other literature review methods in scientific disciplines wherein a large variety of topics, methods, evidence and theoretical frameworks come into play. Although in-depth qualitative reviews have clear advantages, they tend to reflect the idiosyncrasies of the reviewers, who usually focus on a very specific topic. Also, the great quantity of literature that currently exists makes bibliometric analyses helpful to delimit the scope, evolution and trends of an academic discipline, by aggregating a large amount of bibliographic data to provide unbiased analyses and results.

In this study, a quantitative review of the existing literature on IC in the firm is carried out in order to identify, from a longitudinal perspective, its theoretical foundations and current and future research trends.

In order to undertake the bibliometric analysis, we have followed a sequence of steps (Figure 1). First, we established the specific research question that we tried to answer in the research and the method that would fit best for this objective. Since in this research we aim to identify both the main theoretical bases of intellectual capital and future research lines, we have applied two methods: co-citation analysis and bibliographical coupling.

The second stage is the collection of data. We collected data from the Thomson Reuters Social Science Citation Index (SSCI). In March 2017, we initially selected all documents that included the search term “Intellectual capital” in the title, abstract, keywords of the author and keywords defined by Web of Science, as this is the technical term generally used in the literature, and we thus obtained 2,687 documents. First, we refined the search to publications on science websites that were related to the perspective of our research – IC
and the firm: management (1,297), economics (420), information science library science (348), operations research management science (212) business finance (153), social science interdisciplinary (133), and planning and development (54). This gave us a total of 2,182 documents. Second, we focused on papers published in impact journals, as these were peer reviewed; this reduced the sample to 960 documents. Finally, the number of publications on intellectual capital has grown exponentially since 1990 and few academic papers appeared before that, so we focused on papers published between 1990 and the end of 2016.

We then performed an in-depth review of these papers in two independent rounds to filter out those documents that were not in fact related to intellectual capital. For instance, there were studies that had been done at the regional level that was more closely related with macro-variables than with a corporate competitive perspective, or documents that cited the term “intellectual capital” but they did so to use it in a theoretical or empirical way. This second round left us with 553 documents (see Table I).

Bibliographic techniques allow us to identify trends, theoretical bases or groups of papers based on similarities in the articles cited by them. As citation habits change over time, especially in these fast-growing research lines, these techniques perform best within a limited time frame, so we split the sample into sub-periods, similar to the approach used in previous studies (Ramos-Rodriguez and Ruiz-Navarro, 2004; Ronda-Pupo and Guerras-Martin, 2010; Vogel and Güttel, 2013). Additionally, this research aimed to identify interactions and existing dependencies between the different foundations of the investigation. An analysis of co-citations allowed us to determine the evolution of the theoretical foundations of intellectual capital, as well as the changes that took place in the citations over time. Using the technique of bibliographic coupling, the main areas for the future development of intellectual capital were also identified.

Table I. Summary of the sample

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Note: aThe sum of the columns is larger than the total due to duplicities in the cited documents across periods.

Source: Adapted from Zupic and Čater (2015)
In order to conduct the bibliometric analysis, software bibExcel has been used, with data from Web of Science. This software performs bibliometric calculations based on the similarities of matrices of cited documents in the case of the analysis of co-citations and the documents from the field of study (citing articles) to perform the bibliographical coupling.

As Figure 2 shows, the number of articles on intellectual capital has grown exponentially since its beginning. With fewer than 10 publications per year in the early 1990s, the number of publications has exceeded 50 since 2005. This, together with the broad scope of IC research, led us to divide it into three sub-periods: 1990–1999; 2000–2009; 2010–2016, because citation habits change over time, as shown by other previous bibliometric studies (Diez-Vial and Montoro-Sánchez, 2017; Ramos-Rodríguez and Ruiz-Navarro, 2004; Ronda-Pupo and Guerras-Martín, 2010). The selection of these periods responds to the evolution of intellectual capital itself. As stated by different works (Martin-de Castro et al., 2011; Chiucchi and Dumay, 2015; Buenechea-Elberdin, 2017; Secundo et al., 2018), the evolution of IC research has gone through a series of stages and is currently entering a fourth stage. The first one focused on IC measurement and the understanding of the IC concept. The second provided legitimacy to intellectual capital as a subfield of Management and linked it to company value creation. The third and most recent stage is characterized by a certain degree of maturity, in an attempt to understand how organizations, and especially firms, use, adopt and implement IC as a management practice. The fourth stage of IC development that these authors intuitively propose fits well with some of the main concerns that our work analyzes in the current and future IC developments sub-section.

Co-citations analysis and bibliographic coupling are used for processing the data. In both techniques, it is assumed that a greater degree of overlap in the references of a pair of articles implies a greater degree of relation or similarity between the two publications (Vogel and Güttel, 2013; Meyer et al., 2014), as shown by Figure 3.

The co-citation technique analyzes the references or cited documents and considers that their relationship is stronger or they are similar if they are cited together. In this way, co-citation analysis delimits the knowledge base or the intellectual structure that exists in a given field of study (Zupic and Čater, 2015) by tracing the intellectual roots and mapping the intellectual heritage and evolution of an academic field (Vogel and Güttel, 2013). Co-citation analysis also detects the most influential contributions to a certain field.

