




Antecedents and consequences of intellectual capital: a systematic review, integrated framework, and agenda for future research

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Abstract

This study systematically reviews the fragmented field of Intellectual Capital (IC) to clarify its antecedents and outcomes. Using a hybrid method that combines bibliometric analysis and a framework-based approach, it examines 170 peer-reviewed articles, focusing on key articles, authors, countries, journals, and themes in IC research. The study introduces a comprehensive framework, summarizing the core elements of IC and providing a foundation for future theoretical, empirical, and conceptual research. Six main clusters were identified through co-citation analysis: three related to IC antecedents, particularly board gender diversity, and three concerning IC consequences, notably firm performance. This research maps out existing gaps in the literature and suggests integrated pathways for advancing IC knowledge. It contributes significantly to IC studies by synthesizing a vast array of literature into an integrated framework, offering new insights that both challenge and complement existing narratives. This framework not only elucidates IC's foundational aspects but also sets a strategic direction for future investigations. The findings underscore the evolving nature of IC research and highlight crucial antecedents and consequences. The study bridges academic research with practical applications, emphasizing IC's role in boosting firm competitiveness and value creation. While recognizing its methodological limitations, the study calls for a diversified perspective in future IC research, aiming to deepen the understanding of IC.

Keywords Intellectual capital determinants · Intellectual capital consequences · Intellectual capital efficiency · Intellectual capital disclosure · Bibliometric analysis · Systematic literature review

JEL Classification M40 · G34

Extended author information available on the last page of the article

1 Introduction

The ascendancy of Intellectual Capital (IC) in both academic and practical domains in recent years underscores its pivotal role in value creation and economic progression, especially within knowledge-centric economies (Martín-de Castro et al. 2019; Beattie and Smith 2013; Vafaei et al. 2011; Anifowose et al. 2018; Kucera and Dvorakova 2023). A prevailing discourse posits that the disparity between an enterprise's market and book values largely hinges on its IC—a unique asset difficult to duplicate across entities (Ni et al. 2020; Ur Rehman et al. 2022; Wang 2013; Martín-de-Castro et al. 2011). Essentially, IC embodies intangible assets including the possession of knowledge, experience, skill, good relationships, and core capabilities that elevate firms to competitive prominence (Baima et al. 2021; Tseng and James Goo 2005). The academic zeitgeist classifies IC into a tripartite model: human capital (HC), structural capital (SC), and relational capital (RC), encompassing associated facets such as process, customer, and social capital within this triadic structure (Ni et al. 2020; Prencipe et al. 2023; Nadeem 2020; Nkambule et al. 2022; Subramaniam and Youndt 2005).

Scholars differentiate between intellectual capital efficiency (ICE) and intellectual capital disclosure (ICD). ICE implies the effectiveness with which IC assets are utilized to enhance organizational performance (Chowdhury et al. 2019; Nadeem et al. 2019). While ICD denotes reporting practices related to information about IC assets (Mardini and Lahyani; 2022; Nicolò et al. (2021)). In the realm of IC disclosure, literature bifurcates into two dominant paths. The first trajectory seeks to understand the factors influencing IC disclosure, revealing a diverse array of determinants (Bellora and Guenther 2013; Smriti and Das 2022; Nicolò et al. 2022; Vitolla et al. 2020; Hidalgo et al. 2011). In contrast, the second trajectory investigates the ramifications of IC disclosure, illuminating its intricate implications (Anifowose et al. 2018; Babajee et al. 2020; Boujelbene and Affes 2013; Clarke et al. 2011; Dharni and Jameel 2021). Embedded within this dialogue is a distinction between ICD and ICE. While contemporary investigations revolve around factors enhancing the utilization of IC assets, a holistic analysis connecting both the precursors and outcomes of IC is largely missing.

In the dynamic landscape of IC, discerning the precursors and ramifications of both ICE and ICD is paramount. This investigation aims to achieve three main objectives. Initially, it embarks on a quantitative analysis of the literature to identify leading authors, sources, and themes. Subsequently, it delves into current ICE and ICD research trajectories, recognizing dominant patterns and evident gaps. Ultimately, the study proffers avenues for future exploration, aiming to deepen the understanding of IC dynamics. The research is guided by three pivotal questions:

- RQ1: What bibliographic features define current antecedents and consequences of intellectual capital (ICAC) articles?
- RQ2: What primary IC research themes exist concerning the antecedents and outcomes of both ICE and ICD?

RQ3: What avenues present themselves for prospective research in the spheres of ICE and ICD?

To meet these goals, a systematic literature review (SLR) was conducted on 170 articles from 101 scholarly sources, providing a comprehensive perspective on ICAC scholarship. Our analysis revealed three central themes underpinning IC antecedents and consequences. Recognizable gaps in the current body of knowledge were also identified, highlighting areas ripe for future academic inquiry.

While IC has been at the epicenter of academic discussions, rigorous deliberations specifically focusing on the antecedents and outcomes of ICD and ICE are comparatively limited. Despite the plethora of literature reviews addressing IC, a meticulous focus on ICD and ICE remains uncommon. Key-works include Alvino et al. (2020), Baima et al. (2021), Bellucci et al. (2021), Buenechea-Elberdin (2017), Chaudhary et al. (2023), Daraio et al. (2023), Esmaeili Givi et al. (2022), Inkinen (2015), and Quintero-Quintero et al. (2021). The importance IC for the sustainable and innovative development of organizations was examined by Alvino et al. (2020) using a bibliometric analysis of 45 articles with publication dates ranging from 1990 to 2019. They determined that most of IC research published from a sustainability viewpoint focused on measuring outcomes in terms of improved business performance. Furthermore, in the intersection between IC and business models, Baima et al. (2021) conducted SLR and bibliometric analysis of 74 peer-reviewed articles. They found that most of the studies were concentrated on the value creation and value capture aspects, with a primary focus on examining the relationship between IC and firms' performances (e.g., economic, financial, and organizational). Bellucci et al. (2021) conducted bibliometric and SLR of 187 research that were published in the *Journal of Intellectual Capital (JIC)* between 2014 and 2018 to identify new themes and potential trends. According to their findings, there were four key streams of JIC research that emerged; reporting and disclosure of IC; IC research in universities, education, and the public sector; knowledge management; and IC, financial performance, and market value. In her 2017 review and analysis of the literature, Buenechea-Elberdin examined the connections between IC and innovation. The study identified directions for future study in the field of IC-innovation.

While the SLRs have made significant contributions, they come with certain limitations. Foremost among these is a notable discrepancy in volume; despite the rich landscape of empirical IC articles, those dedicated to literature reviews remain conspicuously few. Moreover, the extant review articles tend to adopt a rather narrow perspective, primarily zoning in on discrete facets of IC. This is evident in works such as Alvino et al. (2020) and Baima et al. (2021) which mainly emphasize specific IC consequences, or in the generalized IC examinations like the one by Quintero-Quintero et al. (2021). Other reviews, such as those by Bellucci et al. (2021) and Esmaeili Givi et al. (2022), are limited to trends within particular journals. This piecemeal approach has left a void—a comprehensive appraisal spanning all IC aspects remains elusive. Another limitation pertains to the narrow thematic focus of several studies on areas like firm

performance, as highlighted by Inkinen (2015), or innovation, as presented by Buenechea-Elberdin (2017). Chaudhary et al. (2023) also presented a constrained view on entrepreneurial orientation. A recurrent issue in previous analyses is the inability to distinguish between the antecedents and consequences of both ICE and ICD, marking a lacuna in the literature. Lastly, there is an imperative to refresh and expand past literature review studies. With IC studies proliferating over time, several prior reviews, such as those by Buenechea-Elberdin (2017) and Inkinen (2015), may not capture the latest trends and insights in our dynamic global context.

Given the limitations identified, we argue for an updated, all-encompassing review of IC, integrating both its antecedents and consequences. Such a review mandates a precise and transparent methodology. Our endeavor departs from prior examinations in its intention to furnish a contemporary framework conducive for discerning the practical facets and implications of IC. Such insights are anticipated to guide academic IC researchers in pinpointing existing lacunae and charting new trajectories in ICAC research, distinguishing our methodology from conventional literature reviews. To our knowledge, the SLR encapsulates a comprehensive selection of 170 IC articles from the past two decades, offering a panoramic view of evolving IC themes. This extensive and interdisciplinary SLR resonates with a diverse audience, ranging from academics to policymakers, practitioners, and corporate magnates. Merging a theme-driven systematic review with bibliometric analysis, our study stands poised to catalyze further exploration in the domain. Our meticulous review creates implications for a broad spectrum of stakeholders. It equips the academic fraternity with tools to spot promising research avenues and predominant themes within the IC literature. Simultaneously, it bestows upon enterprises insights to refine their ICD and ICE strategies. Corporate managers, gleaned from our findings, can demystify questions pertaining to the dynamics of IC disclosure, determinants of its variance, and the ensuing organizational repercussions. Our review underscores the imperative to discern, from an all-encompassing perspective, the key catalysts that can elevate ICD.

The structure of this paper is as follows: Sect. 2 elucidates our research methodology. Section 3 delves into the bibliometric results and a discourse on the salient findings, lays out the content analysis outcomes and our holistic framework for ICAC studies. Section 4 outlines prospective research avenues. The paper culminates in Sect. 5, summarizing our conclusions, implications, and potential limitations.

2 Methodology

This study aims to conduct a SLR by identifying, analyzing, and synthesizing fragmented streams in IC literature. To overcome challenges like subjectivity, a hybrid review methodology was adopted, combining a bibliometric and framework-based review. Block and Fisch (2020) argued that the research is not a bibliographic study if it merely provides a list of articles followed by a brief description. The bibliometric technique was employed to respond to RQ1, drawing on a developing trend in recent business management and accounting research (e.g., Bellucci et al. 2021).

Content analysis was conducted to answer RQ2 and RQ3. Therefore, we followed the instructions provided by the novel work of Block and Fisch (2020), Paul and Criado (2020), and Snyder (2019) to conduct an impactful SLR study that evaluates the development of research on ICAC. The steps adopted ensure transparency, reproducibility, and offer various approaches for selecting articles for review.

Our SLR adheres to the methodology of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) group. The *first*, as suggested by Massaro et al. (2016), the SLR process began with formulating research questions, illustrated in Sect. 1. The *second* step is to determine what database to use for collecting data (Carvalho et al. 2013). Data collection is based on Scopus database. Scopus database has been used as the only source of data in many similar studies in fields of business, management, and accounting (e.g., Drago and Aliberti Amidani 2019; Md Khudzari et al. 2018). Scopus database is considered the most used search database as it offers several advantages since it covers a wide range of subjects and allows scholars to import all needed bibliographical data (such as citation, affiliation, abstract, keywords, publisher, and references) in a single file with a proper excel format (Amrutha and Geetha 2019; Md Khudzari et al. 2018). Data collection commenced in May 2023. It is important to emphasize that our search methodology did not impose any timeline limits throughout the data retrieval procedure. Instead, we opted for inclusivity and included all publications from the Scopus database that fulfilled our predetermined search conditions. Such an approach allows us to identify recently debated topics while also considering what literature has been discussed in the past. The *third* step is to gather data using a variety of keyword strings. After reviewing similar publications, definitions, and categories of IC, the search query was made after applying filters to fulfill the objectives and obtain optimal results. This search query is TITLE-ABS-KEY (“intellectual capital*” disclosure) AND antecedent OR consequences OR determinants OR factors OR performance OR “board diversity*” OR “corporate governance*” AND (LIMIT-TO (LANGUAGE, “English”)) AND (LIMIT-TO (SRCTYPE, “j”)).

The *fourth* step is to determine which articles to include or exclude based on a specific selection criterion. In specific, after conducting a thorough search query in the Scopus database, we were able to obtain 368 documents from various countries and institutions. To ensure comprehensiveness and reliability, the study excluded documents in other languages from the basic query search. Hence, six documents were excluded from the study published in Spanish, Ukrainian, Russian, Portuguese, and Polish. Out of 362 documents, only published journal articles were considered. Hence, 52 articles were excluded at that point. Our search was limited to areas related to business, management, and accounting, which resulted in excluding additional 48 articles resulting in keeping 262 research publications. Further, after reading the title and abstract, we excluded studies primarily that did not analyze the concept of IC in combination with either its antecedents or consequences, since they are not in align with our review’s scope. Additionally, topics without including IC are irrelevant and excluded, such as studies focused on keywords that include antecedents and consequences only (e.g., performance or board diversity or corporate governance). Furthermore, methodological papers lacking empirical research on IC antecedents or

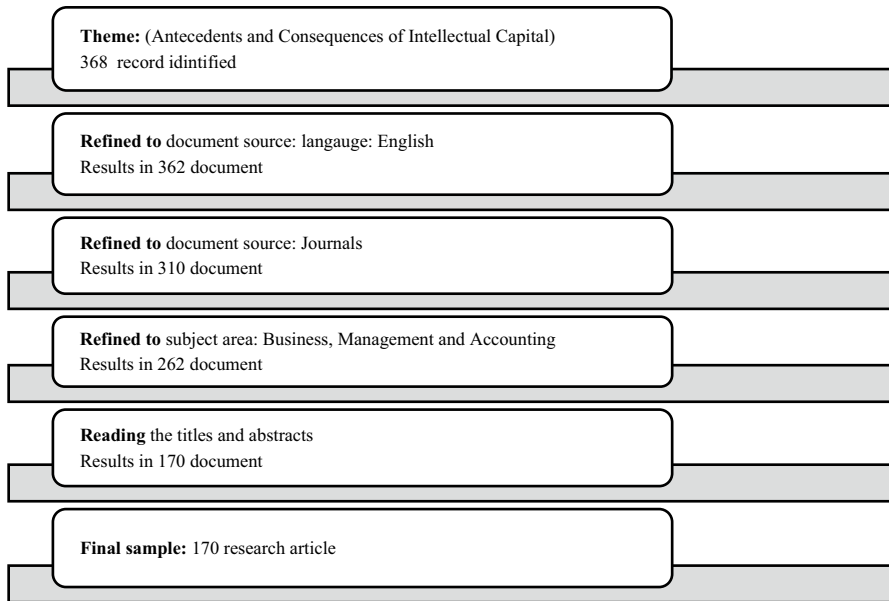


Fig. 1 Flowchart of inclusion and exclusion criteria (Source: Authors' own work)

consequences were not suitable for inclusion. At least two of the authors assessed independently the articles to make sure that only included articles are those that fit with our review's scope. After reviewing the titles and abstracts of these publications, we eliminated 92 publications that did not relate to the search query. This left us with 170 articles. Figure 1 depicts the inclusion and exclusion criteria for the SLR article selection process.

