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The study of intangible capital analysis in economics literature in Scopus sources 1908-2021: The corporate black box unaddressed

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Abstract

Purpose: This paper performs a comprehensive bibliometric investigation of the role of intangible capital in the economics literature and aims to identify unanswered questions and gaps to guide future research.

Design/methodology: The systematic literature review concerned with intangible capital employed bibliometric methods, including the obtaining of datasets from reputable article databases (Scopus), dataset preprocessing and refinement of records, construction and visualisation of networks, and analysis and interpretation that among others involved standard descriptive and qualitative analyses.

Findings: The study highlights that the economics literature on intangible capital focuses on productivity research on the micro, meso and macro levels by showing how intangibles positively impact productivity. Yet, at the same time the results reveal a gap in understanding the mechanism of transmission or the 'why' and 'how' of the impact.

Originality and Value: This study is the first comprehensive bibliometric analysis of intangible capital in economics and complements the earlier limited approaches by conducting a systematic review of research in this area. Further, gaps are identified while the need for deeper understanding of the mechanisms of intangible capital's transmission to productivity is highlighted.

Limitations: The overview of the field given means the research is limited by the lack of detailed analysis for each topic determined to be relevant. Still, future research could identify variables of interest and existing causal mechanisms for each issue to explain how intangible capital affects productivity and spillover effects.

Keywords: Intangible capital, Bibliometric analysis, Literature review

Jel Codes: E22, O34

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1. Introduction

Intangible capital was first recognised in the literature in 1908 when Veblen (1908) distinguished tangible from intangible capital, defining the latter as follows: "Intangible assets are immaterial items of wealth, immaterial facts owned, valued, and capitalized on an appraisement of the gain to be derived from their possession". Both of these forms of capital contribute to wealth creation and productivity growth. Empirically, the determination of the contribution made by intangible capital and other factors to growth has evolved gradually. Statistical analysis of wealth dates back to the late 17th and early 18th centuries when G. King measured wealth in England, while Fisher's calculation of various indices in 1923 was an extremely important step towards a comprehensive growth decomposition (Young, 1923). The most noteworthy contribution was given by Solow (1957) when decomposing the aggregate production function to isolate the effects of the 'shift' in the production function. He showed that the majority of productivity growth in the first half of the 20th century could be attributed to technological change, i.e., the Solow residual.

While both growth decomposition and productivity analysis have made great strides, for a long time a considerable problem entailed how to more precisely define the causes of growth that make up the "Solow residual". For quite a while, the literature relied on "technical progress" measured by R&D expenditures, patents etc. (Bengoa, Román & Pérez, 2017; Bresson, Hsiao & Pirotte, 2011; Castellani, Piva, Schubert & Vivarelli, 2019; Choi, González & Gray, 2013; Edquist & Henrekson, 2017; McMahon, 1984; Sterlacchini, 1989). In the 1960s and 1970s, the literature referred to intangible capital as investment or knowledge capital, which is related to productivity (O'Connor & Carr, 1982). In addition, Kendrick (1972) classified R&D, education and training, health, and mobility as the intangible components that add significantly to GDP growth. Following previous research, Ducharme (1998) argued that a considerable share of productivity growth cannot be explained by the standard elements of productivity growth (capital and labour), but by other factors like education, skills, R&D, acquisition and the transmission of know-how. Upon the advent of the new economy, while it was becoming ever clearer that productivity growth depends largely on intangible capital (Nakamura, 1999) and despite the first empirical studies in this area in the 1960s and 1970s, the lack of a standard definition of intangible capital and reliable data hindered any more detailed research.

The study of intangible capital and the emphasis on defining and measuring intangibles on a level that allows a thorough assessment of their contribution to growth and productivity received considerable interest in the late 1990s and early 2000s following the work of Lev (2001) and Nakamura (1999) and especially the seminal work of Corrado, Hulten and Sichel (2006), who proposed the by now well-established definition of intangible capital as being the sum of: (1) computerised information; (2) innovative property; and (3) economic competencies. This definition allowed for the scope of intangible investment to be more efficiently captured and led to several analyses of the contribution made by intangibles to economic and productivity growth. However, research initially focused on aggregate contributions (Amidon, 2001; Bounfour, 2003; Bounfour & Edvinsson, 2005), and today we can find a large body of empirical work showing that intangible capital is related to the impact on a country's economic growth, productivity growth and, in turn, GDP (Corrado, Haskel & Jona-Lasinio, 2019, Corrado, Haskel, Iommi & Jona-Lasinio, 2020; Jona-Lasinio & Meliciani, 2018; Kaus, Slavtchev & Zimmermann, 2020; Piekkola, Lintamo, Geppert, Görzig, Neumann, Henningsen et al., 2011; Roth, 2020; van Ark & O'Mahony, 2016).

The economics literature on intangibles also explores the relationship between intangible capital and economic or productivity growth by examining investments in specific types of intangibles like IT capital, innovation, human capital and labour quality, knowledge acquisition, and other effects (Ballot, Fakhfakh & Taymaz, 2001; Capello, Caragliu & Nijkamp, 2011; Castellani et al., 2019; Corrado, Haskel & Jona-Lasinio, 2017a; Nonnis, Bounfour & Kim, 2023; Piekkola & Rahko, 2020). Yet, it appears that this vast literature remains primarily focused on examining impacts rather than understanding causalities and transmission mechanisms on the macro, meso or micro levels. The fact is that understanding these causalities is extremely important for being able to provide relevant implications for firms to efficiently "manage intangibles" and thereby support the creation of competitive advantage (Porter, 1980) where such advantage is derived from the theory of a firm's resource base, made up of intangible assets (Lev, 2001; Roos, Roos, Edvinsson & Dragonetti, 1997; Stewart, 2010). This means

the firm's goal is to efficiently manage intangibles to increase firm value, as well as identify intangible activities. Unfortunately, this area seems largely neglected in the business literature.

The purpose of this paper is to examine the literature in the area of intangible capital and to determine possible future research directions. We are especially interested in exploring whether and how the literature explains why productivity increases with intangible investment. As mentioned, the economics literature typically focuses on output, i.e., productivity, yet leaves to one side the 'black box' of the firm. This represents research gap and a great opportunity for firms to further boost their productivity growth by understanding the causalities and mechanisms that allow intangible capital to accelerate productivity growth. To this end, a systematic review of the literature on the intangible capital field's development is conducted and the outstanding challenges are discussed using bibliometric methods in conjunction with a standard descriptive approach to the literature review to explore the topic in greater depth.

The paper thereby addresses several challenges in the study of intangible capital in economics and expands the existing body of knowledge. First, it is the only comprehensive bibliometric study of literature on intangible capital in economics. It focuses on the most important authors and papers and their relevance to the field, while also revealing the breadth of the literature. Second, we confirm the research gap mentioned above and show that while great diversity is apparent in the literature, notably in terms of countries, the analysis is primarily concentrated on productivity research. The aspects most studied are the relationship between intangible capital and growth on the aggregate level and between R&D (innovation) and firm performance. Other aspects remain much less studied. This significant gap accordingly opens up a valuable future research direction that also requires an interdisciplinary approach, particularly collaboration between business and economics. As a result, the paper also offers opportunities to advance the field.

The remainder of the paper begins with a brief overview of the field's development, making it clear that the topic is present, albeit with different focuses, in both economics and business literature. This is followed by an account of the research design, including a description of the objectives, data and methods. The results and discussion section highlight the key findings.

2. Research Goals and Design

The research aims to comprehensively explore the evolution of intangible capital analysis by focusing on detecting the key issues and the main research gaps, especially as concerns understanding the causalities between intangible investment and productivity. To answer this critical question, several aspects are addressed:

1. What are the development dynamics of the field, when did the analysis start, and when did it gain in importance?
2. Which journals were the central dissemination channels and contributed to the field's development? Who are the most important authors in the field in terms of both their publication activity and influence on the development of the field (citations)? Which groups of authors collaborate and what are the characteristics and impact of this collaboration?
3. What are the biggest conceptual building blocks and what are the main themes associated with each block?
4. What are the major gaps in the literature or missing links between the main building blocks?

The analysis is based on standard bibliometric approaches (Aria & Cuccurullo, 2017, 2021; Bellis, 2009; van Raan, 1993; Zupic & Čater, 2014). First, a timeline was presented, counting only the papers extracted using keywords (as explained below). To further explore how field has evolved, the most prolific authors were identified (counting authors – papers and splitting authorship among papers for co-authored papers). The most influential authors were identified through citation analysis, while the most cited papers were also identified to assess which authors and which papers contributed most to the field's development. Co-citation and collaboration analyses were also performed. While the co-citation analysis identifies which papers are related (primarily identifying the most frequently cited papers and clusters of 'common' origin), the collaboration analysis identifies clusters of authors who collaborate and detects both influential author teams and spillover

effects due to collaboration. Key themes were identified based on text mining (identification of keywords) and analysis of keyword co-occurrences. To further investigate the evolution of themes in the field, a conceptual structure was created using the MCA method, an exploratory multivariate technique that identifies themes based on distances. Methodological details can be found in Aria and Cuccurullo (2017).