Figure 2. Growth of publications on the intellectual capital

Source: Thomson Reuters SSCI, February 2017
Bibliographical coupling, in turn, relates citing articles from a given field to others in the same field on the basis of shared references, so two articles or citing documents are more related or similar if they share a larger number of references (cited documents). Thus, bibliographic analysis shifts the focus from the cited to citing documents, and it is suitable for detecting current and future research trends, because citing documents are more recent than the document cited by them. They, therefore, play a key role in understanding current and future areas of interest and debate in a research field that is as vibrant as intellectual capital and management (Subramaniam and Youndt, 2005; Vogel and Güttel, 2013).

After reviewing all references (cited documents), and in order to undertake the analysis of the data (Step 4 in Figure 1), only articles with a minimum of co-quoted citations were considered for analysis. Most studies agree on the need to restrict the sample to those references that are frequently cited, but there is no consensus regarding the number of times a cited document must appear in the sample to be included. Considering the dispersion of the topics and perspectives of IC, we decided to establish a low minimum. This allowed us to evaluate a myriad of approaches, including those that have been broadly adopted along with less frequent but relevant ones (includes the details of the cited documents). In particular, and considering the growing number of documents dealing with intellectual capital, we established no minimum in the first period, 1990–1999, a minimum of five cites in the second period, 2000–2009, and a minimum of ten cites in the last period, 2010–2016. We, thus, compensate for those documents that are cited more often in a recent period as a consequence of the increasing number of documents dealing with the topic in order to consider the relative importance of the documents selected in each period.

Therefore, this study includes 553 articles in the field of intellectual capital (citing documents), distributed throughout the three periods in the following way: 32 in 1990–1999; 128 in 2000–2009; and 393 in 2010–2016. We counted 18,274 references included/quoted in those articles (cited documents), distributed in the three periods in the following way: 581 in 1990–1999; 4,590 in 2000–2009; and 14,373 in the last period, 2010–2016.

Once we have collected the data, we need to identify the relationships that are established between cited journals – for co-citation analysis – and between citing journals – for bibliographical coupling. These relationships become stronger the more similarity between the cited/citing journals, being necessary to identify statistically significant groups of documents to establish the theoretical base and future research lines. In the next section, we present the main results, visualize them with UCINET software and interpret the groups of documents in the light of existing research on intellectual capital.

3. Results
Since the aim of this research is to identify groups of studies that can be considered distinct theoretical bases or new trends, we performed a factorial analysis, varimax rotation. Relationships between each pair of documents were normalized using Salton because the factorial analysis is sensitive to scale, an important issue in this study due to the differences in the number of articles and references used in the three periods (Salton and McGill, 1983). Once the matrices for each period were normalized, exploratory factor analysis (SPSS 22.0)
was used to analyze sub-factors or factors by means of principal component analysis (Díez-Vial and Montoro-Sánchez, 2017).

When interpreting factors, we take into account the total variance explained, the magnitude of the eigenvalues, as well as their number and logical interpretation within the field of intellectual capital. Thus, the factor loads represent the correlation of a given reference and the factor. References with loads greater than 0.7 are considered a key contribution to the factor, and loads below 0.4 are marginal, so they are not considered. In the specific case of the co-citation analysis, it is interesting to note that cited references that carry significantly more than one factor are taken into account, since they represent bridge cities or gate cities in the field of intellectual capital.

In order to reduce subjectivity in the extraction and interpretation of factors, two researchers – authors of the study – performed the factorial interpretation independently, for their subsequent pooling. As shown in the rest of the paper, different factors were identified in each of the periods analyzed, except for the first one.

3.1 Evolution of the foundations in intellectual capital

One of the first practical and academic issues regarding IC was its conceptualization and the identification of its main elements. The earliest IC definitions focus on the gap between a company’s market value and other references such as the replacement cost of its assets (Bontis, 1996; Galbraith, 1969) or its book value (Edvinsson and Malone, 1997; Lev, 1997; Sveiby, 1997). Another series of studies highlight the heterogeneous nature of a set of intangible and knowledge assets and their combination utilized by the company for competitive purposes and value creation (Brooking, 1996; Stewart, 1996; Bueno, 1998; Nahapet and Ghoshal, 1998; Teece, 2000). Notably, some of them grouped different types of intangible assets into broader categories, such as human capital or structural capital (Edvinsson, 1997; Edvinsson and Malone, 1999; Hayton, 2005; Roos, 1998).

Alongside the three IC phases of co-citation analysis, and especially in the first two (Martín-de Castro, 2014), the heterogeneous nature of IC assets posed one of the greater challenges for IC literature: to establish a consistent typology of intellectual capital components. In that sense, one basic IC structure was devised by Edvinsson and Malone (1997), who proposed a bi-dimensional construct: human capital, as the knowledge and IC assets created by and stored – embodied – in organizational employees, and structural capital, as the supportive organizational infrastructure that stores organizational routines and knowledge and empowers human capital. They also differentiated between internal organizational capital and customer capital derived from the relationships between the company and its customers.

**Phase 1: business focus emergence.** Thus, the first period, from 1990 to 1999, features the emergence of intellectual capital as a field of study, which has been called “Phase 1: Business Focus Emergence.” Figure 4 represents the cited documents that configure this period, and the pattern of connections between them is measured by the number of times they are cited in the same document. As may be observed, there are no clusters or well-defined factors, due precisely to their eclectic and emerging character.