The last step is to identify research streams and themes with the help of 'Biblioshiny.' It represents a bibliometric tool provided by a web-specific R package 'bibliometrix 3.0' (Li et al. 2016). It is designed for non-coders to conduct scientometric and bibliometric analysis to explore the impact of a set of researchers, the effect of a particular journal, and specifically to identify the set of impactful papers in a specific field (Kumar et al. 2021). The 'Biblioshiny' analysis output comes in different forms including tables, images, and graphs, which may not exist in other packages (Moral-Muñoz et al. 2020).

Next, to answer RQ2 and RQ3 of the paper. A content analysis was conducted for each article included in our final dataset by at least two of the authors independently. In this phase, first we categorize the main findings and insights emerging from articles and relevant to the scope of the research (Strauss and Corbin 1990). Then, we identify primary research areas that have been investigated by scholars to date by introducing framework-based review (Fig. 8). Moreover, the gaps existing in the literature and potential future research lines were also identified (Takey and Carvalho 2015). Appendix A includes a summary of studies of our sample.

Table 1 Descriptive characteristics of antecedents and consequences of IC literature (Source: Authors' own work)

Description	Results
<i>Main information about data</i>	
Timespan	2003–2023
Sources (journals, books, etc.)	101
Documents	170
Annual growth rate %	15.22
Document average age	4.5
Average citations per doc	94.32
References	8965
<i>Document contents</i>	
Keywords plus (ID)	117
Author's keywords (DE)	365
<i>Authors</i>	
Authors	410
Authors of single-authored docs	11
<i>Authors collaboration</i>	
Single-authored docs	12
Co-authors per Doc	2.9
International co-authorships %	25.88

3 Results

3.1 Results of bibliometric analysis

3.1.1 Descriptive analysis

Table 1 provides the descriptive characteristics of the sample articles of the SLR. We reviewed 170 articles from 101 journals that span over 20 years between the years 2003 and 2023, with a 15.22% annual growth rate. Although some articles lacked author keywords, all these journals employed 117 keywords in addition to 365 author keywords. The articles were written by 410 authors in total, with 11 of them being single authored. This demonstrates a strong level of collaboration in ICAC papers with a high index of 2.9. According to the 25.88% documents per author ratio, one document was created by four authors on average.

By reviewing the year of publication,¹ the sample articles of the SLR run from 2003 to the end of 2023 (see Fig. 2). Our SLR statistical results indicate that there has been a significant increase in the number of research addressing different ICAC between 2013 and 2023 compared to pre-2013, since ICAC studies have expanded exponentially (9 times increase compared to pre-2013 timeframe). In specific, seventeen articles have been published before 2013 and 153 articles in total from 2013 until 2023 indicating that the importance of IC increased tremendously, as seen in

¹ The csv file imported from Scopus database shows the year of publication, rather than the year of acceptance.

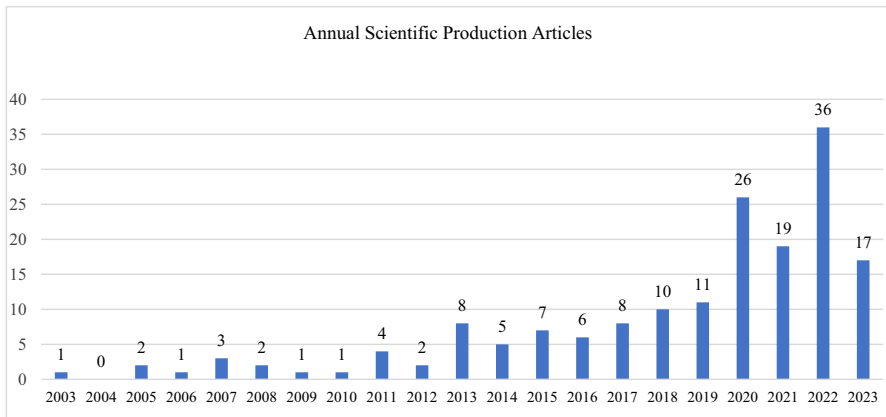


Fig. 2 The Production of IC-related Publication every year (Source: Authors' own work)

the number of publications. In specific, in 2013, IC gained popularity as a scholarly domain, investigating concepts and empirical research due to the development of integrated reporting by the International Integrated Reporting Council (IIRC), offering companies an innovative tool for disseminating IC information (Vitolla et al. 2018) causing a rise in the IC publication in the subsequent years. It is worth noting that there were three significant peaks during the period, while the first of which in 2020 (26 articles), the second in 2021 (19 articles), and the third and highest peak in 2023 (36 articles) which all coincides with the special and Open access issues from JIC. Our results are in consistent with Baima et al. (2021) who reported a theoretical phase from 1997 to 2005 followed by an empirical phase in 2003, with the first empirical IC study in 2003.

Figure 3 presents a three-fold analysis of IC with keywords, institutions of publications, and countries of institutional affiliation,² with the purpose of providing insights about how a specific country affects IC field. Italy has the most IC publications (88 articles), with Lum Jean Monnet University producing the largest amount (12 articles). Some universities focus on a limited number of IC terms, while others have a wider range of coverage. Makerere University in Uganda focuses on IC terms, with little attention being devoted to performance. While the University of Salerno in Italy covers various IC terms, such as IC, disclosure, diversity, CG, and performance. The most frequent keywords are IC (97), performance and financial performance (48), IC disclosure (36), and CG (30).

The top journals producing literature on IC have been identified using the source impact approach. Journal of Intellectual Capital (JIC) ranks the highest with 34 articles published (see Table 2), significantly more than other journals. JIC has increased in publications and citations over the past 20 years, making it

² Bibliometric analysis links countries with authors' working institutions at the time of paper publication, rather than with their nationality, country of birth, or official country of residence (Moed and Halevi 2014).

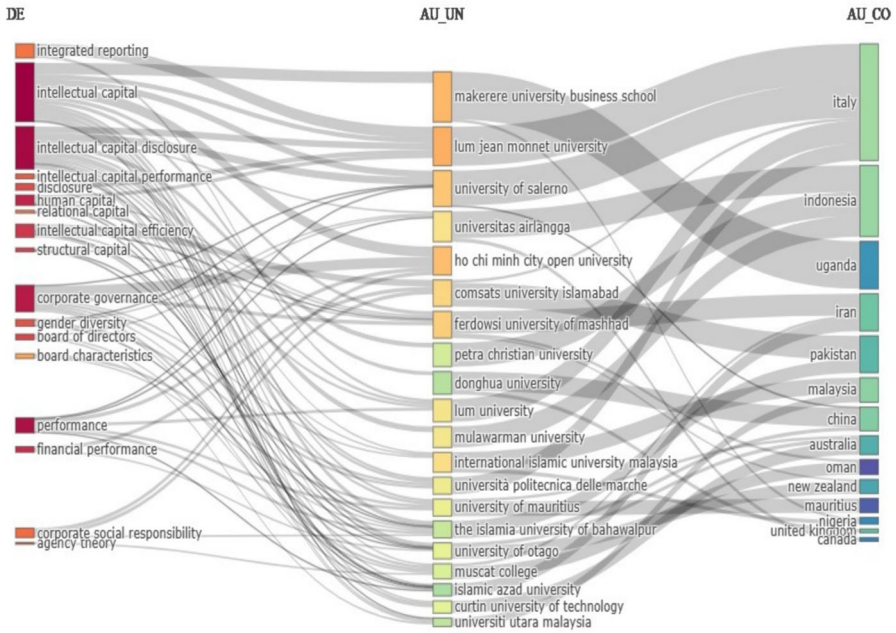


Fig. 3 Three-field analysis of IC linking universities to countries to themes (Source: Authors’ own work)

Table 2 Top ten-journals in IC Literature according to source impact (Source: Authors’ own work)

Element	h_index	g_index	m_index	TC	NP	PY_start
Journal of Intellectual Capital	22	34	1.294	4360	34	2007
Journal of Accounting in Emerging Economies	4	4	0.571	165	4	2017
Sustainability (Switzerland)	3	4	0.6	67	4	2019
Accounting and Business Research	3	3	0.188	413	3	2008
British Accounting Review	3	3	0.25	684	3	2012
International Journal of Disclosure and Governance	3	3	0.429	155	3	2017
International Journal of Islamic and Middle Eastern Finance and Management	3	3	0.375	164	3	2016
Journal of Applied Accounting Research	3	3	0.3	35	3	2014
Asian Journal of Accounting Research	2	2	0.4	60	2	2019
Borsa Istanbul Review	2	2	1	94	2	2022

important to IC researchers and having a higher quality perception. JIC publishes theoretical and empirical studies on identifying, measuring, and managing IC in organizations, providing novel theories and best practices to enhance conversations among researchers and practitioners (JIC 2021). The Journal of Accounting in Emerging Economies and Sustainability (Switzerland) followed in the second place with only 4 articles each. While Accounting and Business Research, British

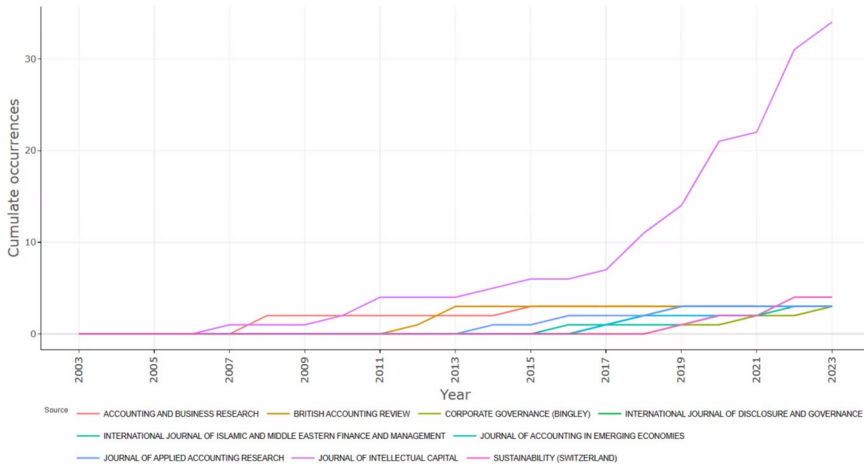


Fig. 4 Trends in IC research in the top journals over time (Source: Authors' own work)

Accounting Review, International Journal of Disclosure and Governance, International Journal of Islamic and Middle Eastern Finance and Management, and Journal of Applied Accounting Research are all in the third place with 3 articles each. In terms of the number of citations for individual papers, JIC has the highest number of cited IC papers (4360 citations), British Accounting Review Journal is second with 684 citations and Accounting and Business Research Journal is third with 413 citations on IC-related literature.

Figure 4 shows the rise in IC articles in leading journals using Loess' smoothing approach. The study categorizes articles into three types: JIC, which experienced a rapid increase in IC publishing since 2007, British Accounting Review, and Accounting and Business Research, which showed stability after 2008. The third category includes journals with little growth in IC studies, such as Journal of Applied Accounting Research and Sustainability (Switzerland), and International Journal of Islamic and Middle Eastern Finance and Management.

Table 3 shows the most cited papers on IC. The cut-off date for the citations was recorded in May 2023 corresponding to the date of extracting the CSV file from Scopus database. The cut-off date of the citations establishes the boundary after which citations are not included in our analysis. The top cited papers are as follows: Subramaniam and Youndt (2005), with 4938 citations, examines how IC influences innovative capabilities in organizations. Zéghal and Maaloul (2010) analyze the role of value added as an indicator of IC and its impact on a firm's economic, financial, and stock market performance. Clarke et al. (2011) investigate the impact of IC on Australian firms, while Tseng and James Goo (2005) investigate resource-based and financial perspectives on IC and its application to value creation. These papers primarily study the causes and effects of IC, focusing on its impact on organizational innovation and value creation.

