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Screening and enhancing intellectual capital consistency: A scoping review of systematised literature reviews

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ABSTRACT

This scoping review aimed to screen and enhance intellectual capital consistency, providing a general overview of existing systematised literature reviews of intellectual capital. This scoping review addressed five research questions: 1. How did the typology of publications, both theoretical and empirical, evolve considering the different stages of intellectual capital? 2. What are the milestone studies marking the beginning of the five stages of evolution of the intellectual capital framework? 3. How has the intellectual capital construct evolved? 4. What are the main streams of research on intellectual capital and how are they characterised? 5. What are the most relevant topics, gaps, and future trends in the field of intellectual capital? To answer the research questions, a scoping review was conducted following a search of the Web of Science and SCOPUS databases. The final search identified 78 full-text articles, published between 2005 and 2023. The evidence revealed the emergence of new topics and identified 13 clusters. We found evidence of the beginning of the fifth stage around 2018 due to the change in the research paradigm observed in this study and the development of new themes, such as innovation, digitalisation, knowledge, sustainability, and entrepreneurship, contributing to the ecosystem development of cities, regions, and nations. This pioneering scoping review systematised literature reviews about intellectual capital, providing important implications for theory, as it presents paths to follow and relevant indications for the evolving fifth stage of intellectual capital.

Introduction

Recent years have seen an exponential growth in both the number and diversity of published literature reviews (e.g. integrative literature reviews, systematic reviews, bibliometric analyses, and meta-analyses) on topics related to intellectual capital (IC) (e.g. Ahlawat et al., 2023; Daraio et al., 2023). A preliminary critical assessment of these reviews suggests that although they are justified and contribute to knowledge in this field, they frequently present an array of isolated results. These results are limited to a specific temporal period, different units of analysis (e.g. organisational, regional, and national), a particular organisational type (e.g. companies, industry and public, private, or social institutions), a specific principal component of IC (e.g. human capital, social capital, and structural capital), or a specific form of measurement (e.g. Value Added Intellectual Coefficient (VAIC), Data Envelopment Analysis (DEA), and Balanced Scorecard (BSC) with Key Performance Indicators).

For these reasons and because this is an area of research with a large number of published literature reviews, researchers looking for a general synthesis of current knowledge find it especially difficult to obtain a unified synthesis in a single document. In the field of research related to IC, no synthesis is found to simultaneously cover all the published literature reviews; therefore, combining, unifying, and identifying gaps in the literature would indicate future research avenues.

Well-drawn syntheses of peer-reviewed research literature generating rigorous results are essential for research (Suri & Hattie, 2013) as long as they are duly justified and successfully carried out (Gough et al., 2012). They provide high-quality analyses, create new knowledge (Suri, 2013), and indicate paths for exploiting knowledge. As highlighted in Gutierrez-Bucheli et al. (2022), these syntheses provide a field of research with a broader and deeper understanding, and are based on knowledge drawn from a given moment (Littell et al., 2008). They also create new ideas for (re)direct research and development (R&D) activities (McMahan & McFarland, 2021) and prepare the ground for more

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reflection and innovation in research and practice by current and future scholars (Harlen & Deakin Crick, 2004). Although some methodological aspects are common to all types of literature reviews, a fundamental consideration for researchers is the need to evaluate the most appropriate literature review technique to perform their work according to the research aims, purposes, time limit, and other practical elements (Gutierrez-Bucheli et al., 2022).

As stated in Arksey and O'Malley (2005), this rapid growth in literature reviews has resulted in a significant number of terms describing approaches which, despite their different names, share certain essential, common characteristics, namely collection, assessment, and presentation of available research evidence. It is also worth highlighting systematic reviews, meta-analyses, quick reviews, (traditional) literature reviews, literature surveys, integrative literature reviews, essays, narrative reviews, critical reviews, research syntheses, structured reviews, bibliometric analyses, and scoping reviews (ScRs). In addition, as underlined by Pham et al. (2014), due to the variability in performing these reviews, methodological standardisation is necessary to ensure the usefulness and strength of the evidence.

An ScR is a relatively new approach (see Arksey & O'Malley, 2005; Westphaln et al., 2021) for synthesising knowledge. ScR can synthesise existing knowledge and identify trends and gaps to inform other research, policies, and practices (Arksey & O'Malley, 2005; Levac et al., 2010; Tricco et al., 2016; Westphaln et al., 2021). Mays et al. (2001) advocated that ScR aims to map the key concepts that underpin a particular area of research and the main sources and types of evidence available. According to the same authors, it can be conducted as an independent project, especially when the area is complex or has not been comprehensively reviewed. As outlined in Munn et al. (2018), ScR can be conducted when the associated goals are as follows: (i) identifying gaps in knowledge, (ii) defining the field of a given body of literature, (iii) clarifying concepts, or (iv) investigating how the research was performed. In addition, ScR is useful for examining emerging evidence when it is still unclear which other, more specific questions can be asked and addressed more thoroughly, for example, through a systematic review (Armstrong et al., 2011; Munn et al., 2018). Arksey and O'Malley (2005) highlighted that an ScR differs from a systematic review in that the latter typically focuses on a clearly defined question for which appropriate study designs can be identified in advance. ScR addresses expansive topics for which numerous study designs may be applicable. According to these authors, a systematic review aims to provide answers to questions derived from a relatively narrow range of quality-assessed studies, whereas an ScR is less likely to address highly specific research questions or assess the quality of the included studies.

For these reasons, and as there is a large number of literature reviews published on IC that consider the credibility and impact of these previous studies as forms of synthesised knowledge, this approach is suitable for mapping the breadth and depth of the literature on the topic of IC for two reasons: (I) ScR is considered an ideal tool to determine the field or coverage of a set of literature on a given topic or area of study and provides a clear indication of the amount of literature and studies available, as well as a general view (broad or detailed) of their focus (Munn et al., 2018); and (II) it offers an opportunity to identify key concepts, research gaps, and types and sources of evidence to inform practice, providing contributions and implications for policy and research (Daudt et al., 2013).

Following Arksey and O'Malley (2005), this ScR was based on four main motivations: (1) to examine the state-of-the-art and conduct a systematic search of the literature on IC for articles published in the form of literature reviews; (2) to map the characteristics and variety of methodologies used in these reviews, synthesise, and share research results; (3) to identify and examine the challenges and limitations reported in carrying out these reviews and highlight important gaps in the literature; and (4) to make recommendations to improve the approach to IC, or the need and/or viability of carrying out a systematic review, improving the consistency of knowledge, and opening up new avenues of study. To achieve the goals of the current ScR, the structure followed by Arksey and O'Malley (2005) was adopted with the following five steps: (i) specifying the research question(s); (ii) identifying the relevant literature; (iii) selecting studies; (iv) mapping data; and (v) summarising, synthesising, and reporting the results.

A clear articulation of the research question(s) was the first step in conducting the ScR. Initially, the questions and purpose of the research were conceptualised based on a preliminary rapid literature review (Arksey & O'Malley, 2005; Westphaln et al., 2021). Considering that the topic of IC has evolved and grown in terms of articles published, journals used, and the number of researchers (e.g. Pedro et al., 2018a; Massaro et al., 2018; Bellucci et al., 2021), its focus has evolved since the 1960s. It now includes four delimited periods and an ongoing fifth stage (e.g. Massaro et al., 2018), requiring a deeper understanding of the evolutionary pathways of these stages, especially the fourth and fifth ones, concerning the remarkable achievements and gaps identified.

In the current approach, the theoretical lens is framed within the scope of several studies. First, neo-institutional and legitimacy theories converge in advocating that organisations' positioning is created through legitimacy search mechanisms targeted to deal with both external and internal pressures from stakeholders and the surrounding environment (van Vught et al., 2008). Second, the intellectual positioning theory analyses the movement through which knowledge and experience are mobilised to inform a high-value intervention (e.g. intellectual or intangible assets) in the public domain (Eyal & Buchholz, 2010). Third, the agency theory provides alternative insights by examining the economic characteristics of organisations in relation to the behavioural implications for governance and efficient resource allocation mechanisms (Kivistö & Zalyevska, 2016). Nevertheless, it must be noted that our cornerstone literature stream is the systems theory, since it can be applied to all development stages of IC and can be used to assess the evolution, growth, changes, and adaptation pathways of IC theory-related literature (Yawson & Paros, 2023).

The first stage of IC goes back to the end of the 1980s and continues into the 1990s, being directed to develop a theoretical framework (Pedro et al., 2018a). In this stage, the IC theory focused on generating or sourcing value from organisational resources (Edvinsson & Malone, 1997). According to Stewart (1997) and Edvinsson and Malone (1997), IC became a viable alternative for competitive leverage (Allee, 1997) as it integrated essential business components. IC theory emphasised balancing human, organisational, and customer capital to optimise intangible assets. It argued that intangible assets have become crucial to achieving competitive advantage in a knowledge-based economy (Sveiby, 1997; Stewart, 1997; Edvinsson & Malone, 1997). In this context, the importance of the systems theory, which links the individual to the process and then to the organisation's performance, was highlighted (Yawson & Paros, 2023). IC shifted from a static to a dynamic theory (Harris, 2000).

The second stage, which began in 2000, was more incrementally innovative and evidence-based, with a line of research focusing on IC measurement, management, and communication. It conceptualised specific aspects of IC, such as accounting, reporting, and measuring IC, and created different taxonomies that have helped define and group different methods for IC assessment.

The third stage, which began in 2004, developed implications arising from the use of IC in organisational management. It focused on practical analysis with deeper implications for IC management. The knowledge, skills, and abilities of individuals chosen for management and leadership roles were crucial factors in determining information access and shaping the structure of an organisation and its internal systems (Harris, 2000).

The fourth stage focused on IC ecosystems at the national, regional, and city levels (Dumay, 2013) and began in 2004. It emphasised connecting knowledge across internal and external systems to enhance performance (Harris, 2000). It also extended IC value creation to external environments, particularly to stakeholders (Secundo et al., 2016), including the transfer of knowledge from universities to society

(Secundo et al., 2018). Dumay et al. (2020) argued that IC should support an ecosystem of various organisations rather than simply utilising its environment. A complex dynamic system is also made up of individuals who work for an organisation, the internal system they utilise, and the external entities they deal with (Mokhlis et al., 2024).

According to Massaro et al. (2018), it is in the fourth stage that researchers began to analyse the interrelations between the three pillars of sustainability in the field of IC: economic, environmental, and social, initiating the fifth stage of IC. The concept of sustainability also applies to the systems theory because it comprises human capital and the rest of nature (Cabezas et al., 2005). Massaro et al. (2018) underlined the need to consider different points of view on the value of IC and sustainability practices, together with a discussion about how their conclusions support the fifth stage of IC research. Dumay et al. (2018) and Dumay et al. (2020) corroborated this premise, indicating the start of the fifth stage.

Considering the above literature review and the inherent challenges of the fourth and fifth stages of IC research, the following research questions were formulated:

RQ1. *How has the typology of theoretical and empirical papers changed over time, considering the different phases of IC?*

RQ2. *Which milestone studies signal the start of the five phases of the developing IC framework?*

RQ3. *What is the evolution of the IC construct?*

RQ4. *What are the primary IC research streams at the moment, and how are they defined?*

RQ5. *In the realm of IC, what are the most pertinent theoretical perspectives, contributions, topics and emerging trends?*

This study provides new insights and critical views based on an ScR of existing literature reviews in the IC context and is structured as follows: First, the methodology adopted is described in detail; second, the evidence obtained is presented and discussed; and finally, the conclusions and limitations of the study are presented.