It may be noted that the great majority of works cited or referenced are monographs or books aimed mainly at managers and business practices, which show seminal models of identification and measurement of intellectual capital, and they are illustrated with cases of companies and institutions that are pioneers in the management of intellectual capital.

Different pioneering works pointed to the leveraging of knowledge assets as the main driver of corporate success stories during the early 2000s. Jointly with Thomas Stewart and Baruch Lev, Leif Edvinsson of the Swedish Skandia insurance company was considered to be the first Chief Knowledge Officer of IC management in practice (Bontis, 1998). In that emerging stage, Stewart (1991), editor of *Fortune* and the *Harvard Business Review*, was one of the main disseminators among management scholars in popularizing the concept of intellectual capital.
as America’s most valuable asset (Serenko et al., 2010). Other noteworthy initiatives appeared mainly in Europe, North America and Australia. These include the New Club of Paris, an association of academics and practitioners focused on the study of the transformation toward a new knowledge-based economy and society, and the Spanish Foro Intellect (1998) where a model for the management of IC was developed in workshops among academics, business practice and consultancy. Other prominent contributors are Kaplan and Norton (1992), Brooking (1996), Edvinsson and Malone (1997), Sveiby (1997) and Stewart (1996).

Phase 2: management and measurement models of IC. The second period analyzed, from 2000 to 2009, has been called “Phase 2: Management and Measurement Models of IC.” This is a phase of expansion as a field of study that focuses on scientific and academic research, resulting in numerous scientific publications. As Table I shows, from 32 citing documents and 581 cited documents in Phase 1, this second phase accounts with 581 citing documents and 4,590 cited documents. During this stage, a certain consensus is reached in considering human capital, structural capital, and social capital as the three main components of IC. They represent different manifestations of companies’ knowledge assets. In this way, and based on a review of the literature (Bontis et al., 2002; Nahapiet and Ghoshal, 1998; Reed et al., 2006; Subramaniam and Youndt, 2005), human capital, in a very general sense, includes explicit and more importantly, tacit knowledge embodied in employees, as well as their ability to generate it, which is useful for

Notes: Each node represents a cited document and the connecting line between two nodes means that they are cited together in any of the citing references. The strength of the line increases with the normalized number of times they are cited together. The algorithm uses iterative fitting to locate dots with smallest path lengths to one another closest in the graph. Unit of analysis: the network created between cited references. Number of nodes/cited documents: 32. Main characteristics: average degree: the number of cited references that appear together in the same citing document: 4.13. h-Index: the largest number x, such that there are x vertices of degree at least x in the underlying graph is 5. Density: number of edges divided by the maximum number possible, note the diagonal is ignored is 0.28. Closure: the number of non-vacuous transitive triples divided by number of paths of length 2 is 0.40. Average distance: average geodesic distance amongst reachable pairs is 1.92. SD Distance: standard deviation of the geodesic distances amongst reachable pairs is 0.76. Compactness: the mean of all the reciprocal distance is 0.54.
company’s purposes, including aptitudes, know-how, and attitudes. Structural capital includes two types of capital: organizational capital, as the combination of explicit and implicit knowledge, which structures, develops and gives cohesion to the organizational activity and values of a company in an effective and efficient way, and technological capital, which refers to the combination of knowledge directly linked to a company’s production process and technical system. Finally, social capital encompasses two types of IC assets (Nahapiet and Ghoshal, 1998; Reed et al., 2006): internal social capital, based on internal relationships among organizational members, and external social capital, based on inter-organizational relationships between the company and its stakeholders, which is labeled by some IC authors as “relational capital” (Bueno, 1998; CIC, 2003; Martin-de Castro et al., 2011; Pike et al., 2005). Other authors highlighted the key role played by a company’s customers or “customer capital” (Bontis, 1998; Edvinsson and Malone, 1997; Moon and Kym, 2006; Roos and Roos, 1997; Stewart, 1996; Wu et al., 2008).

As shown in Figure 5 and described in Table II, within intellectual capital, five factors have been identified in this phase; these are briefly described and interpreted. They are the following.

Notes: Each node represents a cited document and the connecting line between two nodes means that they are cited together in any of the citing references. Number of nodes/cited documents: 89. To illustrate the most significant connections in a clear form, the graphic representation incorporates connections with a Salton value higher than 299. The algorithm uses iterative fitting to locate dots with smallest path lengths to one another closest in the graph. Unit of analysis: the network created between cited references. Symbols for each factor: Square in light blue (Strategic Management foundations); Up triangle in red (Knowledge-Based View), box in orange (Management of intellectual capital), Down triangle in green (Human capital, social capital and networks), Circle in box in yellow (Measurement of intellectual capital), circle in white (no load with specific factor). Main network characteristics: average degree: the number of cited references that appear together in the same citing document: 27.55. h-index: the largest number \( x \), such that there are \( x \) vertices of degree at least \( x \) in the underlying graph is 30. Density: number of edges divided by the maximum number possible, note the diagonal is ignored is 0.32. Closure: the number of non-vacuous transitive triples divided by number of paths of length 2 is 0.43. Average distance: average geodesic distance amongst reachable pairs is 1.72. SD Distance: standard deviation of the geodesic distances amongst reachable pairs is 0.53. Compactness: the mean of all the reciprocal distance is 0.65.