To conduct the analysis, the statistical package R and the package Bibliometrix created by Aria and Cuccurullo (2017) were used along with the tool biblioshiny (Aria & Cuccurullo, 2021). Based on our needs and requests, we also branched the source code of the Bibliometrix package on GitHub and updated the code for visualising the diagrams (colour scales, dimensions to extend the original constraints). To go further into the details of the topics, VosViewer was used as well (Center for Science and Technology Studies, 2021).

Bibliometric analyses typically rely on either Scopus or Web of Science. In the presented analysis, it was decided to rely on all sources listed in Scopus. In general, according to the macro-level study of bibliometric indicators, Web of Knowledge (Thompson Reuters) and Scopus show that the correlations between the measures obtained from the two databases are 0.99 (Archambault, Campbell, Gingras & Larivière, 2009). In Scopus, the coverage is broader; however, both Scopus and WoS tend to overrepresent English and focus more on specific disciplines (e.g., science, engineering, biomedical research) (Mongeon & Paul-Hus, 2016). Similarly, Aksnes and Sivertsen (2019) claim that both sources have a significant overlap and also similar deficiencies in the coverage of social sciences, humanities and non-English publications. According to both platforms, as of 1 March 2021 WoS covered over 21,000 journals, books and proceedings with a total of 79 million records, including 119,000 books and 220,000 conferences, ranging from 1900 to the present, depending on the subject (Matthews, 2021; Web of Science Group, 2020), while Scopus covers nearly 23,000 active journals, another 13.500 inactive journals, and over 150,000 books, with records ranging from 1788 to the present (Elsevier, 2021). Since WoS concentrates more on citation indexed journals and our goal was to explore not only top publications (which according to the above research are included in both with a considerable overlap) but primarily the field's evolution, it was decided to rely on Scopus as the main data source.

The research process followed a standard four-step approach (Figure 1). First, the research questions were formulated and the research design was determined. The second stage involved the creation of a bibliometric dataset, which included obtaining data from Scopus and data preparation. The third stage entailed data preparation, followed by data analysis, which among others entailed both content analysis and visualisation of the results. Finally, the results were interpreted and limitations and guidelines for future research were established.

The data were collected from Scopus in March 1st 2021. The search terms chosen were "intangible capital", "intangible investment" and "intangible assets" since these three terms are used in the economics literature. The scope was limited to "Economics, Econometrics and Finance". In 537 papers, the journals' fields also overlapped with the field of "Economics, Management and Accounting" and in 175 cases with the field of "Social Sciences". A total of 1,489 papers published in journals, books and other publications was included in the analysis (Figure 1). Of these, 1,208 were published as journal articles in 160 different journals, while the rest were published in books, book series, and conference proceedings. One journal, the Review of Income and Wealth, published a total of 23 articles on intangibles. This was followed by the Journal of Business Ethics with 21 articles, Review of Quantitative Finance and Accounting (17), and Applied Economics with 15 articles. Among journals publishing several articles on the topic of "intangibles" that are perhaps somewhat more 'business journals', journals in the accounting field stand out, as discussed below. Yet, a number of these articles address important accounting or strategic issues related to intangibles (albeit, often using different definitions) and thus it would be inappropriate to eliminate them.

Journal articles, books and book chapters along with conference papers were considered. A total of 1,208 journal articles, 55 books, 199 book chapters, and 27 conference papers was examined. The study was limited to English-language contributions and accordingly a total of 34 contributions (9 Spanish, 8 Russian, 7 Ukrainian, 3 French, and 7 contributions from other countries) were excluded. The decision to limit to English was made given the intention to also conduct content analysis. Although other languages are important for dissemination in the domestic academic and professional community, the number of contributions excluded from the analysis worldwide is very small and does not limit the analysis in the paper.

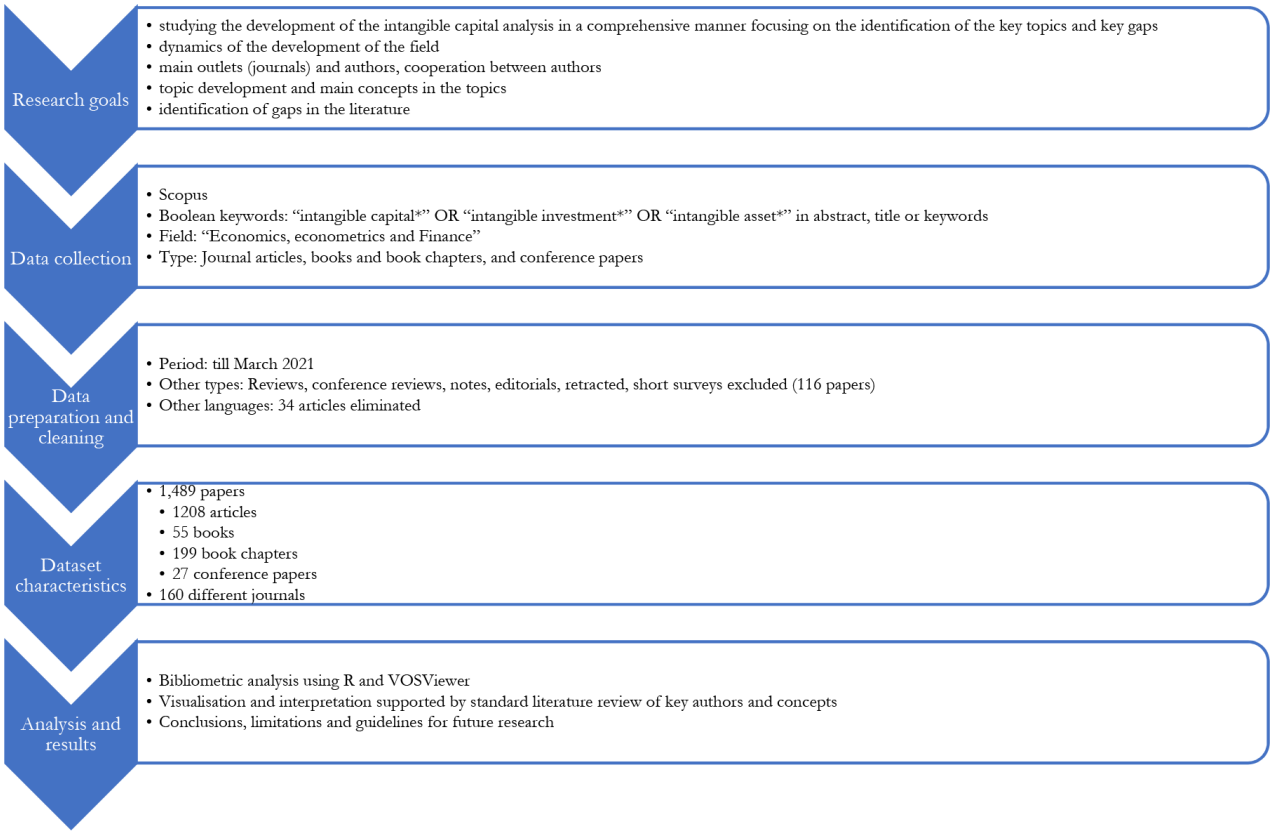


Figure 1. Step-by-step research approach summary (Roblek, Dimovski, Mesko & Peterlin, 2022)

The dataset of 1,489 papers was the work of a total of 2,859 different authors, who appeared in the papers a total of 3,269 times (some papers were co-authored). Further, 466 contributions were written by a single author, while co-written contributions had an average of 2.2 co-authors. The dataset was described by a total of 3,045 author keywords and 791 additional keywords. The average 'age' of the papers (years since publication) was 8.9 years. Each paper was cited an average of 1.6 times per year. The analysed dataset also included 67,.500 references used in the articles.

3. Results

3.1. Overview of the Field's Development

The first papers on intangibles were published already early in the 20th century. In 1908 (Scopus covers generally sources that date back to 1788), in the mentioned paper "On the nature of capital: Investment, intangible assets, and the pecuniary magnate" by Veblen (1908), he was the first author to specifically distinguish tangible from intangible capital when stating that:

> Invested wealth is capital, a pecuniary magnitude, measured in terms of value and (…) which proceeds on an appraisement of the gain expected from the ownership of this invested wealth. In modern business practice, capital is distinguished into two co-ordinate categories of assets, tangible and intangible. "Tangible assets" is here taken to designate pecuniary serviceable capital goods, considered as a valuable possession yielding an income to their owner. Such goods, material items of wealth, are "assets" to the amount of their capitalizable value (…). "Intangible assets" are immaterial items of wealth, immaterial facts owned, valued, and capitalized on an appraisement of the gain to be derived from their possession.