Methodology

Identifying the relevant literature

The search queries were elaborated and refined through brainstorming by the research team. In defining the scope of this study, the aim was to broadly identify the literature reviews published in the realm of IC to address the research questions previously raised (Arksey & O'Malley, 2005). The strategy adopted involved a search for research evidence in electronic databases, which usually contain bibliographic details and abstracts of published material. To be included in the ScR, reviews or articles containing all types of literature reviews published in peer-reviewed journals until the end of 2023 must be included. Because of the cost and time involved in translation, only materials written in English were considered, as this is the most universal language used to disseminate the results of scientific research worldwide. This may be considered a limitation because several relevant studies were ignored. According to Arksey and O'Malley (2005), the search of electronic databases should consider (i) the selection of databases to be used, (ii) the appropriate types of terms or related keywords for the research as well as the key concepts, and (iii) a test of the search query to fine-tune it.

To identify potentially relevant documents, Clarivate's Web of Science (WOS) and SCOPUS databases were searched. These two databases were chosen because they are the most commonly used in this type of research (e.g. Pedro et al., 2018a; Leitão et al., 2023; Pereira et al., 2023); these sources include different domains and cover research in the human and social sciences in general, alongside a diversified set of management and economics topics.

We searched for articles with their 'title', 'abstract', and 'keywords' to ensure the greatest coverage possible. Since IC is a broad concept with multiple meanings (Mustapha & Abdullah, 2004), the search terms used were as follows: 'intellectual capital', 'intellectual asset', 'intellectual resource', 'intangible capital', 'intangible asset', 'intangible resource', 'knowledge capital*', 'knowledge asset', 'knowledge resource', and 'knowledge management', to ensure that no important document was excluded. Finally, the above-mentioned terms were checked with the '*' wildcard to include singular and plural versions, and related words. We developed search strategies to assess the quality of the collected documents. First, only articles published in peer-reviewed journals were accepted; second, the quality of texts was evaluated by reading complete texts whenever the title, abstract, and keywords were not conclusive; and third, the number of citations in Clarivate's WOS and Scopus databases were checked.

After collecting articles from the databases and eliminating all duplicates, all documents were analysed individually, considering that the core focus of the study was IC. They should include a systematic search of at least one database to ensure that the articles are studied based on a search for random data. If the full text was inaccessible, the article was eliminated. Only five recent documents (from 2022 to 2023) without citations were found. After reading these documents, we felt the need to include them given their focal relationship with the ScR topic. Table 1 provides a general overview of the procedures used in this study.

Selection of studies

In this phase, 822 documents were identified in Clarivate's WOS and 1120 in SCOPUS, resulting in 1942 papers. The final search results were exported directly from Clarivate's WOS and SCOPUS to Mendeley and duplicates were removed. The Mendeley platform was chosen for four reasons: (i) the possibility of importing directly from both databases; (ii) the possibility of joining all documents in a single file; (iii) individual access to all the information relating to each document, including the abstract; and (iv) the possibility of exporting the data from all documents to a format accepted by VosViewer, which facilitates the mapping of some data to describe the sample.

After eliminating 572 duplicates, the titles and summaries were read or the full paper was read when analysis of the former elements was not conclusive, leading to the elimination of articles that did not meet the inclusion criteria listed in Table 1. The final selection included 78 studies published in peer-reviewed journals. Fig. 1 presents the ScR protocol and the total number of selected documents. The following section maps the data through thematic analysis and indicates how the ontological organisation was carried out.

Mapping, extraction, and treatment of data

Following Westphaln et al. (2021), this phase included the mapping, extraction, and treatment of data. Data treatment is defined as the process of synthesising and interpreting qualitative data according to the topic studied, using a 'descriptive-analytical' method, understood as the application of a common analytical structure (see, Arksey & O'Malley, 2005). It is therefore necessary to determine the variables of interest for data extraction (qualitative and quantitative) according to the research questions previously raised, and to develop a graphic data structure.

According to Westphaln et al. (2021), data analysis was carried out in two steps, namely: (i) quantitative (descriptive analysis of the ScR) and numerical analysis of the data (that is, *RQ1*); and (ii) qualitative (evolution of publications over time) and content analysis (i.e. *RQ2, RQ3, RQ4*, and *RQ5*).

Summarize, synthesise, and report

Descriptive analyses

First, we present the results of several descriptive analyses, providing

Table 1
Searching and researching procedures: Inclusion versus exclusion criteria.

Procedure	Inclusion criteria	Exclusion criteria
Databases	Clarivate's WOS and SCOPUS	All other databases
Document types	Article or Review article	All other document types
Area of study	Intellectual capital	Whose main theme is not IC
Type of study	'Systematic review' or 'meta-analysis' or 'rapid review' or 'literature review' or 'narrative review' or 'research synthesis' or 'structured review' or 'bibliometric analysis' or 'scoping review'	Documents that do not fit the inclusion criteria
Temporal basis	From appearance until the end of 2023	-
Language	English	All other languages
Source type	Journals	Not peer-reviewed journals
Subject area	Management, business, economics, and accounting	All other areas
Search within	Title, abstract, keywords	-
Search terms	'Intellectual capital' or 'intellectual asset*' or 'intellectual resource*' or 'intangible capital' or 'intangible asset*' or 'intangible resource*' or 'knowledge capital*' or 'knowledge asset*' or 'knowledge resource*' or 'knowledge management'	-
Article selection criteria	Title in the scope of IC; Abstract in the scope of IC; Must include a systematic search in at least one database.	Elimination of duplicates; title out of scope; abstract out of the scope; does not include a systematic search in at least one database; and full text not accessible.
Search queries (made in January 2024)	Clarivate's WOS query: Results for 'Intellectual capital' or 'intellectual asset*' or 'intellectual resource*' or 'intangible capital' or 'intangible asset*' or 'intangible resource*' or 'knowledge capital*' or 'knowledge asset*' or 'knowledge resource*' or 'knowledge management' (Topic) AND 'Systematic review' Or 'Systematic literature review' Or 'Meta-analysis' Or 'Rapid Review' Or 'Literature Review' Or 'Literature Survey' Or 'Essay' Or 'Narrative Review' Or 'Research Synthesis' Or 'Structured Review' Or 'Bibliometric Analysis' Or 'Bibliometric study' Or 'Scoping Review' (Topic) and Article or Review Article (Document Types) and Management or Business or Economics (Web of Science Categories) and English (Languages) SCOPUS query: (TITLE-ABS-KEY ('Intellectual capital' OR 'intellectual asset*' OR 'intellectual resource*' OR 'intangible capital' OR 'intangible asset*' OR 'intangible resource*' OR 'knowledge capital*' OR 'knowledge asset*' OR 'knowledge resource*' OR 'knowledge management') AND TITLE-ABS-KEY ('Systematic Review' OR 'Systematic Literature Review' OR 'Meta-analysis' OR 'Rapid Review' OR 'Literature Review' OR 'Literature Survey' OR 'Essay' OR 'Narrative Review' OR 'Research Synthesis' OR 'Structured Review' OR 'Bibliometric Analysis' OR 'Bibliometric Study' OR 'Scoping Review') AND PUBYEAR < 2024 AND (LIMIT-TO (SUBJAREA, 'BUSI')) AND (LIMIT-TO (DOCTYPE, 'ar') OR LIMIT-TO (DOCTYPE, 're')) AND (LIMIT-TO (LANGUAGE, 'English'))	

Source: Own elaboration.

an overview of the existing literature on IC theory. According to Massaro et al. (2016), different indicators can be used to evaluate trends in publications, such as the number of articles published, year of publication, type of study, focus of study, and authors' productivity. This first analysis provides a preliminary map of the existing literature and identifies possible gaps for future research. Fig. 2 shows a timeline of the total number of publications over time, indicating the study period and focus.

Regarding RQ1 (How has the typology of theoretical and empirical papers changed over time, considering the different *phases of IC*?), the analysis of the timeline presented above (see Fig. 2) led to the following preliminary conclusions:

- Systematised literature reviews of IC began in 2005, with a significant increase in 2021.
- New topics emerged, such as innovation in 2017, big data technologies in 2018, entrepreneurship, ecosystems, and sustainable development in 2020, green IC in 2022, and digital transformation in 2023.
- Some individualised sectors stood out, such as education (2018 and 2021), health (2020 and 2021), and electricity (2023).
- According to three studies (2007, 2011, and 2019), human capital was the most important IC component.
- The most studied topics were IC measurement (seven studies), IC disclosure (eight studies), IC and performance (seven studies), and IC and innovation (five studies).

Fig. 3 shows the authors who participated in at least two studies, methodology used, and journals that published them. The authors with the most publications were J. Dumay (6), J. Guthrie (3), and E. Pedro (3). The most commonly used methodology was a structured literature review, and the journal with the greatest number of publications was the Journal of Intellectual Capital.

Content analysis

To answer *RQ2, RQ3, RQ4*, and *RQ5*, a cluster mapping structure aligned by theme was established. The number of clusters was chosen by all the authors through personal evaluations. A similar procedure was followed to select topics. After careful analysis of the 78 papers, there was a consensual agreement to use the model with 13 clusters in chronological order, as shown in Fig. 4.

Fig. 5 presents a topic roadmap of the clusters, with the areas marking the beginning of each cluster and the IC stages to which they belong (concerning *RQ2* and *RQ3*).

Regarding Fig. 5 and to answer *RQ2* (Which milestone studies signal the start of the five phases of the developing IC framework?), we found that although the initial research was on 'General IC' with Marr and Moustaghfir (2005), which corresponds to all stages of IC, it was only in 2007 that systematised reviews started to focus on specific themes, namely Lerro and Carlucci (2007) for 'National & Regional IC' and Zula and Chermack (2007) for 'IC Components', included in the second and fourth stages, respectively. Subsequently, in 2015, there were themes located in the third stage of the IC cluster 'IC & non-profit and public sector', which started with a structured literature review by Dumay et al. (2015). After 2017 and 2018, there was a gradual increase in the number of systematisations in the literature. After the work of Buenechea-Elberdin (2017) and Grimaldi et al. (2017), both in the 'IC & Innovation' cluster, and de Santis and Presti (2018) in 'IC & digitalisation', whose themes belong to the fourth stage, more areas were linked to the change to the fifth stage of IC mentioned by Dumay et al. (2018), Massaro et al. (2018), and Dumay et al. (2020). These new areas comprised 'IC & knowledge', headed by the reviews by Garcia-Perez et al. (2020) and Paoloni et al. (2020); 'Sustainable IC' with the systematic literature reviews by Secundo et al. (2020); and 'IC & Entrepreneurship' with the mapping by Crupi et al. (2020).