Figure 5.
Network of co-citations and factors, 2000–2009
The first and most important factor focuses on the theoretical frameworks from the strategic management for the study of intellectual capital, so it has been called “strategic management foundations.” From an academic perspective, the nature and entrepreneurial implications of the emerging intellectual capital phenomenon are analyzed and studied in a bid to frame and fit this new phenomenon within the Management field. The main theories used are as follows: resource-based view, dynamic capabilities, knowledge-based view (KBV), evolutionary economics and the intellectual capital view.


The second factor is called the “knowledge-based view of the firm” (Nonaka, 1991; Grant, 1996; Kogut and Zander, 1996; among others). This theoretical framework emerged from the resource-based view by focusing on knowledge management and organizational learning both inside and outside the firm. It emphasizes the importance of knowledge as a key production factor in the new economy, and it defines the nature, antecedents, management and implications of intellectual capital, or knowledge assets in organizations. All this can be considered as a first solid step to address the theoretical development of intellectual capital. Among the most important works cited are Nonaka (1991), Grant (1996), Kogut and Zander (1996) and Hatch and Dyer (2004).

The third factor is called “Management of intellectual capital”, because it groups together a set of pioneering works on intellectual capital headed in great part by Professor Nick Bontis from Canada. Within the field of intellectual capital, he is recognized worldwide as one of the most influential and most important contributors in the IC research field. In this study, Bontis starts to clearly note the importance of the burgeoning field of intellectual capital and the difficulties of measuring and managing these intangible assets, which is a first step in advancing the intellectual capital models. The main studies referenced within this third factor include works by Bontis (2001), Bontis et al. (2002) or Bontis (2003).

The fourth factor focuses on the central and differential aspects of intellectual capital such as human capital, social capital and business networks, so it has been called “human capital, social capital and networks.” Since the origin of intellectual capital, as the seminal study by Nahapiet and Ghoshal (1998) indicated, the concept of social capital has been assigned a crucial role. Other seminal studies such as Adler and Kwon (2002) explored the importance of social capital in the economy and business. In this way, the different components of intellectual capital begin to become more significant in an independent manner, leading to a deeper understanding of them, specifically the studies on social capital and human capital presented by Dean and Kretschmer (2007) in their analysis of the robust expansion of these components of intellectual capital, particularly since the late 1990s. Among the most cited and prominent works in this subfield of the study of intellectual capital are...

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The last factor identified, as expected, focuses on the identification and measurement of intellectual capital, and it has been called “Measurement models of intellectual capital.” Characteristic features of intellectual capital, such as those under consideration, from an accounting point of view, or their intangible character, making it difficult to identify an economic value, lead to additional problems for their effective management (Edvinsson, 1997). The roots of a tree or the submerged part of an iceberg were commonly used analogies in the earliest stages of the development of intellectual capital, graphically illustrating this key concern. The main studies referenced include papers by authors such as Lev (2001), which empirically demonstrated the major, sustained gap that exists when comparing a company’s market value and book value, Kaplan and Norton (1992) with their influential “business scorecard,” one of the most popular strategic management tools, or Edvinsson and Malone (1997) who proposed the model of measurement and management, in addition to Brooking (1996), Stewart (1996) or Roos and Roos (1997).

As progress is made in intellectual capital research, more and more aspects in this area are being studied from different perspectives, which is an indication of how mature the concept is becoming. This can be seen in the third phase of the study, which identifies seven factors.

**Phase 3: IC as practice.** The third period analyzed, from 2010 to 2016, has been labeled “Phase 3: IC as Practice.” It corresponds to the period of the greatest number of scientific publications, and the problematic nature and diversity of the issues involved are reflected in the seven factors or subfields identified within intellectual capital, as shown in Table III and Figure 6. As Secundo et al. (2018) stated, the third stage of IC research focuses on the management of IC as practice and how intellectual capital works inside organizations.

The problem of measurement and its theoretical approach continues to be among the main focuses of interest, with other more novel and common issues of debate reaching maturity, such as criticism and identification of problems within IC that prevent its consolidation and progress as a structured theoretical body of knowledge (Martin-de Castro, 2014; Reed et al., 2006), or the decision to disclose intellectual capital in annual reports. In the following paragraphs, we explain each factor found in the last period.

The first factor, called “Measurement of intellectual capital in business reality,” which looks at business as practice, focuses on developing measurement models for intellectual capital and empirically contrasting them with business reality. Among the main studies cited are Stewart (1991), Saint-Onge (1996) and Sveiby (1997).

The second factor, called “Knowledge-based view and IC-based view,” focuses on the two theoretical currents most used in this period to define IC: the KBV of the firm (Grant, 1996; Kogut and Zander, 1992, Nonaka and Takeuchi, 1995) and the intellectual capital-based view (ICBV) (Reed et al., 2006; Martin-de Castro et al., 2011). The proposal of