Table 3 Most cited IC papers (Source: Authors' own work)

Papers	Authors	Total citations	TC per year
The Influence of Intellectual Capital on the Types of Innovative Capabilities	Subramaniam M., Youndt M.A	4938	259.89
Analysing value added as an indicator of intellectual capital and its consequences on company performance	Zéghal D., Maaloul A	994	71.00
Intellectual capital and firm performance in Australia	Clarke M., Seng D., Whiting R.H	805	61.92
Intellectual capital and corporate value in an emerging economy: Empirical study of Taiwanese manufacturers	Tseng C.-Y., Goo Y.-J.J	766	40.32
Review of empirical research on intellectual capital and firm performance	Inkinen H	476	52.89
Determinants of intellectual capital disclosure: Evidence from Australia	Brüggen A., Vergauwen P., Dao M	466	31.07
Value creation and business models: Refocusing the intellectual capital debate	Beattie V., Smith S.J	462	42.00
Intellectual capital disclosure and corporate governance structure in UK firms	Li J., Pike R., Haniffa R	325	20.31
International comparative analysis of the association between board structure and the efficiency of value added by a firm from its physical capital and intellectual capital resources	Ho C.-A., Williams S.M	304	14.48
Intellectual capital and performance of pharmaceutical firms in India	Vishnu S., Gupta V.K	302	30.20
Exploring the effects of corporate governance on intellectual capital disclosure: An analysis of European biotechnology companies	Cerbioni F., Parbonetti A	283	16.65
The impact of intellectual capital on firm performance: a study of Indian firms listed in COSPI	Smriti N., Das N	282	47.00
The impact of intellectual capital disclosure on cost of equity capital: A case of French firms	Boujelbene M.A., Affes H	213	19.36
The value relevance of intellectual capital disclosures	Vafaiei A., Taylor D., Ahmed K	203	15.62
The effect of audit committee characteristics on intellectual capital disclosure	Li J., Mangena M., Pike R	185	15.42
A longitudinal examination of intellectual capital disclosures and corporate governance attributes in Malaysia	Haji A.A., Ghazali N.A.M	165	15.00
Examining the influence of corporate governance on intellectual capital efficiency evidence from top service firms in Australia	Appuhami R., Bhuyan M	148	16.44
Exploring the impact of intellectual capital on company reputation and performance	Ginesti G., Caldarelli A., Zampella A	146	24.33
Structured literature review about intellectual capital and innovation*	Buenechea-Elberdin M	145	20.71
Linking technology innovation strategy, intellectual capital, and technology innovation performance in manufacturing SMEs	Verbano C., Crema M	129	16.13

Table 4 discusses the top contributors to IC literature based on the H-index. May 2023 is the cut-off date for the H-index values, which usually corresponds with the dates of the analysis and data extraction from the Scopus database. The top contributors are Filippo Vitolla and Nicola Raimo from Italian LUM University. They have the highest H-index and G-index, producing 6 ICAC-related articles with 339 citations. They collaborated on examining the connections between ICD in integrated reports and company value (Salvi et al. 2020a), cost of equity (Salvi et al. 2022), and how the board of directors' characteristics influences ICD (Vitolla et al. 2020). They developed a new scoring system to measure ICD quality (Vitolla et al. 2020) and investigated voluntary online IC practices in knowledge-based institutions (Vitolla et al. 2018), based on agency and stakeholder theories. Their work on online ICD is based on agency and stakeholder theories. Followed by Mahdi Salehi from Ferdowsi University of Mashhad with 99 citations. He focuses on the effect of ICD, board characteristics (Salehi and Zimon 2021), and financial performance on firm value creation, growth, financial performance, fraud in financial statements (Lotfi et al. 2022), and economic value added (Salehi et al. 2014). Jing Li from the University of Bradford, Muhammad Nadeem from the University of Queensland, and Michele Rubino from LUM University are the next most influential authors, producing 4 IC-related articles with total citations of 595, 191, and 319, respectively. The results indicate that few specialized authors have addressed this topic, urging more scholars to focus on future studies and contribute to advancements in this research field with low barriers to entry.

3.1.2 Most prolific countries, institutions, and collaboration network

Table 5 lists countries³ with the most IC-related articles published and the number of citations each author received. Italy has the most IC-related articles, followed by Indonesia, Malaysia, China, India, Iran, the UK, Pakistan, Australia, and New Zealand. These countries have contributed significantly to IC Literature through their universities.

Table 6 lists prominent institutions in IC publications worldwide. Australia has the highest number of citations from published IC work, with 1261 citations from 18 articles. China follows with 1164 citations from 29 articles, and the UK ranks third with 1019 citations from 22 documents. Research primarily focuses on European and Asian businesses, suggesting that American and British academics are no longer the majority in this field. Academics from various cultural and economic backgrounds are increasingly interested in IC. Industry barriers are not a factor in empirical IC research. Table 6 shows that single universities are producing the largest amount of IC publications. LUM Jean Monnet University in Italy and Makerere University Business School in Uganda consistently produce high-quality articles on

³ It is important to note that articles with numerous affiliations are counted in the production of the countries associated with each affiliation. For this reason, the overall frequency of the top 10 countries (334) is higher than the total number of sampled articles (170).

Table 4 Top authors of IC publications according to source impact (Source: Authors' own work)

Author	h_index	g_index	m_index	TC	NP	PY_start
Raimo N	5	6	1.25	339	6	2020
Vitolla F	5	6	1.25	339	6	2020
Salehi M	5	5	1.25	99	5	2020
Li J	4	4	0.25	595	4	2008
Nadeem M	4	4	0.571	191	4	2017
Rubino M	4	4	1	319	4	2020
Aslam E	3	3	0.75	123	3	2020
Ginesti G	3	3	0.5	170	3	2018
Mangena M	3	3	0.25	270	3	2012
Nicolò G	3	5	0.5	153	5	2018

IC. Ho Chi Minh City Open University in Vietnam and University of Salerno in Italy both comes second with 11 IC-related articles.

Table 7 ranks the top ten countries for corresponding authors, with Australia being the top contributor with 19 single-country publications (SCP) and 9 multi-country publications (MCP) resulting in 28 articles on IC. The second is China that has 19 IC articles, with 12 being SCP and 7 being MCP. Followed by Italy (16 articles; 14 SCP and 2 MCP), Malaysia (11 articles; 9 SCP and 2 MCP) and Indonesia (9 IC articles; 18 SCP, zero MCP). While, Table 8 shows collaboration networks between Malaysia, Pakistan, and Yemen, with Malaysia on three IC articles, Spain, and Portugal on three IC articles, and Australia with Portugal and Spain on two IC publications. These collaborations highlight global issues and efforts, requiring collaboration between different countries, although not as extensive as the issues themselves.

3.1.3 Examining the conceptual structure- thematic mapping

This section provides an overview of the ICAC literature streams and their associations, highlighting the evolution and pattern of research within the field. The study's co-occurrence network helps identify various subjects covered by the ICAC literature over the suggested period and analyzes these terms on a thematic map. *First*, Fig. 5 depicts the co-occurrence network analysis, developed by 'Biblioshiny' with the R package. It shows 200 author keywords, occurring a minimum of five times in the 170 articles. The bigger the nodes, the higher the frequency; the lines between these nodes represent the co-occurrence. The most included keywords,

Table 5 Top countries in terms of IC publications and citations (Source: Authors' own work)

Region	Freq	Country	Total Citations
Italy	88	Australia	1261
Indonesia	50	China	1164
Malaysia	45	UK	1019
China	29	New Zealand	996
India	24	Canada	995
Iran	22	Italy	834
UK	22	India	656
Pakistan	21	Malaysia	549
Australia	18	Finland	476
New Zealand	15	Netherlands	466

Table 6 Most influential universities in IC publications (Source: Authors' own work)

Affiliation	Articles
Lum Jean Monnet University	12
Makerere University Business School	12
Ho Chi Minh City Open University	11
University Of Salerno	11
Ferdowsi University of Mashhad	8
Comsats University Islamabad	7
International Islamic University Malaysia	7
Universitas Airlangga	7
Lum University	6
Mulawarman University	6

"performance" and "CG," have the highest total link strength, directing research towards studying the relationship between IC, CG, and performance. The co-occurrence network divides the literature into three main streams: red, green, and blue. The red cluster represents ICAC in terms of antecedents, corporate governance, CEO characteristics, ownership structure, and board gender diversity (BGD), while the green cluster addresses structural capital, relational capital, and HC. The blue cluster represents the broader picture of the IC stream of research, including theoretical basis like agency theory and research methodology like GMM model and content analysis.

Next, Table 9 displays the top three keywords in ICAC literature: IC, ICD, and performance. These keywords are extensively examined in papers, appearing 97, 36, and 34 times, respectively. Other keywords and their frequency of usage include CG (30 times), HC (16 times), financial performance (14 times), ICD (11 times), and structural capital (times). The analysis of ten most important and frequent keywords in IC-related studies was conducted using co-occurrence analysis technique. Keywords were evaluated using a threshold of 10, hence those that were repeated

Table 7 Corresponding authors' country representation (Source: Authors' own work)

Country	Articles	SCP	MCP	Freq	MCP_Ratio
Australia	28	19	9	0.165	0.321
China	19	12	7	0.112	0.368
Italy	16	14	2	0.094	0.125
Malaysia	11	9	2	0.065	0.182
Indonesia	9	9	0	0.053	0
India	8	8	0	0.047	0
United Kingdom	8	5	3	0.047	0.375
Bangladesh	5	4	1	0.029	0.2
New Zealand	5	3	2	0.029	0.4
Iran	4	3	1	0.024	0.25

Table 8 Collaboration network (Source: Authors' own work)

From	To	Frequency
Malaysia	Pakistan	3
Spain	Portugal	3
Australia	Portugal	2
Australia	Spain	2
China	Pakistan	2
Italy	New Zealand	2
Italy	Pakistan	2
Malaysia	Yemen	2
Pakistan	United Arab Emirates	2
Australia	Albania	1

more than ten times were chosen. Figure 6 shows the word cloud generated by the authors' keyword frequency that validates some important keywords, including IC, ICD, IC performance, and CG. Other identified keywords include corporate social responsibility, gender diversity, integrated reporting, HC, and board of directors.

Finally, the ICAC literature is explored through a strategic structure, a visualization instrument, and a strategic diagram. The strategic diagram is created by considering 200 author keywords and using the 'bibliometrix' package with R software. The themes are classified into four quadrants and four distinct themes: motor theme (high centrality and high density), niche theme (high density and low centrality), emerging or declining theme (low density and low centrality), and basic theme (low density and high centrality). The thematic map (Fig. 7) presents six themes spread across the four quadrants. IC, ICD, ICE, IC Performance, board of directors, gender diversity, HC, structural capital, and relational capital come under the general quadrant and appear as particularly important themes in the interdisciplinary field of IC. Themes in this quadrant have high centrality and low density, indicating that these themes have a lower strength of internal ties, which validates the need

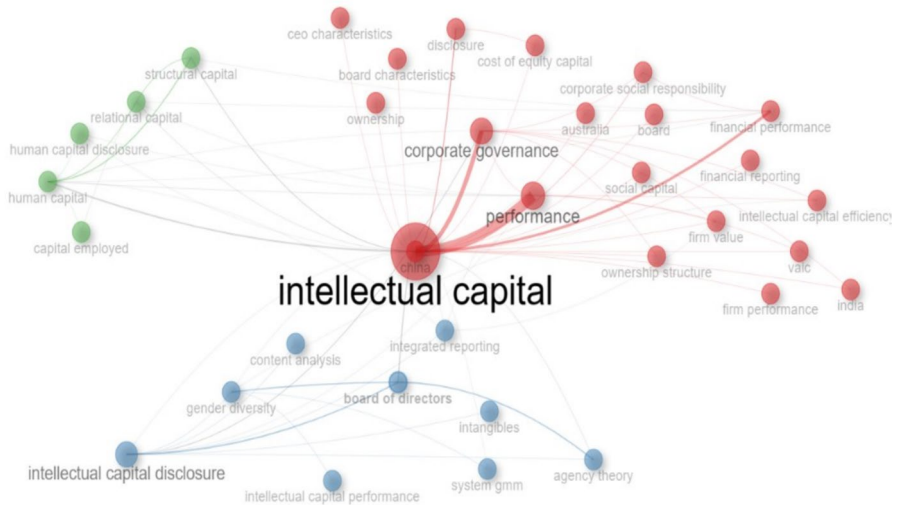


Fig. 5 Co-occurrence network of keywords plus that categorizes IC research into three streams (Source: Authors' own work)

Table 9 Authors' Keywords based on Occurrence (Source: Authors' own work)

Author keywords	Occurrences
Intellectual capital	97
Intellectual capital disclosure	36
Performance	34
Corporate governance	30
Human capital	16
Financial performance	14
Intellectual capital efficiency	11
Structural capital	10
Board of directors	9
Gender diversity	8

for future research to study the subthemes diligently. In contrast, the strength of its ties with the other themes is well developed over the years. Furthermore, the size of the circles exemplifies that these themes are well researched; however, scholarly inquiries into these themes are still required. IC theme is seen to be the largest since the publication period for this theme covers an entire period of more than 20-years. While performance, BGD, intangible assets, integrated reporting, firm value, cost



Fig. 6 Word Cloud developed by the frequency of authors' keywords (Source: Authors' own work)

of capital, and green IC come under the niche quadrant and appear as much focused themes, especially important themes in the interdisciplinary field of IC.