To address *RQ3* (What is the evolution of the IC construct?), it is worth mentioning that the evolution of the IC construct was influenced by several key factors, as shown by the IC cluster roadmap in Fig. 5. First, the management of intangible resources has become vital in maintaining competitive advantage in a rapidly evolving technology. Second, the measurement and optimisation of IC have been possible, with the development of new tools to do so at the organisational, regional, and national levels. Third, the business paradigm has shifted. IC research has transitioned from an initial focus on the knowledge economy to a new paradigm emphasising innovation, digitalisation, knowledge, entrepreneurship, sustainability, and value creation through

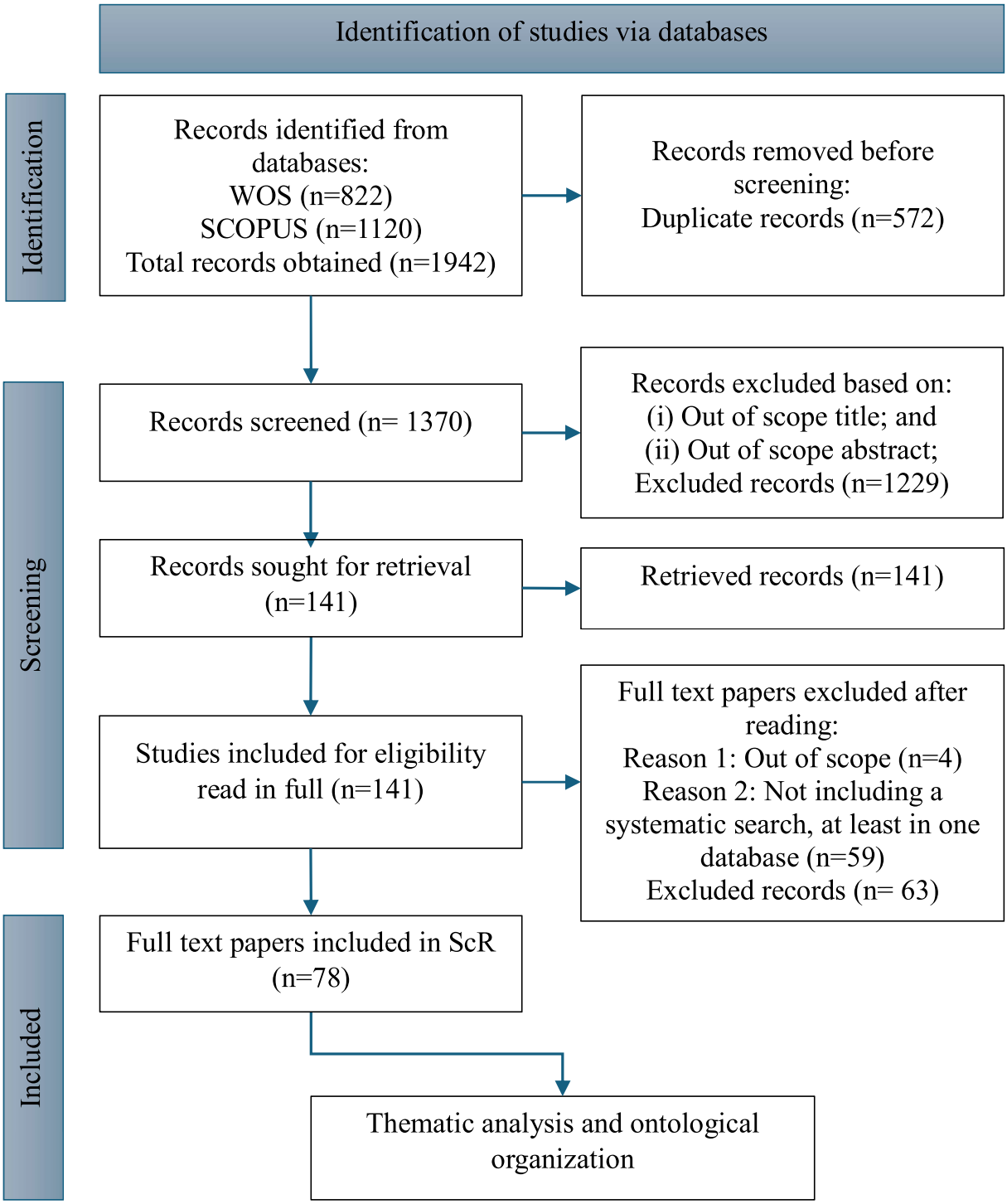

Fig. 1. ScR protocol used for final selection purposes (PRISMA-ScR flow diagram adapted from Tricco et al. (2018)).
Source: Own elaboration.

new business models. Fourth, IC plays an increasingly important role in the knowledge economy because, in this context, IC leads to the activation of capital formation processes and the emergence of other, more technological industries (e.g. Industry 4.0), as well as ecosystems. Finally, the beginning of the fifth stage of IC and related main research streams has been discussed. However, there is a need to explore emerging areas of research, such as IC and cybersecurity, knowledge management and intangible assets, disclosure practices, big data, and the integration of theoretical frameworks for strategy and value creation contexts, and to establish relationships between IC and variables such as scientific production, innovation, and the strategic use of resources in higher education institutions.

Clusters

To answer the two remaining research questions, *RQ4* (What are the primary IC research streams at the moment, and how are they defined?) and *RQ5* (In the realm of IC, what are the most pertinent theoretical perspectives, contributions, topics, and emerging trends?), a summary is presented in Table 2 by cluster, authors, and *RQ4* and *RQ5*, providing a theoretical perspective and topics covered, and addressing principal

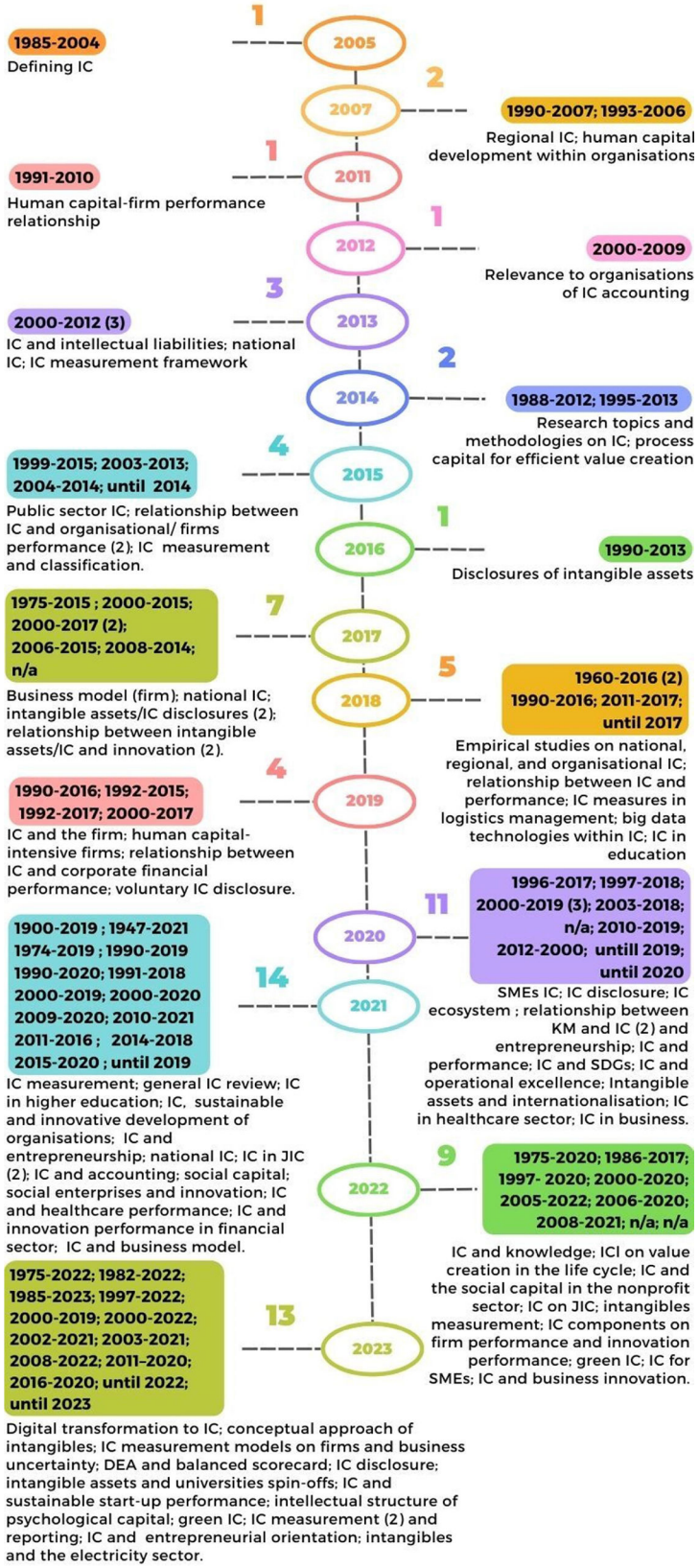

Fig. 2. Timeline of systematised literature reviews on IC.
Source: Own elaboration.

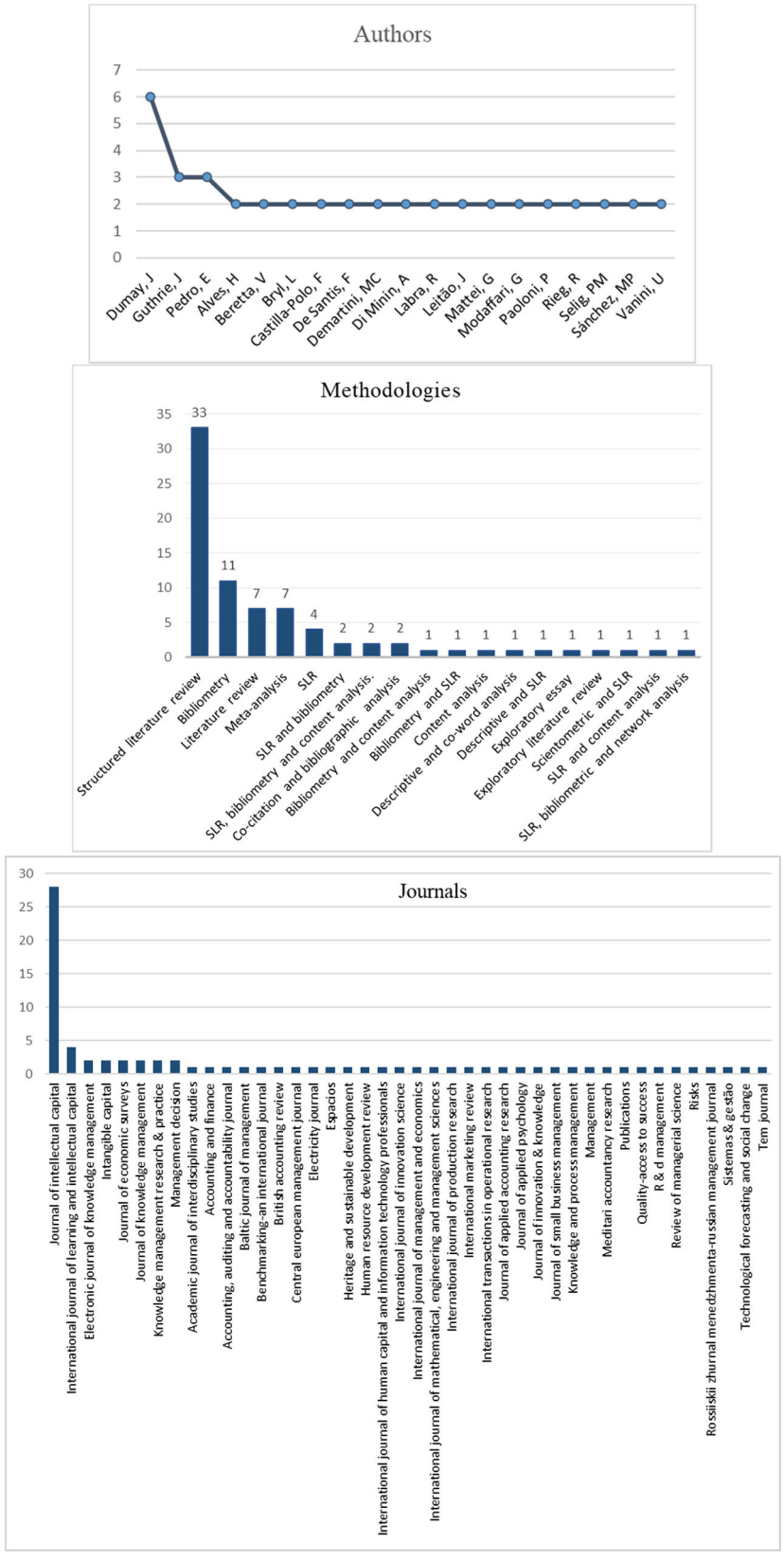

Fig. 3. Authors participating in at least two published studies, methodologies used, and journals publishing the studies.
Source: Own elaboration.