Later, in 1920, Vanderblue's essay "Railroad Valuation by the Interstate Commerce Commission" dealt with the cost and value determinants in railroads guided by the fact that "the law requires the Commission to find and report all elements of value". In this context, they also addressed strategic value, "which seeks to identify as value elements those factors that result in higher gross revenues or lower operating costs and therefore determine net revenues". This discussion is extremely important as it illuminates the early recognition of the

importance of intangibles for business performance. They add the following factors that make up "the intangible value of railroads" for the activity in question: Population and traffic density, type and consistency of population and traffic, facilities for doing business etc. The author also stresses that "the franchise as such and franchise value have occupied a relatively small place in the discussion of intangibles", which points to the recognised value of brands, which are now a core component of corporate intangible assets (Corrado, Hulten & Sichel, 2005, 2006).

The discussion of intangibles continued between 1970 and 1994 in a total of 20 papers, including Kendrick (1972), Cox (1978) and Liu (1977) (Figure 2). Even in this early period, the intangible capital literature in "Economics, econometrics and finance" discussed both the: (1) definition of intangibles; and (2) problem of measurement and the role of including intangibles in national accounts. Thus, in 1972 Kendrick directly opened the discussion on "The Treatment of Intangible Resources as Capital" (Kendrick, 1972). He noted that "it has been widely observed that the increase in national output has been large in comparison with the increase in land, labor hours, and physical, reproducible capital". He attributed this increasing divergence to "various types of human (intangible) investment and capital" and to "intangible investment in research and development activities largely aimed at improving the quality or productive efficiency of tangible, nonhuman goods" (Kendrick, 1972: page 110). This definition already includes two of the main components of the prevailing definition of intangible capital used today: human capital and R&D. This paper also presented the first empirical evaluations of investments between 1929 and 1966 in the United States: Tangible investment was estimated at about 30%, whereas intangibles, including R&D and human capital investment (which encompasses education and training, health, and mobility), were valued at between 14% and 18%. The definition of intangibles in the more economic field of analysis was also taken up by Griliches (1981) who defined the intangible "stock of knowledge" in terms of R&D and the number of patents, which directly corresponds to the dominant definition today put forward by Corrado et al. (2005, 2006). Juster, Courant and Dow (1981) defined wealth in two ways: "conventional tangible capital" and "intangible human capital and other capital assets, the stock of organizational capital reflected in networks of social support systems...". Saunders (1982) examined the determinants of cross-industry differences in foreign ownership in Canada and attributed them to differences in intangible assets: technology, innovative designs, and sales-promotion strategies. This definition already extends the meaning to softer marketing factors, which are now included with brands.

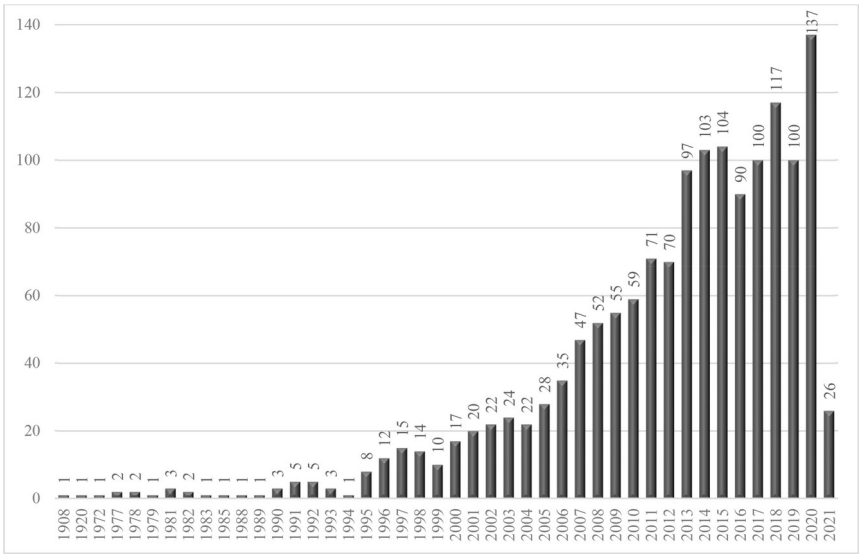


Figure 2. The number of works published by year: 1908 to 1 March 2021 (Scopus)

The literature also highlights the role of including intangible capital or investment in growth accounting and national accounts. On top of the aforementioned work by Kendrick (1972), Eisner examined income and savings in the USA in several papers (Eisner, 1978, 1991; Eisner, Simons, Pieper & Bender, 1982), noting the importance of including both tangible and intangible investment in national accounts calculations. He showed that in the

three postwar decades investment in intangible capital grew faster than that in tangible capital. Other issues related to the impact of intangibles on economic performance (including productivity, market value, foreign investment, global value chains) were also addressed early on in the literature. For example, Patel and Pavitt (1994) discussed the role of national innovation systems and their impact on intangible investment and a number of macroeconomic variables (growth, demand, internationalisation). Several papers consider internationalisation and globalisation in the context of intangibles, stressing the impact of international elements on investment and the nature of intangibles, as well as on intangibles as a strategic advantage (Doeringer & Terkla, 1992; Glenn, 1993; Morck & Yeung, 1992). Work examining firm-level problems also addresses the problem of firm value, capital budgeting, and investment decision-making (Boucher & Macstravic, 1991; Liberatore, Monahan & Stout, 1992).

In 2001, Baruch Lev continued the discussion with a paper that became the most cited work in the field, attracting a total of 734 citations. He defined intangible assets by emphasising that "intangible assets, like any other asset (a machine or a rental property), are a source of future benefits", but "intangible assets lack a physical embodiment". However, a unified definition did not emerge until 2005 when the literature adopted the definition of Corrado et al. (2005) for intangible capital as being the sum of: 1) computerised information (computer software, computerised databases); 2) innovative capital (which mainly includes R&D yet also other innovative expenditures); and 3) economic competencies (brand equity, firm-specific human capital, organisational structure) was widely adopted, even though the work is closely related to Lev and Nakamura's ideas from the 1990s (Lev, 2004; Lev & Sougiannis, 1996; Nakamura, 1999). Carol Corrado is also the second-most cited author in the analysed dataset after Baruch Lev, with 325 citations in the 1,489 papers.

The field of intangibles gained momentum towards the end of the 1990s and especially after 2000. In 1999, in his paper "Intangibles: What Put the New in the New Economy?" Leonard Nakamura discussed the topic using examples of business giants like Microsoft, Pfizer and Gillette, highlighting the importance of copyrights and patents for these companies to encourage investment in "intangibles" that represent significant value. He continued his discussion to develop a definition of intangible assets that includes not only copyrights and patents but also product and process innovations, brand names, and trademarks; even reputation is mentioned. Besides focusing on the actual definition, he already additionally addressed the problem of the mismeasurement of actual investment when claiming that "*most expenditure on intangibles are not recognized as investments*" (…), adding that this practice is not problematic when such "*assets was a negligible portion of total investment*", but stressed that that "*is no longer the case*".

3.2. Key Journals

By 1 March 2021, nearly 1,500 articles on intangibles (investments, capital, assets) had been recorded in Scopus. Since it is very much an economics topic, most articles were published in a purely 'economic' journal, The Review of Income and Wealth, which issued a total of 23 papers on intangibles, the first being "The Treatment of Intangible Resources as Capital" by Kendrick (1972). In 2020, the journal published three papers in the field of intangibles: one focused on R&D capital depreciation (Li & Hall, 2020) (Table A1), the second on the impact of intangibles on productivity in Italy (Di Ubaldo & Siedschlag, 2020), and the third on innovation and R&D in private households co-authored by Sichel and Hippel (2020), with the former article being another dominant reference in the intangibles field. Among more economics-oriented journals "Current Problems in Economics" stands out with a total of 12 papers being published. The focus of these papers is chiefly on intellectual capital and measuring the loss of value of human capital compared to the loss of value in general (Derun, 2013; Kornilova & Klymenko, 2014; Len & Peretiatko, 2015; Malyshko, 2008; Polonskyi & Shapovalova, 2010). Table A1 summarises the top journals by number of articles in the intangibles field.

The overlap in the list of journals in the category of "economics, econometrics and finance" means that some journals with a more economics focus are found in the top positions. Among journals having published the most in the area of intangibles, several finance journals rank highly. For example, the Journal of Business Ethics, a business-oriented journal, had published a total of 21 articles in the area studied, the first in 2000 by Miles and Covin (2000), who emphasised that "corporate reputation is an intangible asset" and related it to corporate performance. The most recent contribution is by Baumgartner, Ernst and Fischer (2020) who also stress the role

of reputation by stating that "Corporate reputation is (...) one of firms' most valuable intangible resources". Other contributions in the journal are also mostly concerned with corporate reputation, corporate social responsibility, and ethics, although there are exceptions. Martin-de-Castro, Delgado-Verde, López-Sáez and Navas-López (2011) developed a model of the "intellectual capital-based firm" and underscored that "intellectual capital (IC) or knowledge assets are replacing the other factors – labor, land, and capital – as the fourth factor of production" with intellectual capital defined largely in terms of human resources, e.g., "talented and committed employees, cultural values, or long-term relationships between the firm and its stakeholders".