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<td>Eigenvalue</td>
<td>Variance explained (%)</td>
</tr>
<tr>
<td>1</td>
<td>Measurement of intellectual capital</td>
<td>100</td>
<td>25.242</td>
<td>13.427</td>
</tr>
<tr>
<td>2</td>
<td>Knowledge-based view and IC-based view</td>
<td>19</td>
<td>15.661</td>
<td>8.330</td>
</tr>
<tr>
<td>3</td>
<td>VAIC: Value Added of intellectual capital</td>
<td>21</td>
<td>11.665</td>
<td>6.205</td>
</tr>
<tr>
<td>4</td>
<td>Intellectual capital and dynamic markets</td>
<td>18</td>
<td>9.843</td>
<td>5.236</td>
</tr>
<tr>
<td>5</td>
<td>Intellectual Capital Critics</td>
<td>11</td>
<td>7.594</td>
<td>4.039</td>
</tr>
<tr>
<td>6</td>
<td>Intellectual capital disclosure</td>
<td>15</td>
<td>6.268</td>
<td>3.334</td>
</tr>
<tr>
<td>7</td>
<td>IC as strategic tool</td>
<td>14</td>
<td>5.017</td>
<td>2.669</td>
</tr>
</tbody>
</table>

Table III. Third phase, 2010–2016: factor analysis and network metrics
Reed et al. (2006) was a milestone in configuring intellectual capital as a mid-range theory in management because they suggested using pragmatic decision making to address some of the issues that existed in other theoretical approaches, such as the resource-based view. This is another step in the direction that we observed in the second factor of the previous period in an attempt to develop a stronger theoretical approach to intellectual capital.

Among the studies most cited in this subfield are Reed et al. (2006) and Roos and Roos (1997) from ICBV, and Nonaka and Takeuchi (1995), Kogut and Zander (1992) and Grant (1996) from a KBV.

The third factor is called “Value Added Intellectual Capital,” and it focuses again on the recurring issue concerning the measurement of intellectual capital, but with an important novelty, in this case utilizing a new and specific methodology: the value-added intellectual capital (VAIC). This method evaluates a firm’s creation of market value, taking into account its intellectual capital value. Among the main studies cited in this category are those by Maditinos et al. (2011), Mavridis (2004) and Kamath (2008).
The fourth factor is called “Intellectual capital and dynamic markets” because it analyses the role of intellectual capital in dynamic and technological markets, based on innovation and knowledge. The pioneering work of Subramaniam and Youndt (2005) that links intellectual capital and technological innovation helps to understand different added values that intellectual capital can have in dynamic markets and environments. In this sense, the articles considered here push intellectual capital scientific studies toward a specific field, which involves an important breakthrough in the development of the intellectual capital approach. Among the main studies referenced in this subfield of intellectual capital research are Hayton (2005) or Conner and Prahalad (1996).

The fifth factor comes fully into what can be called open criticism of the intellectual capital approach and the label used is “Intellectual capital critics.” In this sense, the key study of Dean and Kretschmer (2007) highlighted the controversy, especially in economy, finance and accounting debate, of whether ideas, knowledge or intellectual assets can be called “capital” (Can ideas be capital?). The studies with the most references include the studies by Mouritsen (2006), Mouritsen et al. (2001) and Marr and Chatzkel (2004).

The sixth factor is called “Intellectual capital disclosure,” which in parallel with the previous factor and by generating interest in the fields of finance and accounting results in other novel studies that indicate that intellectual capital is maturing as a field. This refers to the decision of whether or not organizations should disclose intellectual capital. The advantages and drawbacks of this practice, the increasing necessity of management transparency, its voluntary character, etc., are emerging topics in this subfield. This represents advances in the intellectual capital field as it moves toward issues on decision making in the firm. Among the main studies cited are the studies by Garcia-Meca et al. (2005), Cerbioni and Parbonetti (2007), Healy and Palepu (2001) or Bukh et al. (2005).

The last factor identified is called “IC as a strategic tool” because it focuses on the role of intellectual capital as a strategic tool. Understanding the potential, uses and value of these assets to improve competitiveness and business development is the main component. Key references include Bontis et al. (1999), Brennan and Connell (2000) and Bontis (2004).

**Development patterns across phases.** After analyzing the evolution of the co-citation networks over the three study periods, different cohesion measures have been calculated, understood as the number of times that two cited references appear together. Table IV shows the main measures. On the one hand, we observe a clear increase in the cited references and connections between them. Thus, there is an evolution of IC literature from a

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Average degree</td>
<td>4.13</td>
<td>27.55</td>
<td>65.79</td>
</tr>
<tr>
<td>h-index</td>
<td>5</td>
<td>30</td>
<td>71</td>
</tr>
<tr>
<td>Degree centralization</td>
<td>0.22</td>
<td>0.55</td>
<td>0.58</td>
</tr>
<tr>
<td>Density</td>
<td>0.28</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>Closure</td>
<td>0.40</td>
<td>0.43</td>
<td>0.43</td>
</tr>
<tr>
<td>Average distance</td>
<td>1.92</td>
<td>1.72</td>
<td>1.68</td>
</tr>
<tr>
<td>SD distance</td>
<td>0.76</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>Compactness</td>
<td>0.54</td>
<td>0.65</td>
<td>0.66</td>
</tr>
</tbody>
</table>

**Notes:** Unit of analysis: the network created between cited references. Average degree: the number of cited references that appear together in the same citing document. h-index: the largest number × such that there are × vertices of degree at least × in the underlying graph. Density: number of edges divided by the maximum number possible, note the diagonal is ignored. Closure: the number of non-vacuous transitive triples divided by number of paths of length 2. Average distance: average geodesic distance amongst reachable pairs. SD distance: standard deviation of the geodesic distances amongst reachable pairs. Compactness: the mean of all the reciprocal distance

**Table IV.** Cohesion evolution and the co-citation networks
diverse group of cited documents in the first period toward an increasing similarity in the pattern of cited documents; the average similarity of the references cited increased from 4.13 in the period 1990‒1999 to 27.55 in the period 2000‒2009 and to 65.79 in the last period 2010‒2016. Likewise, the h-index went from 5 in 1990‒1999 to 71 in 2010‒2016.