3.2 Results of content analysis

This section aims to refine the output of bibliometric thematic analysis by conducting manual content analysis of 78 highly ranked empirical studies published in Q1 journals. The journal rankings were established based on the SCImago Journal Rank (SJR) for the year 2022 (Gonzalez-Pereira et al. 2010; Guerrero-Bote and Moya-Anegon 2012). Due to occasional fluctuations in journal affiliations with quartiles, we ensured to incorporate rank values from the publication years into our analysis. The content analysis revealed two general groups namely intellectual capital antecedents (ICAs) literature and intellectual capital consequences (ICCs) literature. Our analysis for ICAs literature identifies 33 studies (approximately 42% of the sampled studies) that are divided into three themes including BGD (10 studies or 30% of ICAs studies), CG mechanisms (12 studies or 36% of ICAs studies), and the remaining 11 studies (34% of ICAs studies) were categorized as other antecedents of IC. For the second group, ICCs literature, our analysis reveals 45 studies (approximately 58% of the sampled studies) examined the consequences of IC (only 8 of them are interested in ICD). These studies are further classified into three themes including firm performance (28 studies), firm value creation (11 studies), and other consequences (6 studies). Table 10 lists these studies broken down into different themes. Under each theme, we explicitly distinguish between ICE and ICD studies.

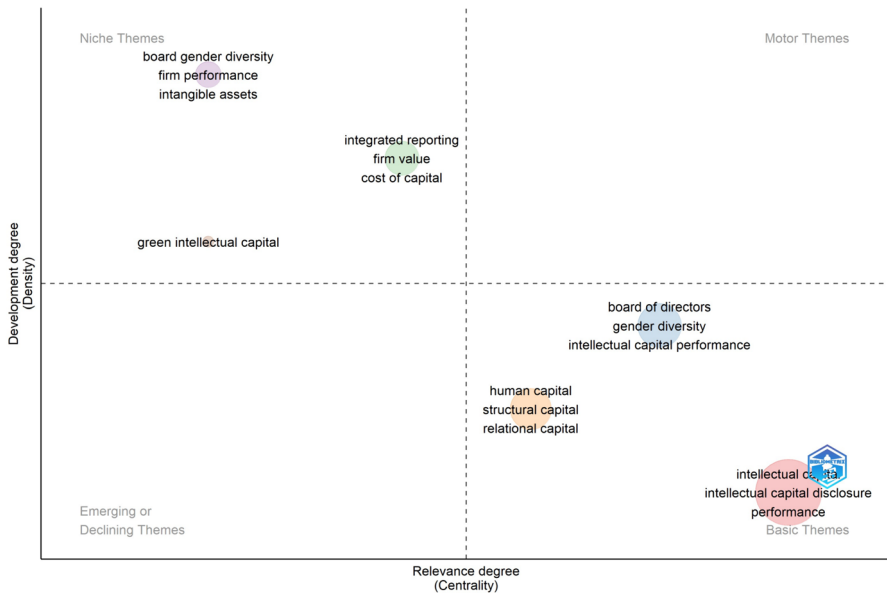


Fig. 7 The strategic diagram of ICAC themes (Source: Authors' own work)

3.2.1 ICE and ICD antecedents

According to agency theory, which has been primarily used to examine CG mechanisms (Appuhami and Bhuyan 2015; Shahzad et al. 2022b), internal CG mechanisms can restrict opportunistic management behavior. As an IC explanatory variable, board characteristics are the most frequently discussed topic among the internal CG mechanisms. BGD, board size, board independence, board activity, board subcommittees, and CEO duality were the six basic characteristics that were typically used in previous studies looking into the effects of board characteristics on IC (e.g., Hidalgo et al. 2011; Tran et al. 2020). As previously highlighted, BGD is a topic that receives a lot of attention in the IC literature; hence, we decided to discuss it separately from the other board characteristics.

3.2.1.1 Board gender diversity According to the upper echelon theory, top management diversity can help board members to have more innovative thinking and more effective strategies (Al-Musali and Ku Ismail 2015; Carter et al. 2003). In addition, the resource dependency theory suggests that BGD enables firms to have critical resources and in return improve their performance (Goodstein et al. 1994). Based mostly on these two theories, studies in this section examined the casual relationship between IC and BGD. Furthermore, the measure of gender is used extensively in the IC literature, except for Prencipe et al. (2023) who relied on nationality to capture the diversity among the members of the board, all other nine articles considered gender diversity.

Table 10 The streams of research and themes across sampled studies (Source: Authors' own work)

IC determinants		IC consequences	
Theme (1) BD and IC	Theme (1) IC and firm performance		
<i>BD and ICE</i>			
1	Nadeem et al. (2019)	1	<i>ICE and firm performance</i>
2	Smriti and Das (2022)	2	Clarke et al. (2011)
3	Farooq and Ahmad (2023)	3	Vishnu and Gupta (2014)
4	Javaid et al. (2023)	4	Shahzad et al. (2020)
5	Prencipe et al. (2023)	5	Tiwari (2022)
<i>BD and ICD</i>			
1	Tejedo-Romero et al. (2017)	6	Probohudono et al. (2022)
2	Nadeem (2020)	7	Shahzad et al. (2022a, b)
3	Vitolla et al. (2020)	8	Ginesti et al. (2018)
4	Nicolò et al. (2022)	9	Lestari and Adhariani (2022)
5	Tejedo-Romero and Araujo (2022)	10	Zéghal and Maaloul (2010)
	Sub-total articles	11	Ur Rehman et al. (2022)
		12	Smriti and Das (2018)
		13	Babajee et al. (2020)
		14	Vidyardhi and Tiwari (2020)
		15	Shahwan and Fathalla (2020)
		16	Nkambule et al. (2022)
		17	Díaz-Fernández et al. (2015)
		18	Massaro et al. (2020)
		19	Subramaniam and Youndt (2005)
		20	Li and Liu (2018)
			Tjajjadi et al. (2019)
<i>CG and ICE</i>			
1	Apputhami and Bhuyan (2015)		
2	Dalwai and Mohammadi (2020)		
3	Hsieh et al. (2020)		
4	Tran et al. (2020)		
5	Aslam and Haron (2021)		
6	Shahzad et al. (2022a, b)		

Table 10 (continued)

IC determinants		IC consequences	
	<i>CG and ICD</i>		
1	Cerbioni and Parbonetti (2007)	21	Torre et al. (2020)
2	White et al. (2007)	22	Wang and Juo (2021)
3	Li et al. (2008)	23	Gómez-Valenzuela (2022)
4	Singh and Mitchell Van der Zahn (2008)	24	Tjahjadi et al. (2022)
5	Hidalgo et al. (2011)	25	Ruiz-Fernández et al. (2023)
6	Li et al. (2012)	26	Chatterji and Kiran (2023)
	Sub-total articles	27	Rehman et al. (2023)
Theme (3) Other determinants of IC		12	<i>ICD and firm performance</i>
	<i>Other determinants of ICE</i>		
1	Ginesti (2019)	1	Dharni and Jameel (2021)
			Sub-total articles
			28
		Theme (2) IC and value creation	
2	Nadeem et al. (2021)	1	<i>ICE and value creation</i>
3	Vo et al. (2022)	2	Tseng and James Goo (2005)
	<i>Other determinants of ICD</i>		
1	Brüggen et al. (2009)	3	Wang (2013)
2	Bellora and Guenther (2013)	4	Abhayawansa et al. (2015)
3	Li and Mangena (2014)	5	Anifowose et al. (2018)
4	Manes Rossi et al. (2018)	6	Ni et al. (2020)
5	Beretta et al. (2019)		Battisti et al. (2022)
6	Nicolò et al. (2021)		<i>ICD and value creation</i>
7	Mardini and Lahyani (2022)	1	Vafaei et al. (2011)
8	Ramírez et al. (2022)	2	Boujelbene and Affès (2013)
		3	Salvi et al. (2020a)

Table 10 (continued)

IC determinants		IC consequences
Sub-total articles		11
4	Salvi et al. (2020b)	
5	Salvi et al. (2022)	
Sub-total articles		11
Theme (4) Other consequences of IC		
<i>Other consequences of ICE</i>		
1	Tayles et al. (2007)	
2	Beattie and Smith (2013)	
3	Lotfi et al. (2022)	
4	Shahwan and Habib (2020)	
<i>Other consequences of ICD</i>		
1	Ndou et al. (2018)	
2	Al-Omoush et al. (2022)	
Sub-total articles		6
Total articles		45
		78

The results of the first strand of research relating to the effect of BGD on ICE are to some degree competing. For instance, Nadeem et al. (2019) used a UK sample of 3,297 during period of 2007–2016 and reported a significant positive relationship between female representation on boards and ICE. Similar findings by Javaid et al. (2023) demonstrate that ICE rises as the number of female directors reaches a critical mass (three or more). On the other hand, Farooq, and Ahmad (2023) showed that the presence of female director in boardroom has significant negative impact on the ICE. However, Smriti and Das (2022), using two measures to capture BGD, have provided mixed results. Whilst they confirmed a positive effect of female directors on the ICE, the effect of female independent directors was negative. Finally, Prencipe et al. (2023) examined the relationship between two proxies of board diversity and innovation capital as SC. They argued that whereas BGD and innovation capital have a U-shaped relationship, board diversity has an inverted U-shaped relationship. The second strand of research argues that BGD explains the level and qualities of ICD. Most studies exploring this relationship show that the increase in women percentage in board of directors enhances the level of ICD in annual reports (Tejedo-Romero et al. 2017), integrated reports (Vitolla et al. 2020), IPO prospectuses (Nadeem 2020), and websites “online disclosure” (Nicolò et al. 2022) as well as the quality of ICD (Vitolla et al. 2020).

Based on the discussion above, it is important to note that most of the research on the relationship between BGD and ICD have only been published in the last two years, with the exception of the Tejedo-Romero et al. (2017) study, which is the first to examine the effect of gender diversity on ICD. As a result, the link between BGD and ICD is regarded as a relatively recent topic. Given that study on the subject is still in its early phases, this implies that there is still much to learn about the relationship between BGD and ICD. Additionally, studies in this field looked at board diversity using only two dimensions, nationality, and gender diversity, with a stronger emphasis on gender diversity. However, several additional board diversity factors, including tenure (Khatib et al. 2021), age, experience, education, religion, ethnicity, and linguistic diversity, have not been studied. This presents an array of additional study directions to pursue in the future to investigate issues beyond only gender diversity. Furthermore, except of Tejedo-Romero and Araujo (2022) who examined the relationship between HC and BGD, the BGD-IC relationship has been investigated on the overall level using the total score of ICD with less emphasis on the effect of BGD on disclosure of IC individual components.

3.2.1.2 Other CG mechanisms *Board size.* Literature offers two opposite arguments on how board size may affect ICE. From the perspective of resource dependency theory, larger boards are more likely to provide larger number of experts (Appuhami and Bhuyan 2015; Mooneeapen et al. 2022) and bring more innovative and transparency practices (Kamath 2019). On the contrary, agency theory states that larger boards may adversely affect board effectiveness in supervising and monitoring (Hidalgo et al. 2011) due to communication problems (Shahzad et al. 2022b), the increase in the time needed to make decisions (Hidalgo et al. 2011), and the increase in the probability of conflict of interest comes to surface. Referring to these two opposite arguments, studies under this stream of research provided mixed findings on several

levels. In respect of the overall ICE, Dalwai and Mohammadi (2020) noted positive relationships with ICE. While Shahzad et al. (2022a, b) and Tran et al. (2020) both documented negative effects. Other studies reported insignificant relationship between board size and ICE (Appuhami and Bhuyan 2015; Farooq and Ahmad 2023). Regarding the efficiency of IC individual components, studies reported a significant and positive impact of HC efficiency (Aslam and Haron 2021; Dalwai and Mohammadi 2020) and SC efficiency (Aslam and Haron 2021). In relation to ICD, some studies show a positive impact on the level of ICD quantity (Hidalgo et al. 2011) and quality (Vitolla et al. 2020). Cerbioni and Parbonetti (2007) indicated that board size affects semantic properties of ICD, as firms with larger boards are more likely to provide less historical and more negative ICD. Finally, neither Manes Rossi et al. (2018) nor Nicolò et al. (2021) were able to find significant effect of board size on the quantity or the quality of ICD.