In terms of source influence, the Journal of Business Ethics is prominent. It has the highest H, M and G indexes. Still, in terms of citations and the journal's influence on the field of intangibles' development, the gap between business and economics literature should also be considered here. The most important work on intangible investment in the economics literature has been published in the Review of Income and Wealth. Reference is made to these papers for the definition and methodology of measuring intangibles in terms of their impact on productivity (Corrado, Hulten & Sichel, 2009; Fukao, Miyagawa, Mukai, Shinoda & Tonogi, 2009; van Ark, Hao, Corrado & Hulten, 2009).

The economics, econometrics and finance literature also highlight an important issue that acts as a challenge for future research. As stated by Marčič (2020), there is an obvious gap in the study and conceptualisation of intangible capital analysis in economics and business literature. While economics is primarily interested in the problem of intangibles and productivity, the more business-oriented topics focus either on selected aspects (accounting, valuation) or selected elements of intangibles and their relationship/role in the firm. Yet, little has been done to bridge this gap, notably with respect to understanding why companies invest in intangibles.

3.3. Key Contributors And Contributions

The field of research on intangibles has been dominated in recent years by several core researchers and their teams. Although the now dominant research on intangible capital in economics was driven by the work of Nakamura and Lev in the late 1990s and early 2000s, the most prolific author was Jonathan Haskel (Table 1). Haskel was also part of the Corrado team that published the most influential papers using today's generally accepted definition of intangibles and examining the impact on economic growth (Corrado et al., 2005, 2006; Corrado, Haskel & Jona-Lasinio, 2014). After Teece, the founder of the concept of dynamic capabilities, Corrado is the second-most prolific author.

Even though citations also indicate the most important work, they also strongly influenced by the 'age' of a work and the breadth of the field. Focusing on the narrow area of economic research on intangibles, Griliches' work on the relationship between R&D, patents, and market values is the most cited, with a focus on a particular segment of intangibles. With 417 citations, it is the 10th-most cited paper and, despite being published in the heavily economics-oriented journal Economic Letters, it deals with a finance topic. In general, the first nine most-cited papers focus on financial aspects, with Francis from 2004 being the most cited with 825 citations, dealing with the cost of equity and intangible assets, followed by Lev from 1996, dealing with R&D value, with 803 citations, and Moser Con with 783 citations, dealing with asset vulnerability and urban development. The Corrado et al. (2009) paper ranks 18th with 268 citations (Corrado et al., 2009; Francis, LaFond, Olsson & Schipper, 2004; Griliches, 1981; Lev, 2004; Lev & Sougiannis, 1996; Patel & Pavitt, 1994; Prescott, 1998; G. Roos & Roos, 1997).

The authors and co-authors of the papers came from 76 different countries. Most authors were from the USA, with a total of 657 (the same author may appear more than once), or 26% of all papers written or co-written by US authors. This was followed by researchers from the United Kingdom responsible for 9% of the authorship. Italian authors accounted for 6% (Corrado, Haskel & Jona-Lasinio, 2016, 2017a,b, 2019; Jona-Lasinio & Meliciani, 2018; Marrocu, Paci & Pontis, 2012; Marrocu & Paci, 2010; Zambon & Marzo, 2012), while Australian and Spanish ones for 5% (Aguer-Hortal, 2018; Alfaro, Lopez & Nevado, 2011; Lopez & Olivella, 2018; López-Ruiz, Alfaro-Navarro & Nevado-Peña, 2016; Navarro, Ruiz & Peña, 2014), followed by Chinese and German (Erickson & Rothberg, 2017; Li, Vo & Wu, 2019; Li & Wu, 2018; Roth, 2010). However, looking at the narrow scope of intangible research in economics related to development and productivity, the most notable contributions are made by the aforementioned USA, Japan and several EU economies (Italy and Jona-Lasionio,

Finland and H. Peikkola, France with A. Bonfour, Germany with Roth (Roth, 2010; Roth & Thum, 2013), and several others). The dominance of the USA is also seen on the map of country collaborations (Figure 3).

Author	Number of papers	H index	G index	M index	Total citations
Haskel	13	6	13	0.5	184
Teece	9	5	9	0.263	184
Barth	6	6	6	0.231	1,510
Corrado	6	3	6	0.333	81
Jona-Lasinio	6	3	6	0.333	81
Piekkola	6	4	5	0.364	30
Windsperger	6	4	6	0.19	104
Zhang	6	3	3	0.158	11
Barajas	5	3	5	0.375	31
Holland	5	4	5	0.25	131
Labory	5	2	2	0.118	8
Liu	5	3	5	0.15	130
Mcgrattan	5	4	5	0.222	127
Miyagawa	5	2	4	0.222	18
Pantzalis	5	5	5	0.217	174
Serrasqueiro	5	2	2	0.222	6
Shakina	5	3	5	0.375	31
Bianchi	4	2	2	0.118	6
Bounfour	4	3	4	0.214	16

Table 1. Most productive authors in the field of intangibles and their impact (Data Scopus, 2021, analysis in R)

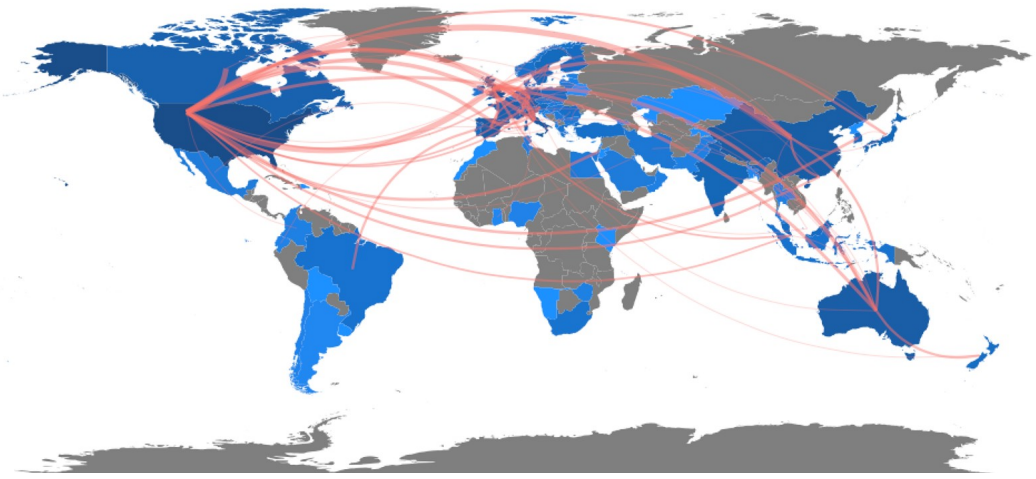


Figure 3. Country collaboration map (Data Scopus, 2021, analysis in R)

The field has been influenced by very diverse literature (Figure 4), including some highly regarded work in business and economics, reflecting divergence in the literature. The set of cited references (also Table A2) reveals that the work by Lev and Sougianni (1996) entitled "The Capitalization, Amortization, and Value-relevance of R&D" is the most cited. As expected, the next strong node is Corrado, who along with her co-authors made the seminal contribution with their methodological papers in 2005, 2006 and empirical papers in 2006, 2009 and initiated the development of the literature principally in the field of economics focused on productivity effects. The most cited work by Corrado in the literature analysed is the 2013 paper "Innovation and Intangible Investment in Europe, Japan, and the United States" (Corrado, Haskel, Jona-Lasinio & Iommi, 2013). Productivity is a dominant research area related to intangible capital and investment, as also evident in the

literature (local citations). This primarily refers to Griliches (1981), Prescott (McGrattan & Prescott, 2004, 2010; Prescott, 1998) as well as some other sources like "Intangible Assets: Computers and Organizational Capital" (Brynjolfsson, Hitt & Yang, 2002). Due to the designated 'finance' focus of the literature, there are also several widely cited works from the finance field that may be understood as microfoundations for the macro estimates of Corrado et al. These papers are chiefly concerned with market valuation, investment intensity, q ratios, specific asset types and valuations, and the like (Bond, Cummins, Eberly & Shiller, 2000; Griliches, 1981; Hall, 2001; Roos & Roos, 1997). Of course, one can also find work that specifically addresses the appropriate recognition of intangibles (Barth, 2000; Barth, Kasznik & McNichols, 2001; Wyatt, 2001, 2005), providing methodological support for the literature initiated by Corrado. Figure 4 additionally shows that the intangibles field is also firmly influenced by the management literature, with this connection being mainly seen in the "finance and accounting" literature. Among the authors, Barney, Teece, Grant, Edvinsson and Guthrie are particularly strong (Barney, 1991; Edvinsson, 2000; Grant, 1999; Lin & Edvinsson, 2011; Teece, 2003, 2015). While predominantly concerned with skills, competencies, intellectual capital, and intangibles from a management (competitiveness) perspective, this stream of literature is significant for the field's development not only today, but also in the future after it was recognised that productivity, competitiveness and management go hand in hand.