On the other hand, the results in Table IV also show that the overall density of the network in each period is almost constant, which indicates that the number of connections from all the possible connections between cited documents has hardly changed, that is the cohesion of the literature over time has not increased. Also, the average distance between two cited documents, that is, the number of other cited documents that it would be necessary to jump through in order to connect them, has not changed either. Taking into account these network data over time, we can conclude that although the literature on IC has attracted much new research in recent periods, the studies have maintained their structure over time, with no increase in each research group’s awareness of others.

3.2 New trends in intellectual capital

After analyzing the intellectual roots or foundations of IC, the main lines and research trends are presented in this second part of the results. Through bibliographic coupling, an analysis of citing documents in the last period 2010‒2016 has been conducted. Figure 7 shows the four major trends in intellectual capital research. Each of them is described below.

The first and most important factor found refers to the “advances in the measurement of intellectual capital in specific industrial settings.” This trend of current and future research in intellectual capital shows the importance always granted to the improvement of the identification and measurement of the different components of intellectual capital. The analysis of how IC works and contributes to organizational value creation in specific industrial settings, using new techniques such as AHP, economic value added, VAIC, etc., constitutes one of the great challenges for future development in this field of study. Among them, we can highlight the utilization of mixed methods to assess IC (Ayranci and

Notes: Blue square nodes represent the new trends result of the factor analysis and white circle node represents a citing document. When a citing document has a load higher that 0.4999, a connection line to the factor is represented. The algorithm uses iterative fitting to locate dots with smallest path lengths to one another closest in the graph.
Colakoglu, 2014; Solitander and Tidström, 2010) or the proposals for measuring IC in different contexts, such as the hotel industry (Kim et al., 2011), banking sector (Shih et al., 2011; Wang et al., 2013) or education (Lee, 2010), which shows empirical studies of IC in action, as claimed by Chiucchi and Dumay (2015).

The second factor, trend in future research, is represented by human capital, knowledge and innovation, and their interactions with other components of intellectual capital (Morris and Snell, 2011; Teo et al., 2014). Understanding how and when it originates, and under what circumstances it can be best used is important to improve business competitiveness. In this sense, the selection and design of a set of human resource policies and the development of knowledge capabilities in order to achieve innovation and value creation in organizations are emerging as a fruitful line of incipient research (Cabello-Medina et al., 2011; Hsu and Sabherwal, 2011; Pasamar et al., 2015; Su and Carney, 2013, among others).

The third factor identified is related to the role of intellectual capital in new business models, which extends the classic domain of IC to include both the inside and the outside of the organization (Secundo et al., 2018), and to include new scenarios in business and the economy by addressing its role in emerging businesses (start-ups and entrepreneurship), as well as new business realities and activities such as the Internet of Things or cloud-based management. Among them, we can cite the study assessing IC in a pioneering company in the Internet of Things such as Cisco (Murray et al., 2016), the link between IC and cloud-based accounting and finance structures (Clearly and Quinn, 2016), and the impact of IC on start-up expectations (Matricano, 2016).

The fourth and last factor identified was already a novel aspect in the previous period and refers to the decision on whether or not to disclose intellectual capital reports. This new research stream on IC directly seeks to understand the impact of IC management in organizations on the economy and society, representing one of the most promising avenues of research in IC, which is referred by Chiucchi and Dumay (2015) and Secundo et al. (2018) as the fourth stage of intellectual capital. What are the effects of voluntary IC disclosure and how big is their impact? The integration of IC into more general business reports is a common emerging and unresolved key issue in IC management. Of note is the study by Low et al. (2015), which makes an international comparison of voluntary IC reporting by companies from different countries, the effect of IC disclosure on the effectiveness of corporate strategies, such as mergers and acquisitions (Ott et al., 2014), as well as its causes (Bellora and Guenther, 2013), or the necessity to standardize those IC reports so that they include the same information (Dumay and Cai, 2015; Goebel, 2015; Melloni, 2015).

4. Discussion, conclusion, limitations and future research

4.1 Discussion

The findings in this study regarding IC foundations reveal the breadth of the expanded field of intellectual capital – in coherence with the high, and sometimes excessive, fragmentation of current Management research, as pointed out by Durand et al. (2017). In that sense, and in order to shed some light on the evolution of IC foundations, in this sub-section, we attempt to order and connect the networks extracted from the extant literature on the basis of shared references between sub-periods, showing recomposition, differentiation, continuity, strategic turn and emergence as different strands of IC research (see Figure 8).