Fig. 4. Cluster model development.
Source: Own elaboration.

contributions and future trends[1].

Given the various perspectives presented in Table 2, the evolving construction of IC was shaped by changes in the business scenario, the need to increase the effectiveness of measurement and optimisation exercises, and the growing importance of intangible resources for management at different levels: individual, organisational, regional, and national. Based on the information provided above, arising from the synthesis of the relevant literature by study clusters included in this ScR, it can be inferred that IC's intersection with business models, leveraging IC assets for new value propositions, and research oriented towards ecosystems are important areas for future exploration. However, several contradictions and inconsistencies were observed in this study. It is clear from the findings in the Discussion section that even though the text advocates for more comprehensive IC frameworks and practices, current implementation and research are still fragmented and inconsistent across several areas and lack an integrative theoretical framework.

[1] For more information about the thematic analysis and ontological organisation procedures applied in the methodology, see the Appendix.

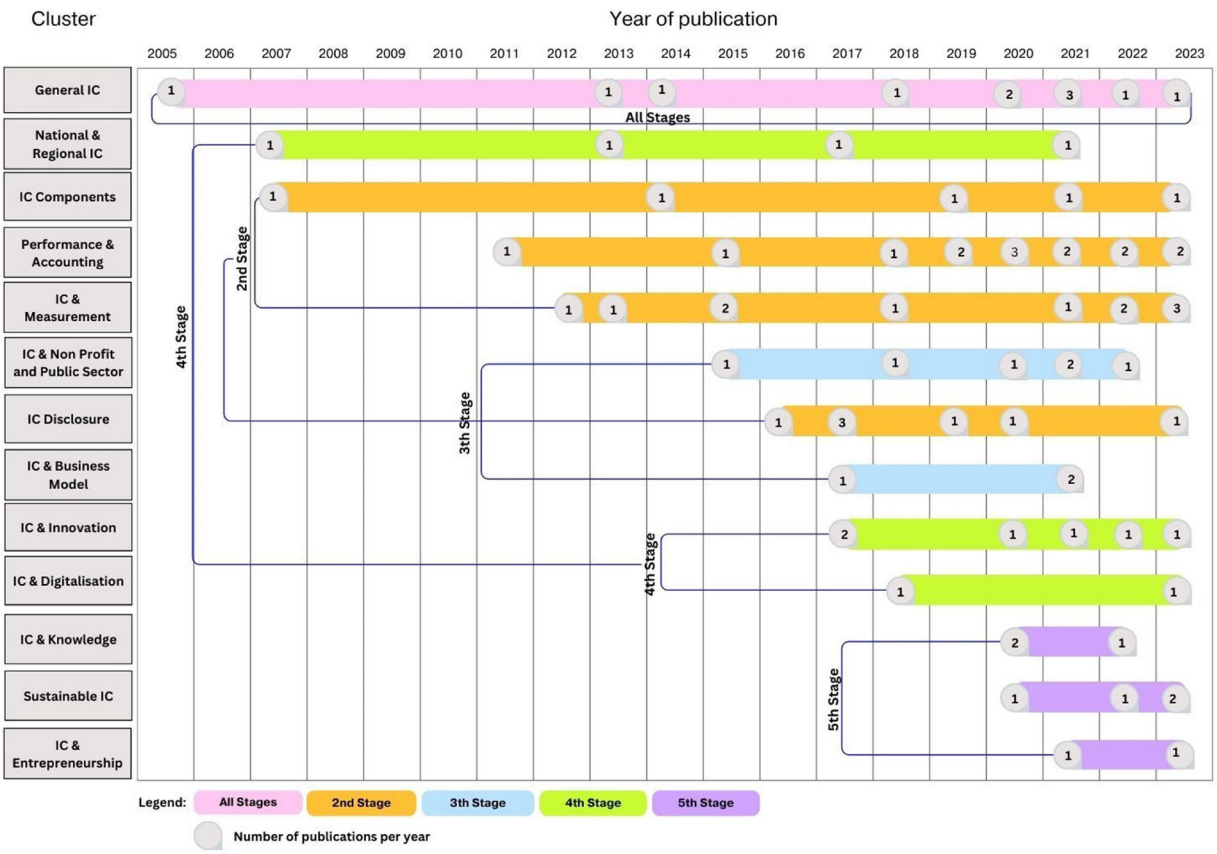

Fig. 5. IC clusters roadmap and IC stages integration.
Source: Own elaboration.

Discussion

Summarising the answer to *RQ2*, the evolution of the IC framework has been traced through several milestone studies, which collectively established the foundation for the general IC framework. In 2007, the systematic organisation of IC research began to concentrate on themes such as the development of IC components, the NIC, and the RIC. These themes were situated in the second and fourth stages of the IC framework. An additional extension occurred in 2015, with a particular focus on the relationship between IC and the non-profit and public sectors. This was the third stage of IC. A notable increase in the number of systematic literature reviews was observed after 2017 and 2018, with new areas of enquiry emerging in relation to 'IC & Innovation' and 'IC & Digitalisation'. These studies corresponded to the fourth stage and indicated a gradual transition towards the fifth stage, as conceptualised by Dumay et al. (2018) and Massaro et al. (2018). The key themes characterising this transition included 'IC & Knowledge', 'Sustainable IC', and 'IC & Entrepreneurship'.

In response to *RQ3*, the evolution of the IC construct has been influenced by a number of key factors, including (i) the management of intangible resources, which is of critical importance to maintain competitive advantage in a rapidly changing technological environment; (ii) the measurement and optimisation of IC, with the development of tools for IC measurement and optimisation at organisational and national levels; (iii) the shift in the business economics paradigm, that is, the change from a focus on the knowledge economy to a new paradigm emphasising innovation, digitalisation, entrepreneurship, and sustainability; (iv) the role of IC in the knowledge economy, where IC has driven capital formation and supported the emergence of new industries and ecosystems, such as Industry 4; and (v) the beginning of the fifth stage marks IC's expansion into new areas, including cybersecurity and big data, without neglecting the increasing ability of artificial intelligence (AI).

Bridging knowledge within and outside the organisation (Borin & Donato, 2015), starting with digitalisation and big data Dumay (2013) changes the focus of IC from the organisations to the ecosystems in which it operates. This creates knowledge on a broader scale, aligned with the fourth stage of IC (Dumay & Garanina, 2013), and thus reaches its peak (Dumay, 2016; Secundo et al., 2017). From this perspective, and taking into account (i) what was mentioned by Massaro et al. (2018), that the relationship between IC and sustainable development could benefit from a fifth stage of IC research, which would consider justifications for the value of IC and sustainable development practices; (ii) what was mentioned by Dumay et al. (2020), when stating that the great potential of IC in the fifth stage is to understand how human, social, relational, cultural and natural capital interact when combined with knowledge, experience, and intellectual property so that IC is understood as a crucial element of a sustainable ecosystem, creating economic, environmental, social, and cultural values; and (iii) the information obtained from the roadmap presented in Fig. 5, we are witnessing the beginning of a new stage. Therefore, we find evidence of the fifth stage starting around 2018, due to the change in the research paradigm observed in this study.

Regarding *RQ4* and *RQ5*, the streams of literature are developing consistently with relevant topics according to the trends of each period and the creation and evolution of new stages of IC. Therefore, for IC directed towards the development of a theoretical framework and how this can be used as a management technology in practice (Pedro et al., 2018a), more focused on organisational IC and in companies (first stage), there is a gradual move towards IC, concentrated on building stronger economic, environmental, and social ecosystems, which are simultaneously more sustainable (e.g. Dumay, 2013; Leitão et al., 2018).

Table 2
Tying study clusters with ScR research questions.

Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
General IC	Marr & Moustaghfir, 2005; de Santis & Giuliani, 2013; Vaz et al., 2014; Pedro et al., 2018b; Lin & Edvinsson, 2020; Dhamija, 2020; Quintero-Quintero et al., 2021; Dabić et al., 2020; Bellucci et al., 2021b; Bamel et al., 2022; Slyvkanyč & Glova, 2023	■ Consolidates the importance of strategic management, behavioural influence, and external validation within IC. ■ Identifies a taxonomy for studies of national IC (NIC), regional IC (RIC) and organisational IC (OIC), and highlights the importance of the organisational dimension.	■ Finds a limited cross-disciplinary dialogue in IC research and some uncertainty regarding the impact of intellectual management. ■ Identifies a need to carry out interdisciplinary studies addressing the Sustainable Development Goals (SDGs).	■ Identifies clusters related to operations management, IC and knowledge management, highlighting the importance of investment in human resources. ■ Investigates intellectual liabilities (IL).	In the NIC and RIC context, it is necessary to develop IC analysis and monitoring schemes at various levels, with theoretical and empirical studies. In IL, there is a need for a comprehensive IC approach and investigation of hypothetical associations in IC management and sustainable operations management and change management.
National & Regional IC	Lerro & Carlucci, 2007; Labra & Sánchez 2013, 2017; Orjala 2021	■ In RIC, the main components are human, social, structural/ organisational and stakeholder capital, highlighting the importance of thematic analysis, definitions, and strategic roles, both for theoretical research and for an effective contribution to regional development.	■ In NIC, there is a clear need for a constant evolution of tools due to the evolving nature of technological advancements, and the development of measurement tools reflecting the evolving nature of IC and alignment with national data policies.	■ Finds a growing interest in measuring NIC, with emphasis on the strategic value of intangibles since 2005, for the creation of wealth and competitive advantages. ■ Regarding NIC measurement models, it highlights the value added of enabling pragmatic decision-making, validated by empirical studies on the role of NIC in wealth creation. However, reliance on common data sources raises concerns about research integrity, highlighting the need for data vigilance and diversification to ensure robust results.	■ There is a need to make the connection with established definitions, approaches, and tools from economic and regional science literature on RIC. ■ Empirical studies are scarce on the relationship between knowledge assets and regional development, which is why it is necessary to strengthen connections between RIC studies and economic literature. ■ Comparative studies and adapted measures are needed to understand IC management across countries with different levels of development, suggesting the development of new models for IC measurement methodologies adaptable to different economic contexts.
IC & Components	Zula & Chermack, 2007; Matthies, 2014; Cézanne et al., 2019; Alan & Köker, 2021; Goswami & Agrawal, 2020	■ Research on human capital advocates for human capital planning to sustain competitiveness in service-oriented economies. ■ Regarding process capital, the authors outline the lack of practical concepts for process capital in interdisciplinary research; and few tools address the development of process capital. ■ The approach to psychological capital allows it to be categorised in four main themes: theoretical concept development, relationship with organisational variables, underlying mechanisms linking organisational variables, and interventions.	■ For ideal financial performance, human assets should be prioritised through greater intervention in human resources development (HRD), education and training, besides practical concepts, encouraging more experiential narratives. Suggested are human capital planning practices including innovative strategies in HRD interventions; studies about human capital investment funds investigating the movement of talent dynamics, network dynamics, and strategies to improve companies' specific human capital. ■ In process capital, it is relevant to include assessment methods, implementation challenges, and strategies to stimulate that capital	■ A consistent impact of structural social capital on organisational aspects over time is identified, contributing to understanding the management of structural social capital within organisations.	■ A recommendation to explore the impact of structural social capital and its effective leverage in organisations; and study how organisations can use structural social capital to improve collaboration, communication, and general performance. ■ Highlights the importance of psychological capital and its impact on organisational development. Suggests a focus on the antecedents of psychological capital.