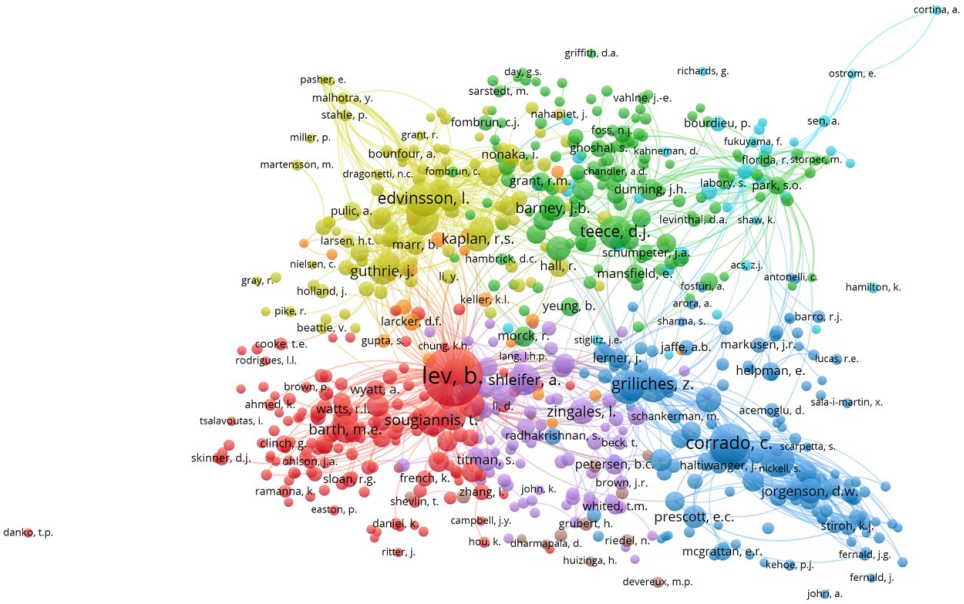


Figure 4. Local citations of authors (Scopus, 2021; VosViewer analysis)

3.4. Key Topics

The field of intangible capital research in economics was shown to have developed in two main directions: Economics and Finance with Accounting. As explained in the methodology, there are several ways to study content. The simplest, by definition, is to examine keywords. Figure 5 provides an overview of the keywords and the strength of the links. As expected, intangible assets and intangibles are the two most important terms. Yet, intellectual capital, human capital, innovation, and R&D are also found within the top papers, suggesting that among intangible assets, human capital, knowledge and R&D receive the greatest attention because they are either defined directly as part of intangible assets (like in Goodridge, Haskel & Wallis, 2017, for example) or studied with a focus on that specific component and are only loosely linked to intangible assets (Kornilova & Klymenko, 2014). The fact that the section is divided into economic and financial analysis is also justified by the content. The financial and accounting aspect is also very strong in the economics literature and reflected in the components of corporate performance, corporate governance, valuation, capital structure and market value, revealing the efforts in the literature to properly value intangible assets and link them to enterprise value (performance).

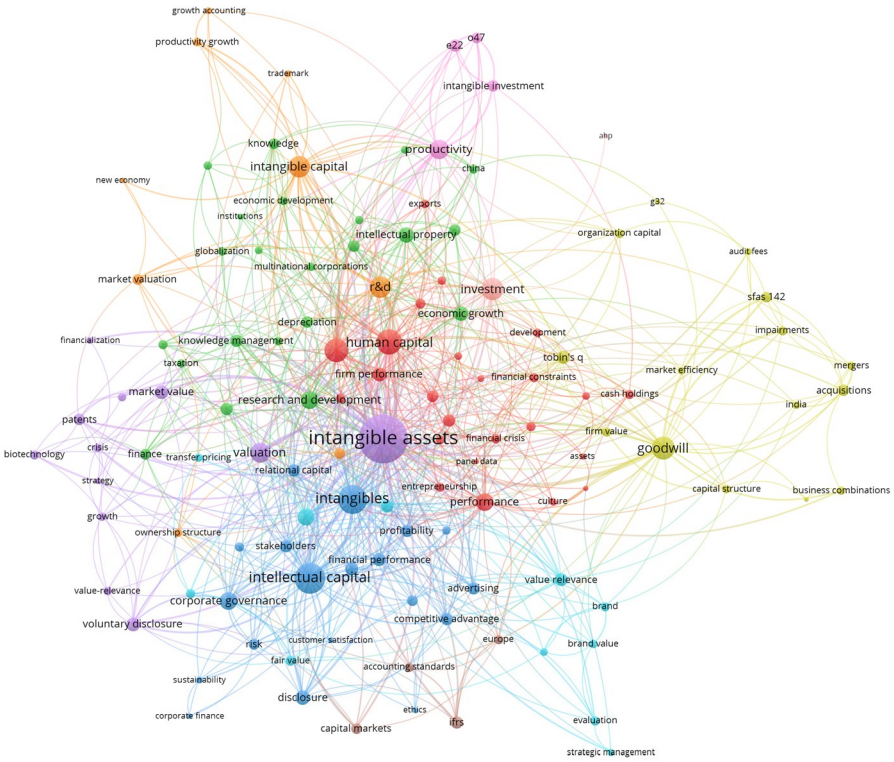


Figure 5. Results of the key words analysis (Scopus, 2021; VosViewer analysis)

The keyword analysis also provided initial indications of topic dynamics (Figure A1). While the term "intangible assets" dominates due to the overlap with "accounting and finance" topics, the "economic" current strengthens after 2007 with the rapidly increasing appearance of the term "intangible capital" (the first Corrado estimates were published in 2006). Although the "financial and accounting" aspects are either stable (valuation, reporting, governance) or declining (assets), the economic side has gained in strength, as shown by the growing use of other terms related to intangible capital as well, such as investment, innovation, human capital, productivity, and economic growth (due to the macro focus of the research).

To further investigate the field's thematic evolution, a thematic evolution in R was performed based on author keywords, giving weighing to word repetitions. The field was temporally divided into 1908-2008 and later, marking the publication of the three articles on intangibles in the Review of Income and Wealth (Corrado et al., 2009; Fukao et al., 2009; van Ark et al., 2009). The analysis of thematic development shows the main themes remain relatively stable, even though R&D is more closely related to social capital, while human capital, R&D and innovation are directly related to intangible capital, which did not exist as a concept before 2008. Globalisation is becoming an important element of R&D, and innovation is linked to advertising. A more detailed look at the domains by time period shows that the basic pre-2008 themes (Figure 6, Panel B) concentrated more on financial/accounting issues. Basic 'economic' issues also tended to focus on individual components of intangible assets (human capital, IT, knowledge, productivity), albeit the terms "intangible assets" and "intellectual capital" have begun to appear. Still, the economic perspective is gradually becoming stronger, as reflected in the motor themes where R&D, intangibles, the new economy, and performance are in the centre of attention.

After 2008 (Figure 6, panel B), economic issues begin to dominate the fundamental issues and the financial aspect loses importance. "Intangible" becomes a well-established term for both capital and investment. Interestingly, among the niche topics, depreciation also emerges – the problem of the depreciation of intangibles is a very important yet extremely thorny issue addressed already by Piekkola and co-authors in the Innodrive project (Piekkola, 2011a) and also anticipated in the surveys on intangible assets (e.g., in Italy, (Perani & Guerrazzi, 2012). With the methodological development and better data availability, more niche topics associated with intangibles are also studied.