Board independence. According to agency theory, conflict of interest and agency cost can be minimized by monitoring the performance of management to make sure that its actions conform to stakeholders' interest (Appuhami and Bhuyan 2015). In addition, non-executive directors are normally experts in their fields in a way that enhances the effectiveness of decision-making of board (Aslam and Haron 2021). Consistent with the conceptual argument, several studies reported a positive effect of board independence on ICE whether for the overall ICE (Appuhami and Bhuyan 2015) or for the performance of individual IC component including HC, RC, and SC (Aslam and Haron 2021). On the other hand, ICD studies have focused more on the quantity of ICD and found that board independence positively affects the level of information disseminated about IC (Cerbioni and Parbonetti 2007; Li et al. 2008; Nicolò et al. 2021; Vitolla et al. 2020; White et al. 2007), HC, and SC (Cerbioni and Parbonetti 2007). Only two studies (Nicolò et al. 2021; Cerbioni and Parbonetti 2007) explored the link between board independence and ICD and reported a positive effect.

Board Activity. Reducing agency problems can be achieved by showing the commitment of the board members through frequent and timely meetings and increasing the probability to respond immediately for arising organizational issues (Ahmed Haji and Mohd Ghazali 2013). However, the increase in number of board meetings means introducing additional costs and increase the probability of emerging conflicts among board of directors (Ahmed Haji and Mohd Ghazali 2013). Despite the importance of the board activity variable, only three studies across our sampled studies examined the relationship between board activity and IC. According to Vitolla et al. (2020), more yearly board meetings foster more transparency, which improves ICD quality. Tejedo- Tejedo-Romero and Araujo (2022) reported a U-shape relationship between board activities on HC disclosure, which means that HC disclosure increases with the increase of board activity up to a maximum limit above which there is a decline in the voluntary disclosure of HC.

Board subcommittees. Several characteristics of board subcommittees have been investigated in literature including audit committee size, shariah board size (Aslam and Haron 2021), remuneration committee independence (Appuhami and Bhuyan 2015), audit committee independence (Shahzad et al. 2022b), and audit committee activity (Dalwai and Mohammadi 2020). For example, Aslam and Haron (2021)

found that the larger the audit committee size, the higher the HC efficiency, but the lower relational capital efficiency and SC efficiency. Considering ICD, some key studies reported on how board subcommittees can interpret variance in the level of ICD. According to Li et al. (2012), audit committee size affects positively the total ICD index as well as its sub-components (human, social, and relational). Li et al. (2008) reported comparable results. On the contrary, Cerbioni and Parbonetti (2007) found that board committees independence negatively influences the extent of information related to IC, HC, and relational capital but insignificant to SC. While audit committee activity (meetings) had positive impact on ICD, relational capital disclosure, and SC disclosure (Li et al. 2012, 2008).

CEO duality. CEO duality may imply a conflict of interest as it restricts board independence (Cerbioni and Parbonetti 2007), allows CEO to control the agenda of board meetings to put forward his or her own personal interest (Boivie et al. 2011). In addition, CEO duality can result in equipping CEOs with more authorities that inherent the board independence required for restraining the opportunistic behaviors of CEOs (Appuhami and Bhuyan 2015). Studies in our sample provided mixed findings of the relationships between CEO duality and IC. While some studies reported a significant negative effect of CEO duality on the efficiency of HC and SC (Aslam and Haron 2021) and disclosure of IC and relational capital (Cerbioni and Parbonetti 2007), other few studies documented a positive relationship between CEO duality and ICE (Tran et al. 2020) or relational capital efficiency (Aslam and Haron 2021). In addition, Cerbioni and Parbonetti (2007) reported a negative impact of CEO duality on forward-looking ICD.

Ownership structure. Studies such as Tran et al. (2020) stated that ownership concentration is positively related to ICE. Hsieh et al. (2020) found the total IC as well as efficiency increase with the increase in percentage of controlling shareholders up to an optimal point after which the relationship turns to be negative. For ICD studies, results showed that the level of ICD level decreases with the increase in the level of ownership concentration (Li et al. 2008) or institutional ownership (Hidalgo et al. 2011). On the other hand, Singh, and Mitchell Van der Zahn (2008) documented that ICD extent in IPO prospectuses increase when ownership retention at the IPO increases. However, other studies provided no significant relationship between ownership concentration (Dalwai and Mohammadi 2020; White et al. 2007) and family ownership (Hidalgo et al. 2011) with ICD.

To conclude, the literature on this theme has highlighted several CG mechanisms influencing ICE and ICD by emphasizing largely on boardroom characteristics as internal mechanisms. However, several other internal factors that could enhance ICE or ICE are still uninvestigated. For example, despite the importance of incentive structure of CEOs as internal CG mechanism and its role in explaining firm performance (Matolcsy and Wright 2011; Ozkan 2011) and quality of disclosure (Hui and Matsunaga 2015), nevertheless, there is no study that investigate its effect on ICE or ICD. In addition, it is well known that accounting information system effectiveness plays a critical role in managing performance and reporting quality (Alsalam et al. 2016; Amin and Mohamed 2012; El-Feel et al. 2024); even so, its role with IC is not clear. Moreover, contemporary studies recommend considering internal CG mechanisms as a system of interrelated elements (Amin et al. 2021; Hassan et al. 2023);

however, the interconnection between CG mechanisms and best composition in relation to IC is ignored among scholars.

Additionally, it is evident that insufficient studies have been conducted to determine whether external CG mechanisms, such as those imposed by regulatory bodies, financial institutions, trade unions, shareholder activism, audit quality, and audit firm type, could enhance ICE and ICD. Furthermore, research on ownership structure has only been conducted using a limited set of measurements, such as institutional ownership, family ownership, and ownership concentration. The impact of other ownership measures, such as state ownership, insider ownership, foreign ownership, and financial (bank) ownership, on ICE and ICD is still unknown. Since there is research that demonstrates how foreign and state ownership can change the effectiveness of investments (Chen et al. 2017), it is crucial to look into how the aforementioned measures affect ICD and ICE. Finally, most of the studies of CG did not consider how industry/sector might moderate the effect of CG mechanisms on IC. Given that there is evidence demonstrating how type of industry can influence the link between CG mechanisms and IC. For example, Dalwai and Mohammadi (2020) examined the effect of CG on ICE in the financial sector and showed that board independence and ownership concentration are significant determining factors of ICE only for banks but not for the other investigated financial subsectors. Similarly, Brügger et al. (2009) demonstrated that firms associated with the health care and information technology industries disclose more IC information than those associated with other industries.

3.2.1.3 Other antecedents of IC (firm characteristics, performance, and context) Analyzing studies on this theme reveals several explanatory variables of IC that can be classified into three groups include firm characteristics, firm performance, and firm context. For the firm characteristics, firm size is considered the most examined variable. Brügger et al. (2009), Nicolò et al. (2021), and Bellora and Guenther (2013) confirmed a significant positive impact of firm size on the levels of ICD extent and quality. Likewise, other studies showed that the quantity of IC related information disclosed is positively associated with company leverage (White et al. 2007), complexity (Manes Rossi et al. 2018). While Li and Mangena (2014) found that ICD tends to be more text in nature for firms with multiple listing.

Regarding firm performance, the sampled studies employed two dimensions of firm performance, i.e., financial performance (e.g., Nicolò et al. 2021; Mardini and Lahyani; 2022) and non-financial performance (e.g., Beretta et al. 2019) to investigate how ICD tone is affected by financial and non-financial performance. Beretta et al. (2019) reported that ESG score as a non-financial performance proxy affects positively the optimistic news of ICD, while the impact of financial performance was insignificant. On contrast, Li and Mangena (2014) found that market-to-book ratio is positively related with numerical and text ICD but not with graphical ICD. Unexpectedly, Mardini and Lahyani (2022) reported negative effect of ROE on disclosure of IC, HC, and RC.

Literature also investigated how ICD varies according to several contextual factors. Regarding sector-based studies, Brügger et al. (2009) concluded that industry type represents a key determining factor of level of ICD. In addition, Bellora and

Guenther (2013) reported that firms in high R&D intensity industries disclose significantly more innovation capital items and to a higher qualitative level than firms in low R&D intensity industries.

Even though earlier research on this topic made a significant contribution to our understanding of IC, more research needs to be done on other firm characteristics, including company growth, stock price movement, industry shock, managerial ability, corporate culture, analysts' coverage, corporate risk, organizational life cycle, organizational competitive strategy, and industry type. For instance, Kucera and Dvorakova (2023) argued to evaluate IC antecedents across each industry as their finding suggests that IC components are more vital for the sustainability of firms in high-tech sector than the traditional industries. The potential impact of a crisis on IC is yet another area of research that has not been sufficiently explored in the sampled studies. Some studies highlighted the role of financial crisis (e.g., Cohen et al. 2014). Still, contemporary significant crisis such as COVID-19 pandemic and Russia-Ukraine War have not explored yet. Finally, our analysis shows that, except for CSR performance and CEOs' age, connection and ability, the relationship between the theme of "firm characteristics, performance and context" and ICE is still not yet explored. For instance, it remains unclear how firm size, firm performance, market performance, information asymmetry, and internationality and complexity can affect ICE.

3.2.2 ICE and ICD consequences

3.2.2.1 Firm performance Since the ultimate goal of any entity is to maximize its performance, it is not surprising to observe that approximately 62% of studies on the consequences of IC (28 of 45 studies) are interested in examining the impact of IC on firm performance. Such is done in terms of objective firm performance (18 studies, 40%) that uses secondary data-based measures to calculate firm performance obtained through published data and in terms of perceived firm performance (10 studies, 32%) that uses the firm's perception of its own performance. For objective firm performance, employed measures are from both financial and nonfinancial perspectives. In addition, the sampled studies have differentiated between two main groups of financial measures: accounting- and market-based financial measures. Accounting-based financial measures included return on assets (ROA) (e.g., Díaz-Fernández et al. 2015; Shahzad et al. 2020), return on equity (ROE) (e.g., Clarke et al. 2011; Ginesti et al. 2018), return on sales (ROS) (Vishnu and Kumar Gupta 2014), sales growth, and assets turnover (ATO) (Smriti and Das 2018). While stock market-based financial performance measures included Tobin's Q (e.g., Dharni and Jameel 2021; Ur Rehman et al. 2022; Zéghal and Maaloul 2010) and stock price crash risk (Probohudono et al. 2022). Some studies have investigated another perspective of performance using firm efficiency (Nkambule et al. 2022; Shahwan and Fathalla 2020; Vidyarthi and Tiwari 2020). However, despite the importance of IC as intangible asset in interpreting non-financial performance, only few studies in our sample have investigated the relationship between IC and non-financial performance measure such as corporate social responsibility (CSR) (Shahzad et al. 2022a), firm reputation

(Ginesti et al. 2018), and environmental, social, and governance (ESG) performance (Lestari and Adhariani 2022).

In addition, most prior scholars revealed positive effects of ICE on different dimensions of performance such as profitability performance (e.g., Babajee et al. 2020; Tiwari 2022; Shahzad et al. 2020), operating performance (Clarke et al. 2011; Shahwan and Fathalla 2020), economic performance (Zéghal and Maaloul 2010), and market performance (Smriti and Das 2018). Similarly, ICD is proved to have significant effect on Tobin's Q (Dharni and Jameel 2021). Considering IC components, empirical results are mixed. For example, several studies showed that capital employed efficiencies (CEE) associated positively with ROA (Tiwari 2022), Tobin's Q (Smriti and Das 2018), employee productivity (Clarke et al. 2011), yet other studies showed negative effect on economic performance (Zéghal and Maaloul 2010). Further, some studies fail to report any significant relation between CEE and corporate reputation (Ginesti et al. 2018). Similarly, HC efficiency is shown to have positive effect on ROA, ROE, and employee productivity (Clarke et al. 2011), cost, revenue, and profit efficiency (Vidyarthi and Tiwari 2020), and firm reputation (Ginesti et al. 2018). Similar results have been reported for the other components of IC such as HC and relational capital.

Regarding perceived performance, scholars used several measures of several dimensions including general performance indicators such as financial, customer, learning, process, (Chatterji and Kiran 2023), green performance (Li and Liu 2018), and organizational performance (Torre et al. 2020), and specific industry performance indicators such as occupancy rate (Ruiz-Fernández et al. 2023), teaching outcomes (Tjahjadi et al. 2019). Such studies reported a positive effect of IC components. For instance, Torre et al. (2020) used three components of IC including HC, relational capital, and organizational capital to examine the relationships between IC and the perceived performance. Their findings indicated that all IC components have a positive effect on organizational performance in hotels. Such results have been reported also for higher education institutions by Chatterji and Kiran (2023) whom they used balanced scorecard perspectives as dimensions for organizational performance. On this track and based on the notion that higher education institutions are considered knowledge-based entities, Tjahjadi et al. (2019) investigated how IC affects the performance in terms of teaching, research, and enhancement of community in Indonesia. They reported that IC has a crucial role not only as an explanatory variable in improving the perceived performance, but also, as a mediator variable between performance management systems and performance of higher education institutions. Innovation performance is another important dimension that has been investigated in relation to IC. Scholars show that IC can boost innovation performance (Rehman, et al. 2023) and affect its types (Subramaniam and Youndt 2005). Another non-financial performance measure that has been investigated is competitive performance. Li and Liu (2018) used three components of IC customer capital, SC, and HC and demonstrate that IC affects competitive performance directly as well as indirectly through problem identification capabilities.