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
			effectively; and develop models and processes in various organisational contexts.		
IC, Performance & Accounting	Crook et al., 2011; Inkinen, 2015; Pedro et al., 2018b; Albertini & Berger-Remy, 2019; Martín-de Castro et al., 2019; Bryl, 2020; Demartini & Beretta, 2020, 2022; Shakina et al., 2020; Garanina et al., 2021; Gravili et al., 2021; Pigola et al., 2021; Daraio et al., 2023; Silva Júnior et al., 2023	■ Positive influence and direct impact of IC on performance, reinforcing components such as human, structural, and relational capital, with the example in the healthcare sector. ■ IC positively influences financial and innovation performance, driven by social capital; and it plays a crucial role in innovation and internationalisation efforts. ■ Human capital's non-tradability and its correlation with operational performance are crucial in knowledge-based economies; its impact on financial performance varies based on ownership and tradability.	■ Strategic investment in firm-specific human capital is crucial, especially for internationalisation efforts; tools aiding academia, policymakers, and managers in IC development are essential, considering the complex interrelations among IC components. ■ Study of IC's role in SMEs' social performance. ■ In the energy sector, managers should integrate intangible asset management across different business life cycle stages for long-term market presence and performance. The need to incorporate intangible aspects into energy sector activities to enhance performance and effectiveness. More development of information systems for intangible management practices. Operations for sustainable long-term success and performance enhancement.	■ IC management affects financial metrics in small and medium enterprises (SMEs). Highlights the need for policymaker support to enhance performance through IC investments. ■ IC research has evolved from measurement to new business models and roles of social capital. ■ Integration of DEA, BSC, and IC offers insights into strategic decision-making in knowledge-based organizations. ■ In energy companies, IC research helps to understand how to measure intangible assets and performance.	■ A more advanced theory on the human capital-firm performance relationship is necessary, with the suggestion to explore contingencies in that relationship. ■ The development of IC, performance, and accounting contributed to revealing some gaps, such as the need for empirical IC research, with novel research angles, particularly in regional and national contexts; the redefinition of measurement tools for dynamic IC exploration; the development of comprehensive value creation metrics and definition of measurement tools such as Analytical Hierarchy Process and VAIC for specific industries; comparative studies on intangible assets in internationalisation processes; international comparisons to understand the role of intangible assets in internationalisation processes; investigate the dynamic role of knowledge capital; and explore formalising tacit knowledge through big data analysis, exploring intangibles' utility and codifying tacit knowledge.
IC & Measurement	Guthrie et al., 2012; Verbano & Crema, 2013; Ferenhof et al., 2015; Tsakalerou, 2015; Wudhikarn et al., 2018; Ferreira et al., 2021; Van Criekingen et al., 2022; De Almeida et al., 2022; Cosa et al., 2023; Paoloni et al., 2023; Santosa et al., 2023	■ Exploring IC measurement, accounting, and reporting. Observing and noting increased research, especially in developed nations with a focus on management control and strategy. ■ Human capital is considered an important component in IC's impact on firm performance, as well as in human resource management and value generation, highlighting the need for universal IC measurement approaches adaptable to company attributes.	■ Proposes an integrated IC measurement system, categorising variables into human, structural, and relational capital. ■ Identifies gaps in IC methods in logistics studies that advocate inclusive indicators and highlight the importance of considering human capital.	■ Key research areas include IC in the public sector, evaluation methods, disclosure, corporate social responsibility, and management; and prevalence of VAIC suggests avenues for further exploration.	■ A considerable limitation in measuring IC in logistics management and a lack of management models that analyse the impact and degree of influence of IC components in each stage of the life cycle in the construction industry. ■ IC measurement requires calibration of research studies on variables, intervals, and data; exploration of the interaction between IC components, technology, innovation, and network building strategies; understand the impact of IC on specific industries, social development objectives, and digital transformation performance; an analysis of IC's potential to become a strategic tool to

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
					reduce information asymmetries, transaction costs, and generate trust and transparency in relationships with stakeholders; suggests including other variables, such as innovation and relational capital, in the VAIC survey and studying the impact of the modified VAIC on financial and non-financial performance; also suggests exploring the link between IC, corporate governance, and sustainability issues, particularly in green and knowledge-based economy contexts.
IC & Non-profit and Public Sector	Dumay et al., 2015; Bisogno et al., 2018; Paoloni et al., 2020; Paoloni et al., 2021; Iskandar et al., 2021; Civitillo et al., 2022	■ There is a greater incentive for more active participation in IC research in the public sector, driven by the resurgence of IC in integrated reporting guidelines, highlighting discussions on structural, relational, and human capital in the literature. ■ Highlights the positive influence of IC on social enterprises, driving social impact through innovation.	■ In HE, suggests strengthening relationships with universities' external stakeholders; discusses the increasing focus on IC and KM in universities, especially on improving competitive advantage and spreading innovation. Regarding universities' third mission, limited focus on the social dimensions of IC; and lack of focus on tools to promote the effectiveness of this mission and gender reporting. It is therefore necessary to analyse the ethical, social, and environmental impacts of managing IC, revealing how IC components improve value beyond educational organisations; and explore tools to promote the effectiveness of the 'third mission' and gender reporting in universities to enhance IC research in these areas. ■ Authors advocate more recognition of intellectual and social capital in NPOs: to enhance their value creation potential.	■ In the area of education, the focus is primarily on higher education. There is a need for expanded research, as well as longitudinal and empirical studies to develop and test IC frameworks in specific contexts (educational and country), for public policy debates, with new frameworks offering insights into the emerging development of universities. ■ In the area of healthcare, provides insights to explore IC, with a focus on performance and knowledge management (KM), despite limited research on relational and human capital in healthcare IC. ■ Identifies themes in non-profit organisations, instigating a deeper analysis of IC and social capital to improve performance and goal achievement; highlights opportunities to value intangible assets in non-profit organisations (NPOs), advocating more research.	■ Researchers need to help public sector professionals implement IC frameworks, emphasising practical insights gained from researching IC in action. However, one of the gaps is limited empirical research to develop and test IC frameworks and models in specific public sector contexts. ■ In the field of healthcare, there is a need for better understanding of relational and human capital associations with IC. ■ Due to a limited focus on talent management and innovative structures in social enterprises, future studies must pay more attention to talent management, innovative structures, and creative solutions in social enterprises, to help address community challenges effectively.
IC & Disclosure	Castilla-Polo & Gallardo-Vázquez, 2016; Castilla-Polo & Ruiz-Rodríguez, 2017; Cuozzo et al., 2017; Dumay & Guthrie, 2017; Vanini & Rieg, 2019; Bryl & Fijalkowska, 2020; Rieg & Vanini, 2023	■ Emphasises the deficiencies in the content analysis of intangible asset disclosures (IAD), highlighting the lack of innovation, and the consideration of IC in different contexts. ■ Presents theoretical references linked to the Signalling, Agency,	■ There is a lack of standardisation in the types of companies and in categorisation, which leads to methodological inconsistencies and makes comparability difficult. ■ The value of disclosures to stakeholders is considered higher, but the validity of	■ The results support the positive effects of voluntary ICD on company value, encouraging the diversification of research across different organisational contexts and languages, encouraging the exploration of ICD	■ Lack of theoretical references to support ICD, which needs to develop theoretical foundations to justify ICD, improving understanding and guiding practice. ■ It is necessary to improve the comparability of literature on IAD through content analysis; and to

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
		Stakeholder, Institutional, and Political Economy of Accounting Theories for future studies on intellectual capital disclosures (ICD) that should be more in-depth. ■ ICD improves market value and accounting performance, highlighting its positive effects, calling for greater theoretical development and defending standardised disclosure, guiding stakeholders towards better quality and usefulness.	involuntary disclosures is questioned. ■ Diverse methodologies for studying and harmonising sources are highlighted for a thorough examination that goes beyond conventional content scrutiny. Robustness in this case is limited by the prevalence of qualitative techniques.	beyond corporate reporting. ■ A recommendation to investigate methods to standardise the classification of companies, to improve the comparability and consistency of research results. Despite limited studies and a lack of improvement trends, hybridising financial and non-financial data reduces capital costs; addresses involuntary disclosures, emphasising the importance of risk management and its impact on economic, environmental, and social aspects.	explore the integration of qualitative and quantitative approaches for comprehensive analysis and deeper insights. There is an unclear distinction and relationship between IC and intangible assets, and a lack of extension to new forms of non-financial disclosure. Therefore, it is necessary to explore new avenues of research, extending the analysis to different forms of non-financial disclosures, expanding the scope of research; and conduct research on various organisational sectors, comparing results and identifying sector-specific nuances in ICD.
IC & Business Model	Ujwary-Gil, 2017; Baima et al., 2021; Alvino et al., 2021	■ Common underpinnings, definitions, components, and value creation aspects of business model (BM) and IC are identified and investigated; a comprehensive approach to analysing BM and IC is presented, highlighting common elements.	■ Despite increased attention, the literature remains fragmented, requiring more holistic and integrated frameworks to fully understand the relationship between BM and IC; enhances understanding of resource accumulation, KM, and IC perspectives in strategic management to aid practitioners and scholars. There is still difficulty in assessing reciprocal relationships among intangible resources and their impact on the entire BM.	■ Need for investment solutions and technological systems to enhance KM processes and maximise IC potential, and a lack of empirical evidence from certain geographical contexts and specific IC and BM issues. Despite emphasis on IC components' impact on business performance, a limited understanding of the value-creation side of the BM is observed. ■ Extended literature focuses on IC's role in performance improvement, but less attention is paid to its relation to SDGs; IC is recognised as a strategic resource but requires further exploration regarding its alignment with SDGs.	■ Future studies must focus on assessing the value of the BM itself, which may differ among firms, to improve BM evaluation and decision-making; Explore the implementation of investment solutions and innovative systems to optimise KM processes and leverage IC potential effectively; and conduct empirical research in under-investigated geographical contexts and specific IC and BM areas to fill the gaps in understanding. There is limited understanding of how IC assets drive innovation and create value, and investigate companies' abilities to innovate, create new products, value propositions, and enter new markets through the strategic use of IC assets, advancing knowledge in this field. ■ Authors suggest that measuring key components also related to SDGs can enhance BM effectiveness, providing a framework for focused efforts. It is worth exploring how IC and its components contribute to value creation, including social, environmental, and economic aspects, to provide a holistic understanding of BMs' value.
IC & Innovation	Buenechea-Elberdin, 2017; Grimaldi et al., 2017; Gallego et al., 2020; Ali et al., 2021; Nejjari & Aamoum, 2022; Park et al., 2023	■ The lack of consensus on enhancing innovation through strengthening IC components stems from differences observed in firm location, technology	■ Academics stand to benefit from gaining insights into the evolution of IC and innovation research, as it can serve as a guide for	■ Lack of understanding of the IC-innovation relationship. A suggestion is to explore the specificities in IC-innovation linkage,	■ Five areas for future exploration emerge: intangible assets in OI as a process, intangible assets as features of OI actors, intangible assets