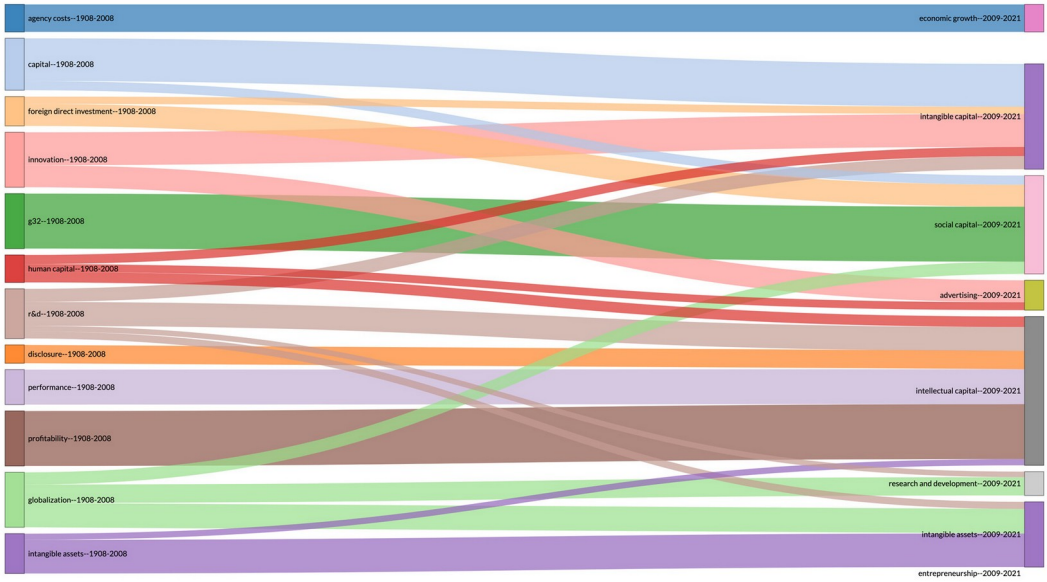
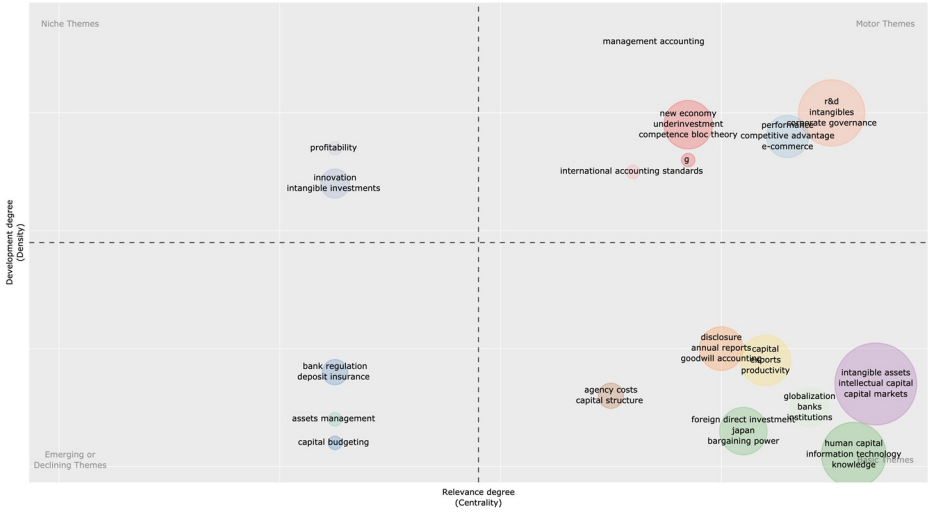


Figure 6 (panel A). Thematic time-map (Data Scopus, 2021; analysis in R)

Time slice 1: 1908–2008



Time slice 2: 2009–2021

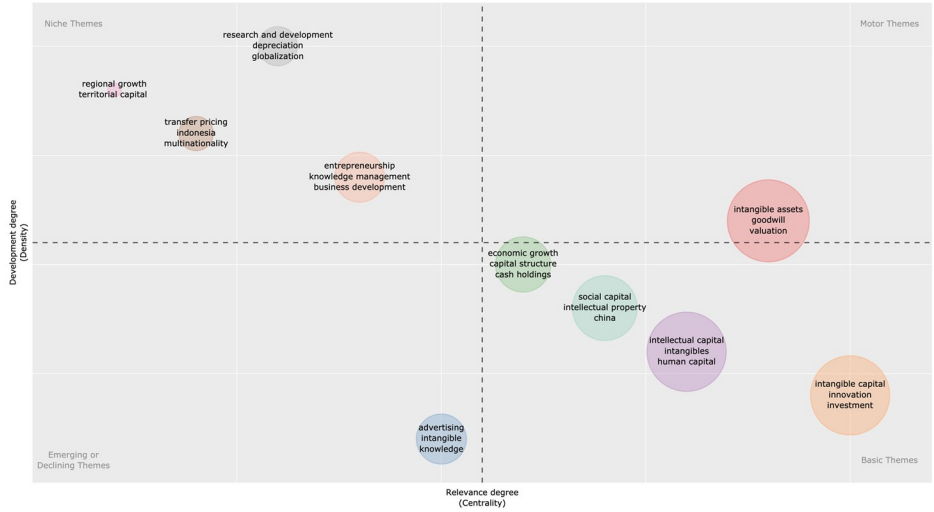


Figure 6 (panel B). Thematic time-map by time (Data Scopus, 2021; analysis in R)

The fact that the field of intangibles is divided into two main streams (according to "Economics, Econometrics and Finance" in Scopus and in general): economic aspects and enterprise-level aspects (business aspects), with literature strong in finance, is also confirmed by the MCA analysis (Figure 7). The conceptual structure according to the MCA method (Figure A2 in the Appendix) shows that in economics the focus in terms of intangible capital is on intangible capital, economic growth, productivity, innovation, development, R&D, FDI, and so on. As stated, the work focuses on empirical research on productivity in different countries. On the other hand, there is a clear focus on the financial perspective.

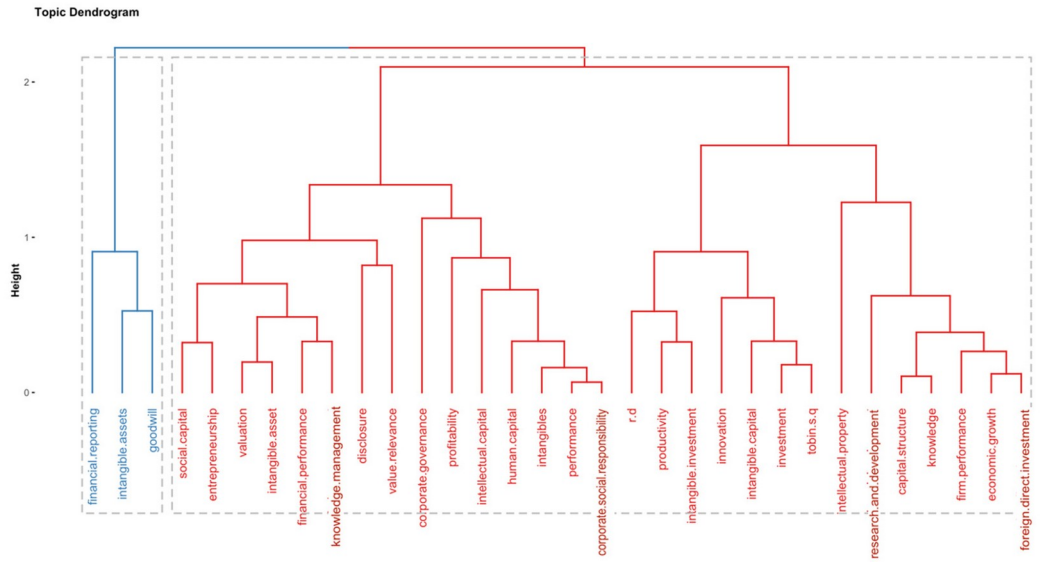


Figure 7. Topic dendrogram and author keyword clusters (MCA method) (Data Scopus, 2021; analysis in R)

4. Discussion

4.1. Discussion of the Results

The paper focused on analysis of the field of intangible capital (investments, assets) solely in the field of economics, econometrics and finance (according to the definition of Scopus fields). The analysis clearly revealed that:

1. The research focuses on two main aspects: the aggregate (and to some extent sectoral) level, mostly concentrating focusing on productivity research, economic growth and contributions to growth, including econometric analysis. Firm-level analysis primarily considers the financial and accounting aspects such as aspects of corporate governance, valuation, capital structure, and market value. This part of the literature also aims to properly value intangible assets and relate them to business performance.
2. The analysis of the literature used in this area shows that the connection with the typical management literature is quite weak, notwithstanding that authors like Barney and Teece are cited in the literature as representatives of the "Resource View" strand of literature (Figure 4).

The productivity steam in the literature is dominated by research motivated by the work of Corrado and her team (Corrado et al., 2005, 2006, 2014) mainly on productivity-related research in the private sector, yet also in the public sector. Several studies have extended the work to other countries, concentrating on sectoral analyses (Corrado et al., 2017a, 2019; Fukao et al., 2009; Ilmakunnas & Piekkola, 2014; Jona-Lasinio & Meliciani, 2018; Roth, 2020, 2022). On the other hand, Piekkola (Bloch, Piekkola, Rybalka, Eklund & van Criekingen, 2021; Piekkola, 2011b, 2018a) has contributed significantly to the development of a micro-based approach and to research on the impact of intangibles on firm productivity. Yet, despite extensive research, the lack of a link between the micro-based approach and the sectoral/macro approach remains a challenge. Indeed, the macro and sectoral estimates often rely on data such as EU Klems, Innodrive or Coinvest and other data based on the estimation of 'investment' using input-output flows. In contrast, the micro approach proposed by Piekkola (2011) and extended in Bloch et al. (2021) stems from the employment structure, which allows the simulation of

investments. There is a lack of a uniform measurement approach and data collection, possibly also by extending international accounting standards to allow for detailed data collection.