In conclusion, prior studies suggest that IC plays a vital role for a firm's performance on several levels. However, some levels have received more in-depth research than those of others. Since few studies have focused on nonfinancial performance

metrics, the examined literature has highlighted financial performance significantly. Our analysis is supported by the claim made by Van et al. (2022) that further research is needed to fully understand the impact of ICD on a variety of issues, including the performance of the supply chain, innovative performance, ESG performance, sustainability performance, and green performance. An important question here is what is (are) IC component(s) that may enhance a specific type of innovation (i.e., product or process, incremental or radical...etc.). Buenechea-Elberdin (2017) differentiated among innovation output, result, process, and the degree of radicality that opens the doors for several relationships that can be investigated in relation to IC. In addition, a non-linear relationship between IC and firm performance indicators needs to be explored (Le et al. 2022). It is also important to notice that most of the studies investigated only the direct effect on firm performance, while limited studies investigated the mediating role of IC (e.g., Shahzad et al. 2020; Shahwan and Fathalla 2020).

3.2.2.2 Value creation Several scholars (e.g., Ni et al. 2020; Salvi et al. 2020a; Torre et al. 2020; Vafaei et al. 2011; Wang 2013) consider IC as a crucial factor to increase firm value. The reviewed studies have used different measures for firm value. For instance, net value per share (Wang 2013), market price (Vafaei et al. 2011), free cash flow (FCF) and economic value added (EVA) (Anifowose et al. 2018), and Tobin's Q which is the most widely used indicator of market firm value (Ni et al. 2020; Salvi et al. 2020a; Tseng and James Goo 2005; Wang 2013). Furthermore, other studies investigated how IC can affect firm value through affecting some related variables such as dividend payout (Battisti et al. 2022) and cost of equity (Boujelbene and Affes 2013; Salvi et al. 2020b).

Most of the research showed that a growth in ICE, together with its components of HC, relational capital, and IC, increases a firm's value (Wang 2013; Ni et al. 2020; Tseng and James Goo 2005). However, such studies showed that other IC components such as organizational capital (Tseng and James Goo 2005), and customer capital (Ni et al. 2020) are insignificant in relation to firm value. Further, Anifowose et al. (2018) empirically examined the impact of IC as well as its components on firm book value measured by two proxies: free cashflow (FCF) and economic value added (EVA). The study's empirical findings had a range of mixed views. The protected capital (also known as intellectual property), on the other hand, showed a significant negative relationship with both proxies of firm book value. On the one hand, the overall ICE has a significant positive impact on firm book value. Meanwhile, HC exhibits a positive effect only on FCF, but insignificant relation to EVA.

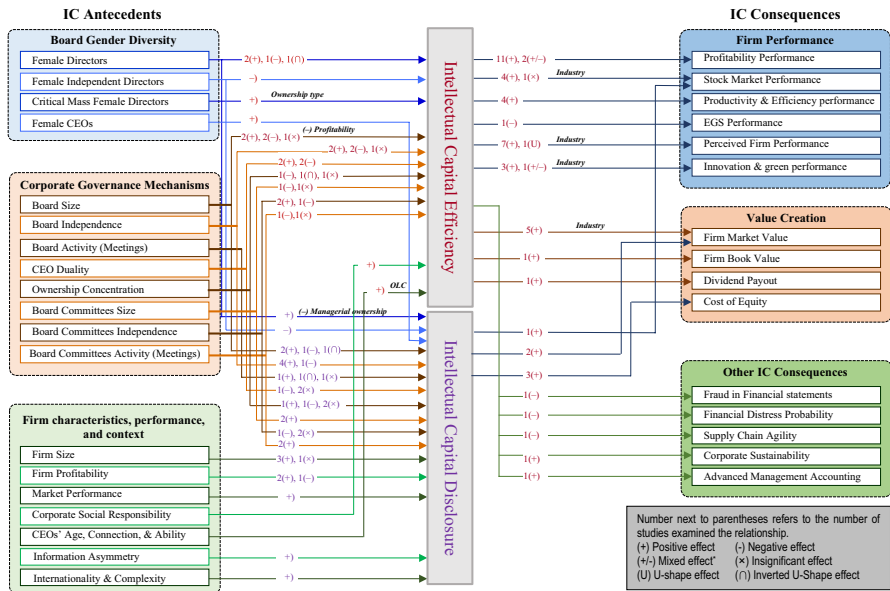
Moving to the ICD, most of the sampled studies (three out of five studies) were interested in investigating the effect of increasing the level of ICD on the cost of equity. Salvi et al. (2020a, 2020b) chose to examine only the overall ICD and reported a negative effect on cost of equity through reducing firm risk perceived by investors and boosting firms' ability to reach external financial resources. On the level of ICD components, Boujelbene and Affes (2013) reported a significant negative relationship between information disclosed about HC and SC with cost of equity. In the same vein, Vafaei et al. (2011) and Salvi et al. (2020b) showed empirically that IC has value relevance role in determining firm value.

On their study, Baima et al. (2021) differentiated between two terms of value including value creation and value capture where alignment between these two faces of value is essential (Sjödin et al. 2020). From this point of view, we can conclude that the sampled studies were only concerned with the outcomes of the value creation process, not the process itself. So, further studies are needed to investigate how IC could enhance value creation process and assist in achieving the “appropriateness” between value creation and value capturing. Sjödin et al. (2020) developed a value creation process framework that hinges on three phases: value proposition definition, value provision design, and value-in-use delivery. An interesting research area would be what role IC can play regarding these three phases. In addition, value creation process could be carried out on several layers reflecting several stakeholders, which implies the need to investigate the role of IC in each of these layers. Finally, how IC could help in finding out the most fit business model for value creation in a specific context is still a debate.

3.2.2.3 Other consequences Other antecedents have been investigated in the studies we reviewed such as the level of fraud in financial statements (Lotfi et al. 2022), the probability of financial distress (Shahwan and Habib 2020), supply chain agility, collaborative knowledge creation, and corporate sustainability (Al-Omouh et al. 2022), development in management accounting practices (Tayles et al. 2007). In these studies, an encouraging effect of IC has been demonstrated. For example, Lotfi et al. (2022) showed that the higher the ICE level as well as its components, the lower the level of fraud in financial statements of listed firms on the Tehran Stock Exchange (TSE). On this track, Shahwan and Habib (2020) used Egyptian listed firm as a sample and reported that the probability of financial distress decreases, when the level of IC increases. With the purpose of providing in depth view, Ndou et al. (2018) utilized case study approach and collected data from one Albanian private university using various sources such as its website, Facebook page, periodic reports and statements outlining future goals. They concluded that firms adopt ICD practices intentionally especially regarding information about social engagement and regional development. In addition, social media is important when analyzing how universities disclose their IC information.

3.3 An integrated conceptual framework of ICAC

We create a framework for the field (Fig. 8) based on our thorough review of the literature and content analysis, which synthesizes the most recent understanding of the relationships between the antecedents and outcomes of the IC. Regarding the antecedents of ICE and ICD, we identify three main categories: BGD, other internal CG mechanisms, and firm characteristics, performance, and context. Such categories are different drivers of ICE and ICD; however, understating of factors that drive firms to report on its IC may depend on other factors, for instance, organizational life cycle, firm’s profitability, managerial ownership, and ownership type. Additionally, our integrated framework demonstrates how ICE and ICD can affect organizational outcome in a variety of ways, including financial performance, non-financial



* Mixed results means that some of IC components show a positive effect while other show a negative effect.

Fig. 8 Integrated Framework for Mapping the ICAC Field (Source: Authors' own work)

performance, and other aspects, such as fraud in financial statements, the likelihood of financial distress, supply chain agility, corporate sustainability, and advanced management accounting. The effects of ICE and ICD on organizational outcomes are further influenced by a variety of industry-specific contextual factors. Finally, the relationships between antecedents of ICE and ICD on the one side and ICE and ICD, and organizational outcome on the other are mixed, ranging from positive, negative, to no relationship. With the help of our integrated framework, we can identify research gaps and unexplored areas, which we discuss in the following section.

We may infer from the results of the bibliometric analysis, in specific the co-occurrence, thematic map, and keywords cloud (please see Figs. 5, 6 and 7 and Table 9) that earlier research in the field of IC focused on certain factors that influence ICD and ICE. For instance, gender diversity, board of directors, and other CG mechanisms, as well as the effects of ICD and ICE, such as cost of equity, firm value, and performance. As a result, we may conclude that, in terms of reflecting the work that has been done to date in the ICAC field, our integrated framework (Fig. 8) concurs with the findings of bibliometric analysis. However, neither the integrated framework nor the bibliometric analysis addressed a number of keywords that we highlighted in our future research topics, such as the board of directors members' incentive structure. In conclusion, our framework aligns with current ICAC research trends, but the absence of certain keywords indicates areas needing further investigation and suggests opportunities for future research that could provide novel insights for the field which are presented in the next section.

4 Future research directions

Despite the significant strides made in ICAC research, our SLR has unveiled specific gaps and challenges. These identified limitations not only pave the way for new lines of inquiry but also bring into focus the intricate antecedents and consequences of IC. Echoing the sentiments of recent literature reviews (Alvino et al. 2020; Baima et al. 2021; Bellucci et al. 2021; Buenechea-Elberdin 2017; Chaudhary et al. 2023; Daraio et al. 2023; Esmaeili Givi et al. 2022; Inkinen 2015; Quintero-Quintero et al. 2021), we identify consistent areas of study and potential avenues for exploration. Delving deep into the ICAC domain, we underscore the need for both theoretical advancements and empirical pursuits in specific segments, which we will elaborate upon in the current section. Future research directions presented below can be summarized in Fig. 9.

4.1 Future research direction-related to ICE and ICD Antecedents

4.1.1 "Board diversity characteristics" theme

Our analysis revealed future research opportunities in the field of board diversity characteristics. Hence, we provoke scholars to investigate how ICE or ICD could be affected by several board diversity characteristics such as age, experience, education, religion, ethnicity, tenure, and language diversity (Fernández-Temprano and Tejerina-Gaite 2020; Khatib et al. 2021). Still, some of these board diversity characteristics will be more momentous, hence exploring the circumstance where one or more of these board diversity characteristics hold greater importance would be a good opportunity for future research. We also recommend investigating those effects on two levels including the aggregate IC and the individual components of IC. Additionally, Fig. 8 demonstrates that no studies have been conducted yet to examine the connection between female CEOs and ICE. Similarly, the relationship between critical mass female CEOs and ICD is still unexplored area.

4.1.2 "Other CG" theme

Relating to CG, more studies are needed to explore the relationship between IC and CG mechanisms. Whether internal mechanisms such as incentive structure of CEOs (Matolcsy and Wright 2011; Ozkan 2011) and accounting information system effectiveness (Shagari et al. 2017), or external mechanisms such as shareholder activism (Bourveau and Schoenfeld 2017), audit quality, audit firm type (Chen et al. 2019), and several ownership structure factors. Another crucial observation is the inconsistent outcomes in relation to the impact of CG mechanisms on ICE and ICD, as demonstrated in Fig. 8 (e.g., Smriti and Das 2022) which opens the doors for applying meta-analysis method to investigate the effect of one or more CG mechanisms on ICE or ICD.

<i>Future research direction-related to ICE and ICD Antecedents</i>		<i>Future research direction-related to ICE and ICD Consequences</i>	
<i>Theme of opportunity</i>	<i>Un-or-Unexplored areas</i>	<i>Un-or-Unexplored areas</i>	<i>Theme of opportunity</i>
Board Diversity characteristics	<ul style="list-style-type: none"> - The effect of board diversity characteristics (age, experience, education, religion, ethnicity, tenure, and language diversity) on ICE or ICD, and exploring the circumstance where one or more of these board diversity characteristics hold greater importance. - The relationship between female CEOs and ICE and the relationship between board activity meetings and ICE. - The relationship between critical mass female CEOs and ICD. 	ICE or ICD	<ul style="list-style-type: none"> - How IC could enhance several nonfinancial dimensions including innovative performance, ESG performance, sustainability performance, supply chain performance, and green performance. - How ICD could affect costs of debt, firm book value, and dividend payout or how ICE could affect cost of equity. <p style="text-align: right;"><i>Firm performance</i></p>
Other CG	<ul style="list-style-type: none"> - How ICE is affected by CG internal mechanisms such as incentive structure and accounting information system effectiveness. - How ICE is affected by CG internal mechanisms such as external mechanisms such as shareholder activism, audit quality, audit firm type, and several ownership structure factors. - Using meta-analysis method to investigate the effect of one or more CG mechanisms on ICE or ICD. 		<ul style="list-style-type: none"> - The most suitable composition of IC components in a particular context in creating value. <p style="text-align: right;"><i>Value creation</i></p>
Other antecedents of IC	<ul style="list-style-type: none"> - How firm characteristics (such as organization life cycle, corporate competitive strategy, corporate risk, corporate culture, and analysts' coverage) could affect the quantity and quality of published IC information. 		<ul style="list-style-type: none"> - How one IC component can affect the other components. - How the level of ICE is correlated to the level of IC information the management would like to disclose. - The effect of ICD on issues such as fraud in financial statements, the probability of financial distress, supply chain agility, corporate sustainability, and advanced management accounting. <p style="text-align: right;"><i>Other consequences of IC" Theme</i></p>

Fig. 9 A Summary of Future Research Directions (Source: Authors' own work)

4.1.3 "Other antecedents of IC" theme

Furthermore, we encourage examining under investigated questions of how firm characteristics could affect the quantity and quality of published IC information as several studies investigate the relation between reporting and variables such as organization life cycle (Kabir et al. 2020) and corporate competitive strategy (Yu et al. 2017). Other scholars suggest investigating factors such as company growth, movement of stock prices, industry shock (Yan 2017), managerial ability (Rajabali-zadeh and Oradi 2022), analysts' coverage (Hinze and Sump 2019). Still corporate risk, corporate culture, and industry type, among others, represent other interesting factors that need to be examined in relation to IC.