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
		level, industry, and size. Moreover, there is a notable isolation of research from practical implementation and policy-making decision processes. ■ Strategic design, as an intangible factor, significantly influences organisational competitiveness with a positive correlation between IC components, organisational growth, and innovative performance, particularly in the financial sector. By incorporating strategic design into IC, organisations can take an innovative approach to potentially increase their market competitiveness. Emphasising the importance of appropriate measurement methods and construct fusion is crucial to maintaining high levels of innovative performance.	future endeavours in the field. Managers, on the other hand, can use the study's findings to enhance organisational IC and innovation efforts by following its guidelines on IC components, innovation conceptualisation, and variables influencing the IC-innovation linkage. ■ Exploration of the IC-innovation relationship should lead to the development of diverse IC frameworks that consider these differences among firms, thereby providing a more nuanced understanding of the IC-innovation relationship; and to specificities in IC-innovation linkage, contingent upon various firm characteristics such as location, industry, level of technology, and size. ■ The implications for the development of IC components in strengthening innovation performance in the financial sector were highlighted, presenting positive results for organisational growth and innovation. However, there is limited understanding of the impact of IC components on innovation performance. IC components significantly impact a company's innovation capacity, with the magnitude of their effects varying based on the innovation approach chosen.	contingent upon various firm characteristics such as location, industry, technology level, product complexity, and size. ■ Insufficient exploration of intangible assets and multidimensional measures of innovation. Thus, deeper analysis is recommended to capture the full spectrum of innovation activities. By doing so, researchers can gain deeper insights into the complex interplay between different types of intangible assets and their impact on innovation performance. Intangible assets aspects and open innovation (OI) processes are intrinsically linked. ■ Recognising IC as a source of innovation provides companies with valuable information to promote innovation in their operations. However, weaknesses in this domain include the absence of sophisticated measures for scientific innovation and a limited understanding of the reasons behind the failure of academic spin-offs.	as content of OI, intangible assets in the implementation of OI, and intangible assets and strategic goals of OI. Moreover, investigation of intangible assets in OI processes must include collaboration, knowledge integration, and implementation. This exploration should also examine the impact of OI on the stock of intangible assets and the mutual reinforcement between intangible assets and OI strategy. ■ Greater exploration of the social results and intangible assets in science-based innovation should produce recommendations for academics, professionals and policymakers about how to maximise the social benefits of innovation and optimise the use of intangible assets in scientific progress.
IC & Digitalisation	de Santis & Presti, 2018; Yilmaz & Tuzlukaya, 2023	■ The emergence of Big Data (BD) amplifies both opportunities and challenges in IC management. This research field is witnessing growth, evident from the increasing number of contributions over time. This trend provides a practical tool for decision-making and enhances understanding of leveraging BD as intangible assets. It advances theoretical perspectives in IC research, particularly within the context of BD technologies, offering insights into their impact on value creation and the management of IC dimensions.	■ Contributes to the information system literature by establishing links between BD attributes and IC management. It is worth stressing the lack of validation and implementation insights regarding the adaptation of traditional managerial solutions to BD-related risks. Thus, further research and case studies are needed to validate and provide implementation insights to manage IC in the era of BD.	■ The Journal of Intellectual Capital plays a pivotal role, indicating a rising interest in IC and digital transformation within the research community.	■ The evolution of research on digital transformation prompts the proposal to perform topic modelling and content analysis on IC components and digital transformation criteria. Emphasis is placed on the importance of KM and development. In general, there is a very limited understanding of how digital technologies influence the creation and dissemination of knowledge and IC in different sectors. Research topics must include examining the impact of artificial intelligence and machine learning on IC management, analysing the role of digital

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
		■ Related to IC and digital transformation, there is a marked evolution of research areas encompassing business, management, finance and economics, evolving dynamically over time. The literature progresses from human capital to KM and digital transformation, signalling a highly concentrated transition period.			platforms in IC creation and dissemination and investigating the role of digital technologies in protecting and managing intellectual property.
IC & Knowledge	Garcia-Perez et al., 2020; Paoloni et al., 2020; Faraji et al., 2022	■ Institutional complexity and agency relationships in KM strategies have been identified as determinants of suboptimal KM strategies. This topic provides valuable insights into KM and IC practices within professional sports, elucidating their bidirectional relationship and offering valuable insights for stakeholders seeking to optimise their KM strategies. ■ There is a call for integration efforts to understand KM, IC, and entrepreneurship research interrelations better, and maximise their collective impact. Emphasising the need to integrate KM, IC, and entrepreneurship research highlights their significant roles in innovation and firm value, while suggesting avenues for further study to explore their synergistic effects.	■ Limited depth in IC research is found, particularly regarding industries studied, methodological differences, and the involvement of theories.	■ Emerging research areas are identified, such as: The Mediating Role; Entrepreneurial Orientation; and KM. This shift underscores the importance of adapting organisational systems to leverage these emerging concepts, providing insights for policymakers to inform regulations related to IC.	■ Nonetheless, there is still a lack of understanding of how decision-makers' interactions affect KM strategies concerning IC investments in knowledge-based organisations. Thus, future studies can investigate how managers' characteristics influence the formation of beliefs, which in turn shape KM strategies regarding IC investments. ■ Research must focus on identifying intellectual or entrepreneurial drivers for innovation and examining the extent to which entrepreneurs use KM and IC for innovation and knowledge transfer purposes. ■ Some recommendations are to explore IC research more comprehensively by examining industries studied, methodological approaches (quantitative, qualitative or mixed), data collection methods, and the predominant theoretical perspectives shaping research in the IC domain.
Sustainable IC	Secundo et al., 2020; Mehmood & Hanaysha, 2022; Paramba et al., 2023; Ahlawat et al., 2023	■ Several critical areas to foster sustainable development are highlighted, including IC in the private sector and in the public sector. Thematic clusters emerge, focusing on IC for sustainable development across sectors. There is an emphasis on leveraging IC to achieve SDGs, particularly in the context of technology policy development. Relevance of IC and sustainable development in technology policies is highlighted.	■ IC is crucial for start-up innovation and competitiveness, particularly in sustainable performance. Research enhances understanding of IC research's conceptual structure and its impact on sustainable start-up performance, contributing to knowledge expansion in the field.	■ Corporate social responsibility (CSR) and green IC (GIC) are topical issues. CSR drives GIC, green innovation, and competitive advantage, with higher CSR associated with elevated GIC levels and stronger competitive advantages. A nuanced model for GIC is introduced, highlighting the moderating roles of visibility and transparency, and acknowledging the significance of human capital. It is suggested that public visibility, transparency,	■ Uncertainty regarding the mediation effect of GIC and green innovation. Lack of longitudinal studies on GIC and its consequences on firm value and profitability. Additionally, the impact of training and education on green human capital remains underexplored. ■ While GIC influences organisational performance positively, it is necessary to understand its dynamics with performance metrics, requiring further research to elucidate. ■ Limited understanding of the interactions between the components of IC in

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
				environmental dynamics, and regulations moderate relationships between CSR, green innovation, and competitive advantage. The importance of effective GIC management in modern economies is stressed, aiding in policy and practice improvements.	initial studies. This gap underlines the need for wide-ranging studies on how the different aspects of IC interact to influence the success and sustainability of start-ups. Adopting a more holistic approach to study IC in start-ups will help to identify interactions and synergies between their various components and improve understanding. By considering the interconnected nature of the components of IC, researchers can provide wide-ranging information about how start-ups can make the most of IC for success.
IC & Entrepreneurship	Crupi et al., 2020; Chaudhary et al., 2023	■ There has been increasing scholarly attention paid to IC-entrepreneurship since the early 2000s, with theoretical identification. This contributes significantly to understanding IC in entrepreneurship strategies, presenting a research agenda to inspire further exploration in entrepreneurial and managerial studies. ■ A holistic approach in studying IC in entrepreneurship research emphasises interactions and synergies among IC components to better understand their impact on the performance and growth of new enterprises.	■ Current research emphasises knowledge management, organisational learning, IC, and absorptive capacity in entrepreneurial firms.	■ The predominant themes in entrepreneurial firms are knowledge management; IC and entrepreneurial orientation; organisational learning and entrepreneurial orientation; and absorptive capacity and entrepreneurial orientation. Analysis of those themes offers a theoretical model explaining how IC influences firm-level entrepreneurial behaviour, thus contributing to a dynamic business environment.	■ A more holistic view of IC in research on entrepreneurship will help to monitor the interactions and synergies between the different components of IC, contributing to broad understanding of how IC influences entrepreneurial behaviour and performance. ■ A suggestion for studies on the association between IC and the capacity to leverage knowledge assets in dynamic business environments. ■ Suggestion to explore enabling internal and external mechanisms and configurations of IC influencing the relationship between entrepreneurial orientation and KM. Investigating these mechanisms will shed light on how organisations can effectively leverage their IC to foster entrepreneurial behaviour and innovation. It is also recommended to incorporate various dimensions driving entrepreneurial orientation and knowledge management, such as the role of knowledge resources and capabilities, organisational routines, structure, culture, digitalisation, and human resource practices. Understanding the multifaceted nature of these factors and their

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Clusters/Research Questions	Authors	Theoretical Perspectives *RQ4*	Contributions *RQ4*	Topics *RQ5*	Emerging Trends *RQ5*
					impact on entrepreneurial orientation will provide a more comprehensive understanding of how organisations can cultivate an entrepreneurial mindset and effectively manage their knowledge assets.

Source: Own elaboration.

This evolution, which in the first stage gives shape to a line of research positioning IC as a determinant of competitive advantage, changes in the second stage to a development supported by empirical proof (Pedro et al., 2018a). This highlights a line of research focused on aspects linked to the identification of its components (Zula & Chermack, 2007; Matthies, 2014; Cézanne et al., 2019; Alan & Köker, 2021; Goswami & Agrawal, 2020), measurement models (Guthrie et al., 2012; Verbano & Crema, 2013; Ferenhof et al., 2015; Tsakalerou, 2015; Wudhikarn et al., 2018; Ferreira et al., 2021; Van Criekingen et al., 2022; De Almeida et al., 2022; Cosa et al., 2023; Paoloni et al., 2023; Santosa et al., 2023), performance and accounting (Crook et al., 2011; Inkinen, 2015; Pedro et al., 2018b; Albertini & Berger-Remy, 2019; Martín-de Castro et al., 2019; Bryl, 2020; Demartini & Beretta, 2020, 2022; Shakina et al., 2020; Garanina et al., 2021; Gravili et al., 2021; Pigola et al., 2021; Daraio et al., 2023; Silva Júnior et al., 2023), and disclosure (Castilla-Polo & Gallardo-Vázquez, 2016; Castilla-Polo & Ruiz-Rodríguez, 2017; Cuozzo et al., 2017; Dumay & Guthrie, 2017; Vanini & Rieg, 2019; Bryl & Fijalkowska, 2020; Rieg & Vanini, 2023) of IC. In the third stage, studies start to consider different types of organisations, such as non-profit organisations and the public sector (see e.g. Dumay et al., 2015; Bisogno et al., 2018; Paoloni et al., 2020; Paoloni et al., 2021; Iskandar et al., 2021;Civitillo et al., 2022), emphasising the importance of studying and measuring IC, for example, in higher education and the health sector. In the fourth stage, the IC ecosystems of cities, regions, and nations are highlighted (Lerro & Carlucci, 2007; Labra & Sánchez; 2013, 2017; Orjala 2021), with topics related to innovation (Buenechea-Elberdin, 2017; Grimaldi et al., 2017; Gallego et al., 2020; Ali et al., 2021; Nejjari & Aamoum, 2022; Park et al., 2023) and digitalisation (de Santis & Presti, 2018; Yilmaz & Tuzlukaya, 2023), ending at what is already considered the beginning of the fifth stage (Dumay et al., 2018; Dumay et al., 2020). This new stage explores how IC is linked to knowledge (Garcia-Perez et al., 2020; Paoloni et al., 2020; Faraji et al., 2022) sustainability and green IC (Secundo et al., 2020; Mehmood & Hanaysha, 2022; Paramba et al., 2023; Ahlawat et al., 2023), and entrepreneurship (Crupi et al., 2020; Chaudhary et al., 2023).