Second, the literature neglects the question of 'why' and 'how' intangibles affect productivity. Although economics, econometrics and finance focus on productivity and growth, this gap in the literature and the topics studied is nevertheless quite revealing. Economic development, productivity growth, and progress in general are very complex and begin on the microeconomic level where firms decide whether or not to invest (in tangible or intangible resources). And the fact that a strand of literature showing that intangible capital is important in many ways on both the macro- and microeconomic levels does not draw heavily on the management literature and examine motivations for investment reveals a clear gap in the literature (Table 3).

The relationship with productivity, typically measured by value added, could easily be established by the link through competitive advantage (Dodd, 2016) or further explained by human capital and skills, as suggested by Marr (2004) or Barney (1991). There is also no link to the intellectual capital-based view of the firm, especially in the studies looking at productivity growth. The finance and accounting literature more often refers to the concept of structural and relational capital, but neither study addresses the detailed motivations on the firm level from the executive perspective, which is very important. Successful development here will only be possible if the motivations for such investments are understood and considered in empirical analysis. Above all, from a political perspective, it is necessary to address motivation and encourage such investments.

Existing main topics	
Economics, econometrics and finance	**Management**
• Corrado et al.'s (2006) economic definition of intangible capital: • computerised information, • innovative capital, and • economic competencies • Influence of intangibles on **productivity** on the macro, sectoral and firm levels • On the firm level – the **productivity** impact of intangibles: • R&D, computerised capital, human capital, organisational capital, and customer capital • Data: official statistical data, registry data on the firm level	• The intellectual capital-based view of the firm • Marr (2004, 2008): human capital, structural capital and relational capital • Barney (1991) competitive advantage creation theory • Intangible capital is providing a competitive advantage (Dodd, 2016) • No unified definition, separate analysis for specific components • Data: predominantly from surveys
Main gaps in the literature	
• Different methodological approaches to estimating intangible capital on the macro/meso and firm levels, which cause a lack of connection between the levels • The need to develop an internationally standardised definition and measurement approach	• The link between the management/business literature, which focuses on mechanisms, and productivity literature, which demonstrates effect

Table 3. Gaps in the literature

4.2. Contributions, Limitations and Future Research Orientations

The analysis contributes to the literature in several ways. To our knowledge, it is the first comprehensive bibliometric study of the literature on intangible capital in economics, complementing traditional approaches to literature review in this area, which are also scarce (Roth, 2019). This paper systematically highlights the most relevant authors and papers, revealing the diversity of the literature in the field of intangible capital analysis. Second, the paper shows that the majority of the literature focuses on macroeconomic issues and research around productivity on the macro, meso or micro levels. It is also clear that particular aspects of intangible capital (e.g., R&D) are mainly studied. This points to a gap in the literature and drives future research development in the areas less considered in the literature. Third, the paper stresses the need to open the 'black box' and examine causalities in this area and transmission channels in greater detail, stressing issues for future research. Based on the quantitative and visualising analyses, we make contributions to overall understanding of the intangible literature structure between the economics and management stream while suggesting the need to close the research gap concerning economic and management intangible capital research in the academic field.

The analysis can also be expanded and improved in the future to overcome certain limitations of the presented analysis. First, a more detailed analysis of each key theme would allow key relationships/variables of interest within a given theme to be identified. An in-depth examination of each variable would allow the detection of possible existing analyses of causal mechanisms in the literature that explain the channels via which intangibles affect productivity, spillovers etc. Second, to explain the differences in the structure and accumulation of intangible capital that affect productivity growth, it is vital to understand the motivations for investment, which are often linked to managerial decision-making processes. This means that work spanning both economics and management would be of particular interest. Separate analysis of this work could provide a deeper understanding of these processes. Third, similar conclusions could apply to the transmission mechanisms or channels of intangibles' impact on firm performance. Firms may differ in how successfully they use intangible resources. This research strand would also require a detailed analysis of a subset of the literature. Finally, the gap or lack of linkages between economics and management (Table 3) goes beyond the topics just addressed. A comprehensive bibliometric analysis of the field and the overlap could help identify other relevant elements and develop new streams in the literature. Finally, it is important to acknowledge what Donthu, Kumar, Mukherjee, Pandey and Lim (2021) also noted: the nature of the bibliometric methodology itself is a limitation. Namely, the subjectivity of the qualitative claims of bibliometrics, given that bibliometric analysis is quantitative in nature, makes it sometimes difficult to distinguish between quantitative and qualitative conclusions. We are also aware that bibliometric studies can only offer short-term predictions for the research field (Wallin, 2005). In addition, a comprehensive bibliometric analysis would benefit from including all different sources, including working papers, other sources, which are usually not included. As a consequence, for example, Corrado et al. (2005) as the starting point is not included in this analysis.

This paper contains theoretical, managerial and policy implications. It provides an overview of publication trends and distribution, which suggests the economic research of intangible capital is a lasting yet recent valuable research topic. Second, the paper identifies the most productive authors and countries/regions and their co-operation networks, and further analyses the top-cited authors and articles together with their clusters, which led to a picture being formed of the most impactful and influential research bodies of intangible capital research fields. We also revealed the research hotspots and determined the clusters along with their formation and evolution, which reveals the topics and themes most addressed in this domain. Next, it identifies a research gap in the literature that needs to be addressed, concentrating on the management literature that examines the motivations for investment, especially highlighting the lack of a connection to the intellectual capital-based view of the firm, notably in studies that focus on productivity growth. This considerable gap points to an essential future research direction that also requires an interdisciplinary approach, in particular collaboration between business and economics. The annual publication trend of intangible capital research studies in economics shows a significant increasing trend after 2007 and a far more rapid growth in the following years, suggesting that the economic research of intangibles is attracting more extensive attention in the academic field. As a result, the paper also offers opportunities to advance the field. The literature lacks not only the theoretical background, but also the concept of how this is important for businesses. By conceptualising the theoretical background of the motivation to invest in intangible capital, this idea can be translated into management activities, especially those focused on detailed motivations on the firm level from a management perspective. Moreover, by recognising the motivators for investing in intangible capital, the policy framework can be altered to encourage this type of investment and, in turn, productivity growth.

As mentioned, the economics literature typically focuses on outputs, i.e., productivity, and leaves to one side the 'black box' of the firm. This may be seen as a large research gap and, more importantly, a great opportunity for firms to further promote their productivity growth by understanding the causalities and mechanisms that enable intangible capital to accelerate productivity growth.

5. Conclusions

Bibliometric analysis is very useful for tracing the development of the field, showing the structure of the scientific field, and identifying the most important authors, most influential works, and cooperation networks. The aim of this paper was to present the evolution of intangible investment and intangible capital in the economics literature over time. While intangible capital was spotlighted in the literature as early as the beginning

of the 20th century, this stream of literature developed mostly after the works by Corrado et al. (2005, 2006) with a considerable number of works dealing with the methodology, measurement and empirical analysis of either intangible capital as a whole or a specific component of it, generally innovation (R&D) or human capital. The literature also indicates that the area of intangible capital is important in finance, where related topics are studied, but on the firm level, focusing on the impact on firm valuation, capital valuation, and profitability.

An examination of the references also shows the strong links among all sources with a few core papers and a clear indirect nexus between micro- and macro-level research, yet an obvious gap between the very empirical economics and the more conceptual management field. The focus on definition, measurement, and empirical evaluation lacks understanding of the mechanisms and leaves the 'black box' of the firm sealed shut. Therefore, a deeper understanding of the motives, enablers, obstacles and expected outcomes and their empirical evaluation could broaden what is understood regarding the role of intangibles in the development of the economy.

The work also reveals some interesting features that could point to new research ideas. First, there is a clear methodological, measurement and empirical focus in this area. Yet, with the advent of the new technological revolution the question arises of whether the existing definition of intangible capital is still appropriate and whether there is not too much reliance in the literature on the definition provided by Corrado et al. (2005, 2006). Future research that would be complemented by a traditional literature review could examine the literature from a critical perspective. A similar problem arises with empirical research. There is a plethora of research on impact, with studies often relying on similar measurement approaches and employing the same definition. On one hand, this adds to the richness of empirical findings while, on the other, alternative approaches could expand understanding of the role played by intangibles.