As has been mentioned, and as occurring many times in management phenomena, the first stage of the emergence of IC research is characterized by a set of seminal contributions based mainly on business practice in the form of newly IC measurement and management models and tools showing business case evidence from pioneering companies in this field. The transition to the second stage of development (2000–2009), which involved the growth of IC research within Management research, was preceded by the importance given during the 1990s to the Resource-Based View (Barney, 1991; Newbert, 2007) as a key theory in
strategic management, as well as the emergence of the KBV (Grant, 1996). These are, in fact, two of the main factors identified in the second period of analysis, showing the key role given by academics to the IC theoretical foundations and strategic analysis. In that sense, several high impact seminal studies for both strategic management and management, in general, were published. These dealt with the emerging construct of social capital (Adler and Kwon, 2002), the importance and relationships of intellectual capital and social capital (Nahapiet and Ghoshal, 1998), which can be considered determinants to the emergence and consolidation of social capital and networks as a key research tradition of IC identified in the second stage, jointly with the publication of the review of models for the measurement and management of intellectual capital written by Bontis (2001), consolidating measurement and management of IC in the firm as two important research traditions at this second stage and reflecting the important efforts made by academics in order to measure and manage IC.

The transition to the third stage of IC development entails the consolidation and maturity of a research field characterized by an abundance of research topics and the emergence of others, which include the rise of some problems and the focus of IC as a business practice in different industrial settings. Thus, one of the research streams identified in this third stage of development makes a special effort to reconsider and take a critical look at the problems inherent to this field research, as shown by Figure 7. Among them is the discussion about “Can ideas be capital?” (Dean and Kretschmer, 2007), which highlights the concerns about the economic roots and meaning of intellectual capital.

The third stage of IC implies the refinement and reconfiguration of the IC theoretical frameworks (strategic management and KBV) into one more framework focused on the understanding the management and strategic implications of IC and knowledge assets on the KBV and ICBV, thus corresponding to a mature discipline. This transition was reinforced with the publication of a key study, “An intellectual capital-based view,” by Reed et al. (2006), which framed IC as a middle-range theory of Management, between a more academic theory as RBV and the business practice more interested in the management and measurement of IC. In this same way, and as one of the main aims of IC research, its continuity and differentiation, the search for new methods, models and measurement tools, such as VAIC, reflect its importance and the necessity for it to continuously evolve.
Other streams of IC evolution included in Figure 8 show how social capital and networks factor identified in the second stage becomes dynamic markets in the third stage (2010–2016), reflecting the importance of the environmental setting and its dynamism for the field of IC as business practice, as highlighted by Secundo et al. (2018) for the most recent stage of IC research.

Finally, the impact of IC on society and environment can be seen in the emerging factor of IC disclosure, giving information of strategic character about the activities and potential of value creation of companies for different stakeholders, and integrating this information into more general corporate sustainability reports. In the Internet era, transparent management and stakeholders’ engagement are key elements for a firm’s legitimacy, survival and competitiveness (Cabrilo et al., 2009).

4.2 Conclusions
The results of our study imply new and relevant evidence for the academic and practitioner communities interested in the phenomenon of intellectual capital in the firm, due to four main reasons. First, considering previous bibliometric works, our research offers a wider analysis, including a longer period of analysis (from 1990 to 2016), and a wider perspective, taking into account research coming from Economics, Management, Accounting, among other scientific disciplines. Thus, our quantitative and longitudinal research reveals a breadth of topics and disciplines that characterize intellectual capital in the firm, in parallel with the majority of phenomena covered by the strategic management field, as stated by Durand et al. (2017). Second, after three decades of research on the IC and the firm, a bibliometric study is very useful for disciplines with a certain degree of maturity (Vogel and Güttel, 2013), helping in putting a certain order and also understanding a field research evolution and current trends of development. Third, our research includes two complementary analyses: co-citation analysis in order to understand the theoretical roots of this field research, and bibliographical coupling, showing recent and future research developments in the field of IC and the firm. Finally, as Figure 8 shows, complimentary analysis of path dependence and evolution is developed in order to understand the dynamics of evolution of IC theoretical roots among the different stages of development.

In our research, the initial web of networks that was extracted from the extant literature based on the analysis of co-citations shows the breadth and depth of documents that represent the foundations of IC. In order to shed light on this research field, the period was split into three sub-periods due to the changing patterns of citations that usually occur as the field evolves through successive stages of development. The three sub-periods, 1990–1999, 2000–2009, and 2010–2016, fit with the evolution and stages of IC development proposed by authors such as Chiucchi and Dumay (2015) or recently by Secundo et al. (2018), who proposed the beginning of a new fourth stage, a key issue that is addressed in our research through the bibliographic coupling analysis.

Considering co-citation analysis, our results show three remarked stages of development of this field research. Whereas the first sub-period of IC emergence (1990–1999) was derived from business practitioners focused on understanding the meaning and measurement of the IC assets of a firm (Bontis, 1996; Brooking, 1996; Edvinsson and Sullivan, 1996), the subsequent second period (2000–2009) arises with a marked growing interest among academics and practitioners (Stewart, 1991; Bontis, 2001; Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; among others), introducing IC research field to the business, management, and accounting academic communities. In that sense, and especially strategic management, different research streams as the resource-based view, dynamic capabilities view, KBV and evolutionary economics were used to frame and understand it.

Also, a key identifying element of IC and the firm literature is its focus on the development of IC measurement models and tools, such as those developed at this stage by
Bontis (2001, 2003), Bontis et al. (2002). Finally, the second period is characterized by the emergence of new issues focused on the sources, drivers and management of different components of IC, with human and social capital being topics of growing interest.