4.2 Future research direction-related to "IC Consequences" themes

Our integrated framework (Fig. 8) shows that additional studies are also required to explore the relationship between IC and several nonfinancial dimensions including innovative performance, ESG performance, sustainability performance, supply chain performance, and green performance. Similarly, due to their nature, IC components (HC, RC, and SC) complement each other (Tseng and James Goo 2005), this implies that there are some interdependencies among these components. Hence, an important research question is how one IC component can affect the other components. Still, research did not pay any attention to interrelationships among IC components itself. In addition, the results shown in our integrated framework, relating to the effects of IC components on firm performance and firm value are mixed. As a result, one crucial question that arises is there a suitable composition of IC components that is more appropriate to a particular context than other alternatives.

In addition, due to its role in reducing information asymmetry, several studies in our review reported a favorable effect of increase in the ICD level on cost of equity; however, the effect on cost of debt is still an open question (Mangena et al. 2016).

In addition, the moderating effect of ICE on the relationship between ICD and cost of equity could be another future research suggestion. Furthermore, our framework distinguishes between ICE and ICD studies. While the former group of studies is interested in managing IC, the latter group of studies is interested in reporting IC. However, no study has attempted to look into how raising ICE would persuade management to disclose more IC information in line with the signaling theory.

Regarding ICD, all reviewed studies have employed only one disclosing channel –e.g., annual reports, integrated reports, online website, and so on– however there is no study tried to find out what are the more favorable channels for disclosing IC by investigating more than one reporting medium. Additionally, most ICD literature has focused on the level or quantity of information announced, only limited studies investigated ICD tone (Beretta et al. 2019), characteristics (Cerbioni and Parbonetti 2007; Li and Mangena 2014), or quality (Vitolla et al. 2020). This revokes the need for more research to investigate the qualitative characteristics of ICD not just its level. In addition, as Fig. 8 illustrates that no studies have been carried out to investigate the effect of ICD on issues like fraud in financial statements, the probability of financial distress, supply chain agility, corporate sustainability, and advanced management accounting.

Finally, Fig. 8 shows that the relationship between ICE and cost of equity is still not yet investigated as well as how ICD can affect firm book value and dividend payout. Another direction that is underestimated and needs more focus is the nonlinear relationship between IC and other determinants. As illustrated in Fig. 8, analyzing the results of several prior studies indicates the presence of inconclusive and mixed results. For example, the increase of female representation on boards has a positive effect on ICE according to Nadeem et al. (2019) but negative effect according to Smriti and Das (2022). Similarly, the effect HC efficiency on ROA is seemed to be positive according to Clarke et al. (2011), but negative according to Ur Rehman et al. (2022). This opens the door for investigating nonlinear relationships when studying IC variables. This direction of research is supported by results of several studies (Hsieh et al. 2020; Prencipe et al. 2023; Ruiz-Fernández et al. 2023).

5 Conclusion

IC has progressively surfaced as a pivotal asset underpinning firm performance and competitive advantage. Recent scholarly activity spotlights two principal research trajectories: the antecedents of IC and its subsequent outcomes. Within this backdrop, our study introduces a comprehensive SLR that neatly encapsulates and evaluates the trends in ICAC literature, aiming to provide a cohesive view of the current research milieu and pave the way for future explorations.

To achieve the main aim of the study, we examined three research questions. RQ1 is concerned with describing the bibliographic characteristics of existing ICAC articles. The study, as a result, analyzed 170 articles published in 101 journals from 2003 to 2023, revealing a 15.2% annual growth rate in the field of IC research. The

average number of authors per document was four, suggesting that collaboration among authors is essential for IC research. The Journal of Intellectual Capital is the leading journal in terms of total citations, with 34 articles generated on ICAC literature. Nicola Raimo from Italy is the top author with the most impact on IC research, followed by Subramaniam and Youndt (2005) with 4938 citations. Italy has contributed the most publications (88) by its universities to IC literature, with Lum Jean Monnet University being the top affiliation. RQ2 is concerned with discussing the main themes to ICAC research that are presented in Sect. 4. Our content analysis reveals six research themes that are emphasized in our integrated framework, three of which are related to IC antecedents (BGD, other CG mechanisms, and ownership structure), and three of which are related to IC consequences (firm performance, firm value, and others). The IC antecedents and consequences' themes, respectively, were given more weight to BGD and firm performance. Furthermore, ICD studies are fewer than ICE research, which goes against earlier literature reviews studies such as Baima et al., (2021) and Esmaeili Givi et al. (2022) that reported that most IC studies have focused on ICD. Finally, RQ3 is based on providing suggestions for potential future research directions in both ICE and ICD, which are discussed in detail in Sect. 5.

The study presents theoretical and practical implications for many interested parties. *First*, the study is expected to increase the productivity of the scientific community, as our review enables scholars to pinpoint potential research opportunities and key study themes in IC literature. Hence, and consequences of ICE and ICD. *Second*, the study provides numerous insights relating to factors that firms can follow to improve their ICE or enhance their ICD practices. In addition, it addresses how IC is a critical factor in boosting firm performance on several levels and plays vital role in value creation process and value capture. By doing this, the current study provides the needed incentive for corporate managers to encourage them in investing in IC assets that can be functionalized to competitive advantage. *Third*, the study also offers implications for policymakers as it emphasizes the importance of ICD for several stakeholders, so they may review their guidelines in accordance with the findings of this study. *Fourth*, by dividing business practitioners into two categories: those who understand the value of IC resources and those who do not. The first group would benefit from learning how to improve ICE or raise the quantity and quality of ICD. Therefore, knowing how ICE and ICE are determined would be of great value to them. Practitioners who are indifferent towards ICE and ICD might change their viewpoints after learning how they could enhance business performance and create competitive advantages.

While our study offers a robust foundation, inherent limitations present fertile ground for future inquiries. The scope of our review, limited by keywords, linguistic barriers, and database constraints, necessitates broader future explorations. Additionally, nuances like industry differentiation, theoretical anchoring, and

IC measurement techniques remained uncharted. As a subsequent avenue, a more immersive, qualitative inquiry, enriched by practitioner perspectives, could further deepen the ICAC narrative, providing an alternative to our positivistic lens.

Appendix A: Key findings across the sampled studies

	Author(s)	Sample (period)	Key findings
Panel (A)			
Studies on Antecedents of IC			
Theme (1)			
BD and IC			
(A) BD and ICE			
1	Nadeem et al. (2019)	3,297 (2007–2016) UK	There is a significant positive relationship between female representation on boards and ICE (VAIC), including HCE, innovation capital efficiency, and financial capital efficiency
2	Smriti and Das (2022)	3,198 (2007–2019) India	Except for RCE, ICE (MAVIC), HCE, SCE, and CCE are affected positively by female representation on boards but negatively by existence of female independent director
3	Farooq and Ahmad (2023)	510 (2010–2019) Pakistan	Board diversity measured by female representation on board of directors has significant negative impacts on the IC efficiency (MAVIC)
4	Javaid et al. (2023)	8,745 (2004–2017) China	Having a critical mass of female directors (three or more) improve ICE (MVAIC) and all its components (HC, SC, RC, and CE), with physical capital being the critical driver, and these effects are more pronounced in privately owned companies compared to state-owned companies and in the Eastern region against the Western and Central areas
5	Prencipe et al. (2023)	827 (2009–2018) Italy	While gender diversity on board of directors has a U-shaped effect on innovation capital (positive/negative relationship), nationality diversity on boards of directors has an inverted U-shaped effect on innovation capital (negative/positive relationship)
(B) BD and ICD			
6	Tejedo-Romero et al. (2017)	125 (2007–2011) Spain	Gender diversity has a significant positive effect on the total score of IC disclosure

	Author(s)	Sample (period)	Key findings
7	Nadeem (2020)	107 IPOs (2009–2017) China	The existence of female directors enhances the extent of ICD in IPO prospectuses; however, the existence of female independent directors has a significant negative impact on IC disclosure. Moreover, those effects are generally more pronounced when number of women in board is greater than or equal to two, while family ownership has adverse impacts on those relationships
8	Vitolla et al. (2020)	130 (2017) 27 countries	IC disclosure quality increases with the presence of a greater number of women on a board, the increase in the number of board members, the presence of a greater number of non-executive members within the board, and when there are more annual board meetings
9	Nicolò et al. (2022)	123 (2019) Italy	Gender diversity in form of the existence of a female director or in form of the presence of a female CEO has a significant positive impact on online IC disclosure, while the effect of the presence of female chairperson is insignificant
10	Tejedo-Romero and Araujo (2022)	210 (2006–2017) Spain	Increase in percentage of female in boardroom increases the level of HC disclosure and this effect is moderated by managerial ownership, however, the effect of board independence is negative impact. Also, HC disclosure is more likely to increase with the increase of board activity up to a maximum limit above which there is a decline in HC disclosure
Theme (2) CG and IC			
(A) CG and IC Efficiency			
1	Appuhami and Bhuyan (2015)	300 (2004–2013) Australia	CEO duality, board independence and remuneration committee independence show positive effects on ICE (VAIC). However, board size and audit committee independence show insignificant effect
2	Dalwai and Mohammedi (2020)	152 (2012–2016) Oman	Among the studied CG mechanisms only board size and frequency of audit committee meetings have significant positive effects on the overall ICE (VAIC) and only one of its components which is HC efficiency in financial sector. Yet, subsectors analysis shows that VAIC and HC efficiency of banks are also significantly influenced by most of the corporate governance mechanisms including board size, audit meeting frequency, board independence, ownership concentration

	Author(s)	Sample (period)	Key findings
3	Hsieh et al. (2020)	819 (2009–2017) Taiwan	Ownership concentration has an inverted U-shape relationship with each of ICE (VAIC), HCE, SCE (as the ICE variables increase with the increase in percentage of controlling shareholders up to an optimal point after which the relationship turns to be negative) and a U-shape with CCE (i.e., the effect begins as a negative then turns to positive)
4	Tran et al. (2020)	348 (2011–2018) Vietnam	The board size, board impudence, major shareholders holding more than 20% of the outstanding shares and the CEO's duality negatively affect ICE (MAVIC), while the board remuneration has a positive impact
5	Aslam and Haron (2021)	1,290 (2008–2017) 29 countries	CG mechanisms (i.e., board size, board independence, CEO duality, audit committee, Shariah board) have significant impacts on IC components efficiencies (HCE, SCE, RCE)
6	Shahzad et al. (2022a, b)	235 (2016–2020) Pakistan	Corporate governance mechanisms namely board size, board independence, and board committees independence have significant negative impacts on ICE, while the effect of CEO duality is insignificant. Further, the negative effect of sizes of audit and remuneration committees becomes positive with the moderation of profitability
(B) CG and IC Disclosure			
7	Cerbioni and Parbonetti (2007)	145 (2002–2004) 10 European countries	The overall level ICD is affected positively by the proportion of independent directors and negatively by board size, CEO duality, and board committees independence. The IC components disclosure (SC, RC, and HC) show significant relationships with board independence, board size, CEO duality and board committees independence
8	White et al. (2007)	96 (2005) Australia	While board independence and firm size positively affects the level of information in annual reports about IC, firm age and ownership concentration has no effect
9	Li et al. (2008)	100 (2005) UK	Companies with more non-executive directors on their board, larger audit committees that meet more frequently, and less concentrated share ownership tend to provide greater IC disclosure in their annual reports
10	Singh and Mitchell Van der Zahn (2008)	444 IPOs (1997–2006) Singapore	There is a positive association between IC disclosure and ownership retention at IPOs. Moreover, proprietary costs have a negative influence on the association between IC disclosure and ownership retention association

	Author(s)	Sample (period)	Key findings
11	Hidalgo et al. (2011)	300 (2005–2007) Mexico	An increase in institutional investor shareholding reduces voluntary disclosure. An increase in the number of board directors up to 15 has a beneficial effect on the disclosure of intangibles. However, as this number increases, the effect inverts and becomes adverse
12	Li et al. (2012)	100 (2005) UK	The quantity of information published in annual reports about IC and its components increase with increase in size and number of meetings of audit committee. But audit committee directors' shareholding influence negatively on both IC disclosure and SC disclosure
Theme (3) Other determinants of IC (Firm characteristics, performance, and context)			
(A) Other determinants of IC Efficiency			
1	Ginesti (2019)	135 (2015–2017) Italy	Older CEOs with greater external connections generate higher IC efficiency (VAIC). Small companies with a larger number of top managers tend to be more efficient in generating value from IC assets
2	Nadeem et al. (2021)	6,171 (2000–2015) USA	CEOs' managerial ability has a significant positive relation with investments in human, innovation, and relational capital. This relationship is weaker when CEOs face lower career concerns. Furthermore, the relationship is less (more) pronounced in firms at the introduction (decline) stage of their lifecycle
3	Vo et al. (2022)	112 (2011–2018) Vietnam	CSR (proxied by the percentage of charitable contributions to profit) and CG (proxied by board remuneration) have a positive impact on IC Efficiency. Also, IC plays a moderating role in the relationship between CG and CSR