Returning to the statement in the introduction about the theoretical cornerstone of the current ScR—that is, the systems theory aligned with the vision of Mokhlis et al. (2024)—one system cannot be optimised without considering the other, as this would lead to deficiencies, asymmetries, market failures, imbalances, and distinct sources of externalities. Thus, the economic, environmental, social, educational, political, and cultural levels of systems must be simultaneously maximised for organisations to operate effectively. These strata represent ecosystems with dynamic evolution.

The proposal of an IC ecosystem for future research directions signifies the evolution of IC research towards an interdisciplinary approach and sustainable development goals, as stated in Lin and Edvinsson (2020). Since the approach to measuring IC depends on many variables of its activity, it can be difficult to draw clear boundaries between the divisions and relationships of various measured elements (Ozhiganov et al., 2021). According to the same authors, the first postulate of the systems theory suggests that separate IC measurements and indicators cannot reflect the multilevel, multidimensional nature of knowledge. In addition, underlining the conclusion of Martín-de Castro et al. (2019), the emergence of new research streams on IC, such as IC in new business models, and its role in social capital and human resource practices, indicates and links the interdisciplinary nature of IC research.

As illustrated in Ozhiganov et al. (2021), the development of an integrated systems model is of paramount importance for innovative companies, given that intangible assets play a pivotal role in the success of contemporary competitive and continuously evolving landscapes. Accordingly, the selected indicators facilitate comprehensive research and monitoring of each IC component, ensuring a balanced and unbiased analysis for any given segment. This model should incorporate a range of analytical criteria, including the type of model, methodologies employed, IC calculation formulae, and their respective advantages and limitations. This approach facilitates the comparison of disparate innovation strategies, particularly when monitoring alterations in a company's IC levels. In addition, it has the potential to be implemented at local, regional, or national IC levels.

Regarding gaps and future studies, our discussion focused especially on the last three years (2021, 2022, and 2023), as these are the years that best identify current gaps and future trends. In general, Bellucci et al. (2021) highlighted the need for new research related to IC reporting and disclosure, in line with Rieg and Vanini's (2023) conclusion that the relationships and interdependencies between different IC categories are not well understood. Another suggestion is to study the relationship between IC and knowledge management, financial performance, market value (Bellucci et al., 2021), scientific production, and innovation (Quintero-Quintero et al., 2021). Emerging research areas have already been suggested, such as IC, cybersecurity, business research methods (Dabić et al., 2020), the role of IC in innovation, and big data (Bamel et al., 2022).

Related to the NIC and RIC, Orjala (2021) draws attention to the need to use measures that better capture the use of technology, use of different indicators considering countries' different levels of development, and the need for a deeper study of the connections between the NIC research community and national data policies.

Concerning the components of IC, Alan and Köker (2021) highlighted that the main topics for future studies are innovation, entrepreneurship, knowledge management, performance, leadership, technology, and human resources.

For IC and performance, Garanina et al. (2021) stated that research should go beyond implementation practices within a single company to observe how intangibles generate usefulness and social and environmental value for the whole system. Gravili et al. (2021) proposed that Big Data analysis could be a true means of formalising and structuring research, as there is little theoretical or empirical research on this topic, with limited means and variables available to code this knowledge. Pigola et al. (2021) proposed investigating knowledge capital as a dynamic asset in future studies and its effects in different contexts and

measurements to obtain a clear separation between IC resources (human and structural capital) and IC in action (relational and knowledge capital). Finally, Silva Júnior et al. (2023) indicated that companies in the energy sector must incorporate more aspects related to the management of intangibles into their day-to-day activities.

Concerning the measurement of IC by Van Criekingen et al. (2022), further work is needed, both concerning the estimation of 'technical' aspects, such as depreciation rates and deflators, and the continued testing and comparison of different measurement efforts. Cosa et al. (2023) envisaged future research exploring the interplay between IC components, technology, innovation, and network-building strategies for business resilience. Additionally, there is a need to understand IC's impact on specific industries (automotive, transport, and hospitality), social development goals, and digital transformation performance. Paoloni et al. (2023) indicated that most studies deal with IC measurement and internal and external IC disclosure, highlighting the need to apply an integrated framework that combines agency, stakeholder, and legitimacy theories. Therefore, future studies should analyse the potential of IC as a strategic tool capable of reducing information asymmetries and transaction costs and generating a network of relationships with stakeholders based on trust and transparency. For Santosa et al. (2023), future research may include variables such as innovation and relational capital, as they might be hidden factors in the inconsistency of VAIC, as well as the impact of modified VAIC on financial and non-financial performance. Another research avenue regards the link between IC and corporate governance as well as sustainability issues, especially in the context of a knowledge-based and green economy.

Related to IC and non-profit and public sectors, Paoloni et al. (2021) suggested that future research on higher education could explore relational capital and networks with a focus on tools that are useful in promoting and emphasising the effectiveness of the 'third mission'.

For performance and disclosure, another perspective that can be elaborated on involves investigating the methodologies for both reporting and evaluating IC, which is seen as an asset that can improve university performance. Gender reporting in universities is another field that should be investigated in the future. Concerning IC in social organisations, Iskandar et al. (2021) highlighted the need for innovative and creative young minds to resolve the biggest challenges faced. Civitillo et al. (2022) found that there is still some reticence within non-profit organisations to consider the importance of IC resources, more specifically related to social capital, which should now be considered a relevant asset in creating value for any socioeconomic organisation.

As for IC and business models, Alvino et al. (2021) pointed out the need for openness to investment solutions that are able to implement knowledge management processes, as well as the use of innovative technological systems that favour knowledge sharing and optimisation of IC's potential. Another relevant aspect, mentioned by Baima et al. (2021), is the scarce scientific literature on the topic, suggesting more studies to focus on firms' capacity to create new products and value propositions, enter new markets, and develop new pricing models through the strategic use of their IC, which underlines the lack of empirical studies in different geographical contexts. These authors stated that while studies focus on the impact of IC components on business performance, there is a gap in understanding the value-creation side of the business model, studying the social and environmental value approach as opposed to economic value, and assessing how IC and its components contribute to solving social and environmental problems. Few studies focus on aspects of the business model's value creation and co-creation, especially regarding the capacity to stimulate innovation in the business model itself. The same authors also underlined the emergence of green IC, favouring the creation of value for the community, environment, workers, and territory. They also claimed that there should be a greater focus on studying the role of knowledge, information, and relationships in developing business models with social and environmental impacts.

Regarding IC and innovation, Ali et al. (2021) provided evidence for studying the relationship between IC and innovation performance. The authors highlighted the importance of proper measurement methods and the amalgamation of constructs in this area. They emphasised the need to strengthen empirical investigations at the regional and national levels to gain a better understanding of IC components and innovation performance relationships, which may contribute considerably to organisational policies. Park et al. (2023) pointed out that intangible assets influence science-based innovation through academic spinoffs. The literature has a reasonably uniform focus on various levels of contribution to the scientific innovation process, with a slight emphasis on factors at the firm, university, and ecosystem levels. However, the authors state the need for a more sophisticated understanding of what constitutes scientific innovation success through academic spinoffs.

Regarding IC and digitalisation, Yilmaz and Tuzlukaya (2023) recommended investigating the role of digital technologies in the creation and dissemination of knowledge, analysing the relationship between digital transformation and IC in different industries, developing a clear digital transformation strategy, investing in digital technologies, forming strategic partnerships, encouraging employee engagement, and building a data-driven culture. Following this rationale, several key future research topics are connected to the relationship between digital transformation and IC, including the impact of AI and machine learning on IC management, the role of digital platforms in the creation and dissemination of IC, and the role of digital technologies in the protection and management of intellectual property.

Regarding IC and sustainability, the study by Mehmood and Hanaysha (2022) stood out, concluding that reducing the information gap between the organisation and its stakeholders would bring green innovation as an effective outcome of its corporate social responsibility initiatives. The same authors suggested checking whether corporate social responsibility positively affects firms' competitive advantage through the serial mediation effect of green IC and green innovation, public visibility moderates the relationship between corporate social responsibility and green innovation, firm transparency moderates the relationship between corporate social responsibility and green innovation, environmental dynamism moderates the relationship between green innovation and competitive advantage, and environmental regulation moderates the relationship between green innovation and competitive advantage. Paramba et al. (2023) confirmed that research in the field of start-ups should adopt a holistic approach to IC, highlighting the interactions and synergies among its components. Ahlawat et al. (2023) recommended research in organisations related to transport, agriculture, food retailing, sanitary services, communication services, real estate services, education, and postal services. Studies on green IC's contribution to value creation, the role of green IC, and its dimensions in solving green or social issues, as well as more longitudinal studies, will help us understand the various stages of green IC. Another aspect is determining the effects of green IC on a firm's value and profitability as well as the impact of training and education in environmental protection on green human capital.