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Declaration of Conflicting Interests

The author declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix

	Source	H index	G index	M index	Total	# papers	First publication
1	Review of income and wealth	11	15	0.22	255	23	1972
2	Journal of business ethics	15	21	0.68	1,978	21	2000
3	Review of quantitative finance and accounting	8	15	0.32	242	17	1997
4	Applied economics	8	12	0.20	172	15	1981
5	International business review	10	15	0.48	391	15	2001
6	Accounting and finance	7	13	0.32	280	13	2000
7	Economics of innovation and new technology	7	13	0.25	355	13	1994
8	Journal of banking and finance	10	13	0.40	423	13	1997
9	Economics letters	7	12	0.17	596	12	1981
10	Long range planning	9	12	0.20	1,175	12	1977
11	Asian social science	3	5	0.33	37	11	2013
12	International journal of accounting	9	11	0.41	219	11	2000
13	Investment management and financial innovations	5	8	0.31	79	11	2006
14	Journal of financial economics	8	11	0.25	1,243	11	1990
15	Journal of international business studies	8	11	0.31	913	11	1996
16	Journal of the knowledge economy	5	8	0.42	72	11	2010
17	Accounting review	7	10	0.27	760	10	1996
18	Critical perspectives on accounting	7	10	0.44	119	10	2006
19	Journal of accounting and economics	8	10	0.31	2,215	10	1996
20	Journal of corporate finance	7	10	0.29	346	10	1998
21	Managerial finance	3	8	0.12	78	10	1997
22	Small business economics	5	10	0.25	304	10	2002
23	Actual problems of economics	4	5	0.36	32	9	2011
24	Advances in accounting	5	8	0.36	74	9	2008
25	Intangibles, market failure and innovation performance	3	6	0.43	42	9	2015
26	International journal of production economics	9	9	0.30	479	9	1992
27	Academy of accounting and financial studies journal	2	6	0.18	40	8	2011
28	Accounting, auditing and accountability journal	8	8	0.47	617	8	2005
29	Contemporary accounting research	3	6	0.19	45	8	2006
30	Industrial and corporate change	6	8	0.27	202	8	2000
31	Journal of accounting research	7	8	0.29	1,066	8	1998

*For details on the H, M and G indexes, see Sgourakis (2020).

Note: Index h of a journal's or author's paper is equal to, for example, 5, if 5 publications have at least 5 citations each, and the other (5) papers have no more than 5 citations each. The g-index is a variant of the h-index that, in its calculation, gives credit for the most highly cited papers in a data set. The m-index is another variant of the h-index that displays the h-index per year since the first publication (details in Sgourakis (2020)).

Table A1. Most important journals in the field of intangibles* (until 1 March 2021)

Document	Year	Local Citations	Global Citations	LC/GC Ratio (%)	Normalized Local Citations	Normalized Global Citations
Lev, 1996, J Account Econ	1996	58	868	6.68	10.09	7.55
Hall, 2001, Am Econ Rev	2001	35	140	25.00	8.24	1.23
Barth, et al., 2001, J Account Res	2001	26	418	6.22	6.12	3.66
Griliches, 1981, Econ Lett	1981	26	447	5.82	2.89	2.76
Brynjolfsson et al., 2002, Brookings Pap Econ Act	2002	24	383	6.27	9.10	5.74
Hall et al., 2005, Rand J Econ	2005	23	1,570	1.46	10.73	18.97
Wyatt, 2005, Account Rev	2005	22	106	20.75	10.27	1.28
Peters et al., 2017, J Financ Econ	2017	19	110	17.27	30.16	14.99
Barron et al., 2002, J Account Res	2002	18	156	11.54	6.83	2.34
Marrocu, et al., 2012, Ind Corp Change	2012	16	47	34.04	28.00	4.51
Edmans, 2011, J Financ Econ	2011	14	476	2.94	13.25	17.14
Corrado, et al., 2013, Oxf Rev Econ Policy	2013	13	40	32.50	18.54	3.98
McGrattan et al., 2010, Am Econ J Macroeconomics	2010	13	52	25.00	11.62	2.03
Bond et al., 2000, Brookings Pap Econ Act	2000	13	79	16.46	6.70	1.39
Roos & Roos 1997, Long Range Plann	1997	13	581	2.24	5.91	4.11
Collins et al., 1997, J Account Econ	1997	12	704	1.70	5.45	4.98
Dischinger & Riedel, 2011, J Public Econ	2011	11	110	10.00	10.41	3.96
Hayn & Hughes, 2006, J Account Audit Financ	2006	11	101	10.89	6.75	2.33
Borgo et al., 2013, Oxf Bull Econ Stat	2013	10	28	35.71	14.26	2.78
McGrattan et al., 2010, Am Econ Rev	2010	10	48	20.83	8.94	1.87
Awano et al., 2010, Econ Labour Mark Rev	2010	10	24	41.67	8.94	0.94
Ritter & Wells, 2006, Account Financ	2006	10	44	22.73	6.14	1.02
Barth & Kasznik, 1999, J Account Econ	1999	10	97	10.31	6.25	3.86
Brown & Petersen, 2011, J Corp Financ	2011	9	168	5.36	8.52	6.05
Gu & Wan, 2005, J Bus Financ Account	2005	9	88	10.23	4.20	1.06
Barth Beaver at al., 1998, J Account Econ	1998	9	384	2.34	5.04	2.67
Barth & Clinch, 1998, J Account Res	1998	9	254	3.54	5.04	1.76
Miyagawa & Hisa, 2013, Jpn Econ Rev	2013	8	11	72.73	11.41	1.09
Chalmers et al., 2012, Account Financ	2012	8	39	20.51	14.00	3.74
Garca-Ayuso, 2003, Account Audit Account J	2003	8	52	15.38	9.60	0.93
Corrado et al., 2017, Oxf Bull Econ Stat	2017	7	35	20.00	11.11	4.77
Bontempi & Mairesse, 2015, Econ Innov New Technol	2015	7	22	31.82	18.67	2.34
Kimbrough, 2007, Account Rev	2007	7	35	20.00	9.68	1.43
Goodwin & Ahmed, 2006, J Int Account Audit Tax	2006	7	39	17.95	4.30	0.90
Morck & Yeung, 1992, J Int Econ	1992	7	259	2.70	4.38	3.80
Belo et al., 2014, Rev Econ Dyn	2014	6	27	22.22	15.45	3.21
Eisfeldt & Papanikolaou, 2014, Am Econ Rev	2014	6	22	27.27	15.45	2.62
Roth & Thum, 2013, Rev Income Wealth	2013	6	20	30.00	8.56	1.99
Edquist, 2011, Rev Income Wealth	2011	6	17	35.29	5.68	0.61
Sahut et al., 2011, Rev Account Financ	2011	6	23	26.09	5.68	0.83
Nakamura, 2010, Rev Income Wealth	2010	6	26	23.08	5.36	1.02
De & Gutta, 2007, Econ Rec	2007	6	20	30.00	8.29	0.82
Matolcsy & Wyatt, 2006, Account Financ	2006	6	51	11.76	3.68	1.18
Konar & Cohen, 2001, Rev Econ Stat	2001	6	622	0.96	1.41	5.45
Chappell & Jaffe, 2018, Rev Ind Organ	2018	5	7	71.43	22.50	1.80
Clausen & Hirth, 2016, J Corp Financ	2016	5	11	45.45	19.57	1.46
Haskel & Wallis, 2013, Econ Lett	2013	5	22	22.73	7.13	2.19
Borisova & Brown, 2013, J Bank Financ	2013	5	56	8.93	7.13	5.57
Bens et al., 2011, J Account Audit Financ	2011	5	59	8.47	4.73	2.12
Boyd et al., 2010, J Manage	2010	5	187	2.67	4.47	7.30

Table A2. Most locally cited papers with number of (normalised) citations and ratio of global vs local citations

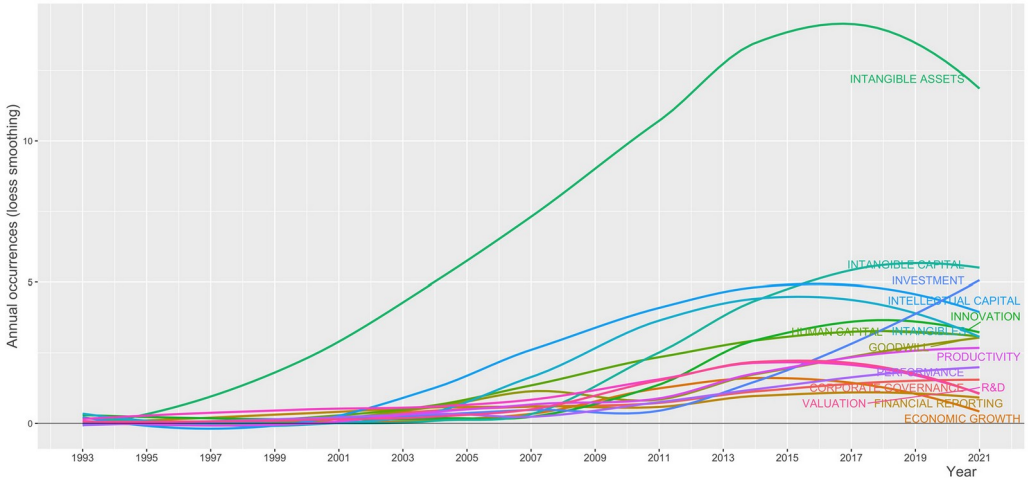

Figure A1. Key word dynamics: Author keywords yearly occurrences in time (Data Scopus, 2021; analysis in R)

Figure A2. Conceptual structure map and author keyword clusters (MCA method) (Data Scopus, 2021; analysis in R)