The last sub-period (2010–2016) analyzing the foundations of IC shows a certain degree of maturity, continuing classic IC topics, as the development of new tools for IC measurement as value added of intellectual capital (VAIC), the appearance of the first important criticisms and concerns made on this field, such as those by Reed et al. (2006), Dean and Kretschmer (2007), Mouritsen (2006) and Martin-de Castro (2014), and the emergence of new issues focused on understanding the management of IC in practice or the issue of IC disclosure.

Considering IC as practice, a research stream about analyzing the role of IC as a strategic tool (Bontis, 2004) or in new dynamic and technological industrial settings (Hayton, 2005; Subramaniam and Youndt, 2005) is drawn. Also, another new IC focus, framed from an Accounting and Financial, arises as the academic and practitioner debate about how, when, and under what conditions firms’ IC is disclosed, as well as the possibility and its integration in company’s sustainability and/or more traditional financial statements.

Nevertheless, our study goes beyond a “historical look” of IC and the firm, and we offer complimentary results, through bibliographic coupling analysis, by taking into account the current and future avenues for IC research in the firm. Thus, a critical element in the advancement and consolidation of IC in Management literature is the work that needs to be done (Reed et al., 2006) to improve and refine the measurement tools – such as AHP, VAIC, etc. – for different components and elements of IC operating in different and specific industrial settings. By focusing on management as practice and the micro-foundations of IC (Teo et al., 2014), such as human and social capital, human resource and knowledge management practices, both inside and outside companies, another important avenue of research looks at how IC is dynamically created, accumulated and transferred (Hsu and Sabherwal, 2011; Pasamar et al., 2015, among others).

Other promising future IC research lines identified are concerned with the role of IC in new Internet and digital business models and entrepreneurship (Murray et al., 2016; Clearly and Quinn, 2016), and the impact of IC management in organization, the economy and society, in general, by linking and disclosing IC management and business sustainability and transparency (Dumay and Cai, 2015; Low et al., 2015; Melloni, 2015; among others).

In summary, evolution and historical roots of intellectual capital and the firm as a field of research have followed the traditional management and strategy model Academics, Business and Consultancy (ABC). Thus, the emerging Phase 1 was characterized by the prominence of practitioners and academics focused on business practice developing pioneering contributions in the field of IC. As expected, the following phases addressed the interest of academia from very different perspectives and unit of analysis. Finally, like many other management fields reaching maturity stages, critics and prospects appear.

As a mature field of research, many future developments are open, as highlighted by bibliographical coupling. Among them, framing IC as practice, in parallel with the well-known SAP “Strategy-as-Practice” (Whittington, 1996), will open the real business utility to IC, facing numerous and specific industry and company setting problems. Also, the focus and main interest of IC research on its measurement and reporting give us a unique opportunity for cross-fertilizing arena among management, strategy and accounting scholars and business practitioners. This is one of the main IC challenges. Another very fruitful avenue of research for intellectual capital will come from integrating business and sustainability.

4.3 Limitations and future research
This quantitative research has several limitations. The first one is about the limited range of academic sources used for both co-citation analysis and bibliographic coupling. We decided
to focus on journals from different academic disciplines included in the Journal Citation Report in order to use accepted academic research. Nevertheless, additional research on IC and the firm has been omitted, as those works published in journals included in other academic repositories (e.g. Scopus). In that sense, future works could include a wider range of publication sources, as papers published in additional journals included in Scopus, combining them in order to have a more complete picture of the IC and the firm as a very fruitful field research. As a discipline coming from business practice, many pieces of literature were published outside the scientific-academic circuit. In that sense, future research could include practitioner-oriented books as key pieces of citing documents.

A second limitation of this research includes the focus and level of analysis. By developing a longitudinal quantitative co-citation analysis and bibliographical coupling, a general picture of different stages of IC development can be analyzed, jointly with a general view of current and future research trends. Nevertheless, a deeper understanding of each of the research traditions included or current research trends is missing. In that way, this type of quantitative reviews of literature could be complemented in a cross-fertilization way with more traditional literature reviews based on the accumulated knowledge and deep experience of IC researchers, like previous ones made by Martín-de Castro et al. (2011) or Pedro et al. (2018). Considering the unit of analysis, our research focuses on the firm. Nevertheless, IC phenomenon is studied in other units of analysis, as countries or regions (Pedro et al., 2018).

A third limitation is that bibliometric methods introduce quantitative rigor into the subjective evaluation of literature, but the empirical analysis is based on the general assumption that the more two papers are cited together (for co-citation) or the more two papers share references, the more they are involved in the same theoretical approach. As a result, heavily cited articles are likely to have exerted a greater influence on the subject than those less frequently cited (Pilkington and Chai, 2008). Although its validity as a means of exploring the intellectual structure of a scientific discipline has been amply demonstrated, this assumption may misrepresent the real structure of the discipline. Additionally, future bibliometric IC review could include a comparison of the last three decades (1990–1999; 2000–2009; and 2010–2019) in order to capture IC evolution and intellectual roots during the last whole three decades.

Finally, considering bibliographical coupling conclusions, they should be taking into account carefully, especially those about future research lines. Its assumptions and nature are focused on understanding current IC research trends, whereas future IC trends are based on the latest available data of 2016. This way, they should be considered only as a potential guide for future search streams on IC and the firm. In that sense, future researchers could benefit from some of the interesting conclusions and works analyzed in order to continue with future research, future research collaboration programs, and so on.

References


Further reading


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