Finally, regarding IC and entrepreneurship, Crupi et al. (2020) concluded that the existing literature seems to confirm that studies addressing entrepreneurship should adopt a holistic approach to IC, thus emphasising the existence of interactions and synergies among the different components of IC itself. Furthermore, particular attention should be paid not only to explaining what IC consists of and how it impacts new enterprises' performance and growth, but also how IC should be managed practically for its potential to be fully exploited. Chaudhary et al. (2023) proposed answering questions related to knowledge resources, capacities, and entrepreneurial orientation; the role played by organisational culture in forming knowledge management in different institutional mechanisms; how culture and digitalisation influence different dimensions of entrepreneurial orientation; how the perception of the organisation's human capital regarding human resource practices shapes knowledge management practices and entrepreneurial orientation at the firm level; and how employees' social

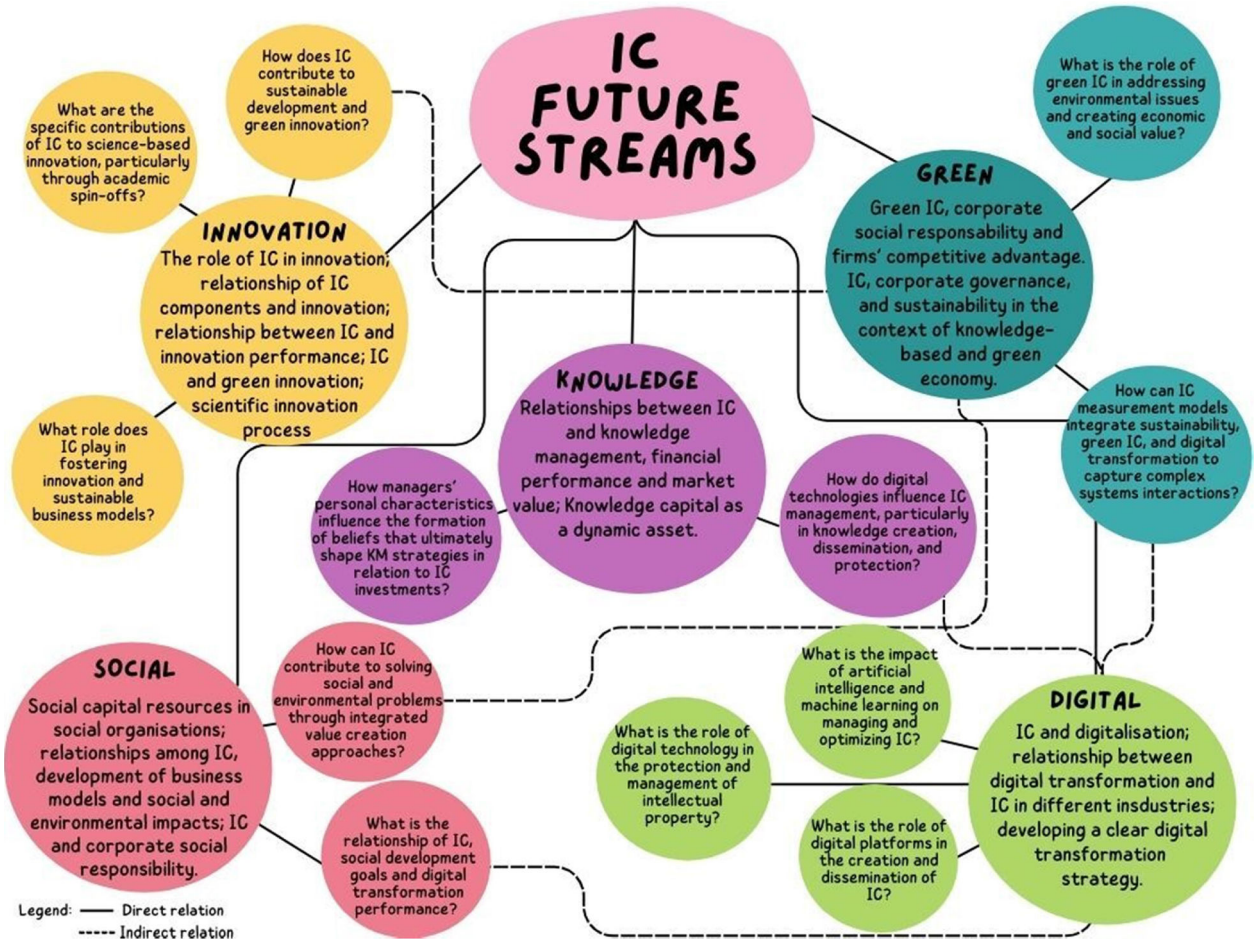

Fig. 6. Mind map graph about the five main words and related main questions for future streams of IC.
Source: Own elaboration.

capital influences the development of entrepreneurial orientation.

The five key terms for future streams of IC are visually represented in Fig. 6 using a mind map graph, which also highlights the most important related questions that have not yet been addressed in the IC literature.

Conclusions

An ScR of systematised literature reviews on IC found in the WoS and SCOPUS databases was performed. The search queries were elaborated and refined through brainstorming by the research team. After identifying the documents, the final selection contained 78 studies that were analysed considering the five research questions. Conclusions can be drawn from three perspectives: contributions, implications, and limitations and future research.

Contributions

This study underscores the strategic importance of IC across its various dimensions and components, emphasising the need for comprehensive frameworks, proper measurement methods, and integrated approaches to leverage IC, including more sophisticated and emerging topics linked to innovation, sustainability, digitalisation, knowledge, and entrepreneurship. From the fourth stage, research on IC gained a new lease of life and extended beyond the borders of organisations to include the ecosystems of cities, regions, and countries. This gave rise to the fifth stage, which is crucial for consolidating IC (see e.g. Dumay et al., 2018) as a unified, relevant theory for the academic community, policymakers, and practitioners. The results demonstrated that the fifth stage began in 2018. It is at this stage that future studies should focus their analysis so that researchers can understand IC as a crucial element of an ecosystem comprising a vast number of organisations, as stated by Dumay et al. (2018). Moreover, these authors state that research in the area of IC should incorporate a broader social and environmental purpose, going beyond the mere management of organisations; otherwise, it runs the risk of dying. As concluded by Dumay et al. (2020), IC's great potential in the fifth stage is understanding how various types of capital, including human, social, relational, cultural, and natural capital, interact when combined with knowledge, experience, and intellectual ownership so that IC can be used to generate economic, environmental, social, and utilitarian value.

ScR also reveals contradictions and gaps in the context of the proposed research areas and the current state of knowledge in the field of IC studies. The following issues require further investigation.

(i) There is a need for research on IC disclosure, particularly considering the current lack of deep understanding of IC interdependencies. Further research on IC reporting and disclosure, focusing on enhancing the transparency and structure of IC information, is needed. However, the interdependencies between different IC categories remain poorly understood. This conflict suggests that the call for improved IC disclosure may be premature if fundamental relationships within IC categories remain unclear. This may lead to an information disclosure procedure that lacks substance.

(ii) ScR investigates the relationships between IC and a range of factors including knowledge management, financial

performance, market value, scientific production, and innovation. However, the interdependencies among IC categories are poorly understood, suggesting that the scope of research may be overextended without establishing a solid foundation for understanding the interrelationships among IC categories.

(iii) Innovation is a key focus; yet, there is a lack of clarity regarding the role of IC in innovation. The ScR emphasises the study of IC in the context of innovation and its impact on scientific production. However, if the fundamental relationships within IC categories are not fully understood, it becomes more challenging to isolate and analyse the specific role of IC in innovation owing to a lack of data representing IC components. This results in a potential conflict between the emphasis on innovation as a key research area and the lack of clarity regarding IC's foundational dynamics. The study of IC in innovation, as viewed through the lens of the systems theory, focuses on two important issues: First, it identifies the hidden mechanisms through which IC supports companies' dynamic innovation capabilities, particularly technology firms. Second, it examines how institutional context regulates the relationship between IC and innovation capabilities. In line with Ozhiganov et al. (2021), the practical goal of the systems theory is to determine the conditions for effectively utilising both tangible and intangible (intellectual) resources across various levels—organisation, industry, city, region, and national economy—to optimise IC's role in innovation.

Implications

The implications of this ScR are especially valid for the academic community, in that it provides avenues for future research, including (i) approaches more focused on the fifth stage of IC; (ii) more empirical studies, above all concerning RIC and NIC; including emerging topics common to almost all the clusters, such as innovation, social and environmental impacts, and the role of green IC; (iii) the importance of IC related to higher education, especially in relation to the third mission; (iv) the importance of IC in the energy sector and the lack of studies in this area; the importance of transformation and digital technologies for IC; and (v) the importance of human capital, which is crucial in all stages of IC and does not only concern skills, capabilities, knowledge and attitudes in organisations. Human capital drives innovation, entrepreneurship, knowledge transfer, and sustainable development and is crucial for all ecosystems linked to cities, regions, and countries, positioning IC as the main asset in an ecosystem of knowledge.

Some implications for the IC theory may also be deduced using the mind map graph's content on the five keywords and associated key questions as a guide:

(i) The role of intangible assets in supporting knowledge-based innovation through academic spinoffs highlights the importance of leveraging IC in research institutions and universities to promote the successful transfer and commercialisation of scientific knowledge.

(ii) Factors such as public visibility, firm transparency, environmental dynamism, and regulation significantly influence how green IC translates into sustainable competitive advantage. This finding implies that the contextual factors surrounding green IC must be better understood to implement effective sustainability strategies.

(iii) The emphasis on the relationships between knowledge management and IC, entrepreneurial intention, entrepreneurial orientation, and entrepreneurial and innovative performance suggests that strategic knowledge utilisation is critical to achieving organisational goals.

(iv) Human and social capital are pivotal in shaping entrepreneurial intention, entrepreneurial orientation, and knowledge management practices, suggesting that firms should invest in developing this type of asset to support innovation and sustainable growth.

(v) Digital technologies are crucial for managing and disseminating IC, particularly in rapidly changing industries. Developing digital transformation strategies and investing in appropriate technologies are necessary steps to facilitate the integration of IC in digital contexts without neglecting the increasing capability of AI.

Limitations and future research

Regarding the limitations of this ScR, we only used two databases. However, these were the most commonly used. This justification was supported by the ScR itself; of the 78 documents analysed, 20 used both databases, 19 used SCOPUS, and 11 used WOS. These 78 articles systematically reviewed around 33,000 publications altogether, which, although repeated by different authors, were addressed from different angles, leading to the results of this ScR being much more wide-ranging.

Second, we only included systematic literature reviews and database searches. It is believed that all articles included in the ScR were not biased and included relevant studies in the area, while recognising that there may be relevant studies by less well-known authors.

Third, the interpretation of the topics and clusters presented here was based on the interconnection of the analyses performed by the co-authors. Nevertheless, our procedures attempted to reduce the bias arising from the selection of results and respective analyses, resorting to conciliation among all co-authors to resolve some less obvious and convergent situations. We did not consult specialists on subjects who could have exercised control and provided alternative research topics, as indicated in Arksey and O'Malley (2005). However, these authors stated that this phase may or may not be included in an ScR, depending on the researcher's level of knowledge and involvement in the topic. Considering that all those involved had already published relevant studies in the area of IC, we decided not to include this phase.

Fourth, only papers were used, rather than other document types, such as books, book chapters, and doctorate theses, which usually include a thorough literature assessment of the topic. This type of publication was not available for consultation, which made a thorough search challenging. However, the reviewed publications are considered to be an excellent corpus providing a thorough summary of the current literature on IC.

Despite offering a focused overview of the IC literature, the previously identified limitations imply that ScR may lack the diversity and breadth of a more comprehensive incorporation of databases, additional publications (such as policy reports or 'grey' literature), and expert opinions. Moreover, while scoping reviews aim at breadth, they may sacrifice the depth of analysis compared to more focused systematic reviews. Readers should be mindful of these limitations when interpreting the results, as they may be more reflective of mainstream research found in the databases and publishing types used.

Suggested for future research is an integrative literature review of the five stages of developing IC through mapping based on a meta-analysis of components, units of analysis, methods, variables, and signs of the relationships tested in studies on IC regarding evolution in the organisational, regional, and national dimensions. Before moving on to more complex and emerging research topics, a more structured approach is required to address the contradictions and gaps previously mentioned. This approach should focus on a new integrative IC theory and should be grounded in foundational research to establish a clear understanding of IC interdependencies. It should also discuss the opportunities and challenges presented by digital transformation for managing IC, as well as emerging technologies such as big data and generative AI.

CRediT authorship contribution statement

Eugénia Pedro: Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **João Leitão:** Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Helena Alves:** Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jik.2025.100664.

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