	Author(s)	Sample (period)	Key findings
(B3)	Other determinants of IC Disclosure		
4	Brüggen et al. (2009)	125 (2002–2004) Australia	Firm size has a significant positive impact on ICD. Firms affiliated to health care industry and information technology industry disclose significantly more on IC compared to those firms of other industries. Information asymmetry has a motivation role to increase IC disclosures only for those two industries
5	Nicolò et al. (2021)	117 (2009) Italy	The company size and board independence have positive affect on both the extent and type of IC disclosure; however, profitability exerts a positive influence only on the extent of online ICD
6	Beretta et al. (2019)	102 IR (2011–2016) 11 European Countries	ICD in integrated reports is mainly discursive, with a backward-looking orientation and a limited focus on human capital. On the other hand, nonfinancial (not the financial) performance affects positively on the optimistic news of IC disclosure, and this effect is more pronounced when that performance is accompanied by verifiable quantitative IC disclosure
7	Mardini and Lahyani (2022)	528 (2010–2017) France	Firms with a higher market financial performance (Tobin's Q) are more likely to disclose more information about IC and its components (HC and RC) except for SC which shows a negative relationship. Further, accounting financial performance (ROE) has negative effects on disclosure level of IC and its components (HC and RC)
8	Bellora and Guenther (2013)	51 (2009) 8 European countries	Firms in high R&D intensity industries disclose significantly more innovation capital items at a higher quality level than firms in low R&D intensity industries. Larger firms, or firms located in German-speaking region provide greater disclosure
9	Li and Mangena (2014)	100 (2005) UK	ICD is provided mostly in text format. Also, market-to-book ratio is significantly related to ICD in text and numerical, but not to graphs (pictures). However, share price volatility is only associated with graphs (pictures) ICD, whilst multiple listing is only related to text ICD

	Author(s)	Sample (period)	Key findings
10	Manes Rossi et al. (2018)	58 (2017) Italy	There is an extensive use of websites to disclose IC, especially regarding human and internal capital. Internationality, online visibility, and complexity positively enhances the extent of online ICD, however firm size and age are insignificant
11	Ramírez et al. (2022)	79 (2020) Australia	Municipalities administrated by females disseminate more IC information on their websites. Also, municipalities occupied by a larger population size, higher level of education and wealth disseminate a greater level of ICD
Panel (B)			
Studies on Consequences of IC			
Theme (1) IC and firm performance			
(A) ICE			
1	Clarke et al. (2011)	10,056 (2004–2008) Australia	ICE (VAIC), particularly derived by CEE, affects positively Australian firm performance (ROA, ROE and employee productivity measured by Profit before tax/number of employees)
2	Vishnu and Gupta (2014)	154 (2005–2011) India	ICE (MVAIC) and two of its components (HC and SC) have positive significant impacts on financial performance (ROA and ROS) of pharmaceutical Indian firms
3	Shahzad et al. (2020)	8,789 (2008–2018) USA	ICE (VAIC) plays an important role in enhancing financial performance (ROA) and mediate the positive correlation between board gender diversity and financial performance
4	Tiwari (2022)	840 (2009–2018) India	ICE (VAIC and MVAIC) is positively related to profitability (ROA) of healthcare firms in India and the CEE is the only component that drives this profitability
5	Probohudono et al. (2022)	152 (2018) Indonesia	Financial performance (ROE) is positively affected by the efficiency of only two IC components (SC and CE) with. However, the effect on stock price crash risk is insignificant
6	Shahzad et al. (2022a, b)	6,152 (2009–2018) USA	ICE enhanced firm financial performance (ROA) and fully mediate the association between CSR and a firm's financial performance
7	Ginesti et al. (2018)	452 (2016) Italy	Firms with higher coefficients of CEE and SCE tend to have higher financial performance (ROA and ROE). However, firms with greater HC efficiency are more likely to have less profit (negative effect). While nonfinancial performance proxied by firm reputation is derived only by HC efficiency

	Author(s)	Sample (period)	Key findings
8	Lestari and Adhari-ani (2022)	784 (2016—2020) 5 Asian countries	ICE (MAVIC) affects positively on financial performance (ROA) but negatively on nonfinancial (ESG) performance
9	Zéghal and Maaloul (2010)	300 (2005) UK	The increase in ICE (VAIC) advances both economic performance (operating income to sales ratio) and financial performance (ROA). However, this positive effect on market performance (Market-to-book value) is only significant for high-tech industries
10	Ur Rehman et al. (2022)	129 (2008—2017) 29 Muslim countries	SCE has positive relationship with all Islamic bank performance indicators in terms of ROA, ROE, and Tobin's Q. However, HCE has a negative effect on ROA and ROE. Further, RCE has a positive relationship with ROA and TQ, but a negative relationship with ROE
11	Smriti and Das (2018)	7,854 (2001—2016) India	Irrespective of sectors, ICE (VAIC) contributes significantly and positively on different performance indicators (productivity or ATO, profitability or ROA, sales growth, Tobin's Q). While the efficiency of IC components (RC and HC) has a major impact only on firm productivity, SC efficiency and CE efficiency were equally important contributors to firm's sales growth and market value
12	Babajee et al. (2020)	43 (2007—2017) Mauritius	In the hotel sector for all financial performance measures (ROA, ROE, and Tobin's Q), ICE (VAIC) has a positive influence
13	Vidyarthi and Tiwari (2020)	37 banks (2005–2018) India	Aggregate ICE (VAIC and MVAIC) as well as three of its components (HC, SC, and RC) have positive effect on firm efficiency measured by cost efficiency, revenue efficiency, and profit efficiency (using the DEA approach)
14	Shahwan and Fathalla (2020)	405 (2014—2018) Egypt	ICE (VAIC) relates positively with firm operational efficiency (ratio of operating expense to sales) and mediate positive effect of the corporate governance on firm operational efficiency
15	Nkambule et al. (2022)	246 (2012—2016) USA	The different IC elements (HC, innovation capital, process capital and customer capital) influence positively the firm efficiency (DEA model's score) of US software firm
16	Díaz-Fernández et al. (2015)	147 (2004—2010) Spain	ROA is related with top management team's IC as it increases with educational background diversity, industry diversity and international experience of top management team but decreases with functional experience and age
17	Massaro et al. (2020)	153 (2017) 153 Countries	IC contributes to improve performance (FIFA world ranking) in the context of temporary teams (national team of football) whether individually or when interacting with assembly decisions and team leader experience

	Author(s)	Sample (period)	Key findings
18	Torre et al. (2020)	500 surveys (NA) Italy	IC components including HC, RC, and organizational capital exhibit a positive effect on the perceived performance of healthcare firms
19	Chatterji and Kiran (2023)	590 surveys (NA) India	All IC dimensions (HC, RC, and organizational capital) have a significant influence on the total score of universities' perceived performance measured in BSC's perspectives
20	Tjahjadi et al. (2022)	119 surveys (NA) Indonesia	IC readiness fully mediates the influence of global market orientation strategy on the higher education institutions' performance
21	Tjahjadi et al. (2019)	182 surveys (NA) Indonesia	IC positively associates with organizational perceived performance of higher education institutions and partially mediates the relationship between Performance management system and organizational performance
22	Ruiz-Fernández et al. (2023)	212 surveys (2020) Spain	Both of environmental dynamism and dynamic capabilities of manager correlated positively with IC performance. While the relationship between IC and perceived performance in Spanish hotels is U-shaped
23	Subramaniam and Youndt (2005)	93 surveys (2001) USA	The firm's incremental innovative capability increases with increase in organizational capital or in social capital, however its radical innovative capability is affected positively by social capital and negatively by human capital
24	Gómez-Valenzuela (2022)	372 surveys (2013) Dominican Republic	SC factors tend to be the dominant component of IC that drive the perceived innovative performance in services firms and the perceived business performance in manufacturing firms. For HC and RC factors, their vital role is more marked for the perceived innovative performance in service firms
25	Rehman et al. (2023)	492 surveys (2020) Pakistan	IC enhances interorganizational learning and innovation performance, besides, IC affects positively on innovation indirectly through interorganizational learning
26	Wang and Juo (2021)	138 surveys (NA) Taiwan	The three green IC constructs positively (HC, SC, and RC) affect the perceived economic performance, green performance, and green innovation. Green innovation fully mediates the linkage of green HC– economic performance and Green SC–green performance and partially mediates the green RC–economic performance and green RC–green performance relationships
27	Li and Liu (2018)	337 surveys (2015) China	IC has a positive effect on a hotel's competitive performance and has an indirect effect through the mechanisms of problem identification. There are interconnections between IC components as customer capital is related to SC, which predicts HC

	Author(s)	Sample (period)	Key findings
(B) ICD and firm performance			
28	Dharni and Jameel (2021)	2,430 (2004–2005 & 2013–2014) India	From one hand, there is increasing trends for all categories of IC disclosures (HC, RC, and SC). From the other hand, the high level of qualitative IC disclosure along with patenting activities increase the stock market firm performance (Tobin's Q)
Theme (2) IC and value creation			
(A) ICE and value creation			
1	Tseng and James Goo (2005)	81 (2000) Taiwan	While innovation capital and RC have direct positive effects on firm value (Tobin's Q), the effect of HC and organizational capital on firm value was indirect through innovation capital. The effect of IC on enhancing firm value in high-tech companies is more pronounced than in non-high-tech companies. Rather than independent separate enhancing firm value, the four constructs of IC (i.e., human, innovation, relational, and organizational capital) complement each other to increase firm value
2	Wang (2013)	361 (2007–2009) Taiwan	IC efficiency (VAIC), knowledge capital earnings, and Tobin's Q have a positive relationship to firm value (Net value per share)
3	Ni et al. (2020)	4,892 (2009–2013) Taiwan	Firm value (Tobin's Q) is affected positively by average net profit per employee as a proxy for HC, the value of goodwill and intangible assets as a proxy for innovation capital, and inventory turnover ratio as proxy of process capital. Human capital is the most significant element of IC and the main driving forces of value creation
4	Anifowose et al. (2018)	455 (2010–2014) Nigeria	The overall IC performance as well as process capital as a part of SC have positive significant influence on firm book value measure by free cash flow (FCF) and Economic value added (EVA). While the performance of RC and innovation as a part of SC have positive effect on EVA, the effect on FCF is negative. Also, the efficiency of HC is related positively only with FCF but not with EVA
5	Battisti et al. (2022)	195 (2016–2018) China	There is a positive effect of ICE (VAIC) on dividend payout which give positive signals to investors in a way that increase firm value. In addition, this effect is higher when the CEO is a woman, or at lower age

	Author(s)	Sample (period)	Key findings
6	Abhayawansa et al. (2015)	19 Interviews (2011) Australia	The “pecking order” approach is used for incorporating IC information in valuation process. As sell-side analysts incorporate IC information into valuation models by adjusting the earnings or cash flow forecasts and discount rate to account for IC information
(B) ICD and value creation			
7	Vafaei et al. (2011)	220 (2002–2008) 4 Countries	ICD is positively associated with market price (i.e., has value relevance) in companies in two of the four countries and in non-traditional industries. On the other hand, the disclosure of IC information for investors and securities analysts is affected by country-specific factors
8	Salvi et al. (2020a)	110 (2016) Italy	A high quality of ICD, as well as of its individual components (HC, SC, and RC), in integrated reports improves firm value (Tobin’s Q)
9	Salvi et al. (2022)	375 (2017–2019) Multi-country	HC disclosure has a significant negative effect on the cost of capital (through reducing investors’ perceived firm risk) and a positive impact on firm value (through improving firms access to external financial resources)
10	Boujelbene and Affes (2013)	102 (2009) France	There is a significant negative impact of IC disclosure and two of its components (HC and SC) on the cost of equity
11	Salvi et al. (2020b)	164 (2016–2017) 12 Countries	A proper ICD within integrated reports significantly reduces the cost of equity capital
Theme (3) IC and other consequences			
(A) other consequences of ICE			
1	Lotfi et al. (2022)	1072 (2011–2018) Iran	There is a negative and significant relationship between the efficiency of IC and its components (HCE, SCE, RCE and CCE) and fraud in financial statements
2	Shahwan and Habib (2020)	153 (2014–2016) Egypt	The efficiency score of IC (VAIC) negatively affects the probability of financial distress
3	Al-Omoush et al. (2022)	289 surveys (2021) Jordan	IC significantly impacts supply chain agility, collaborative knowledge creation, and corporate sustainability during uncommon pandemic crises

	Author(s)	Sample (period)	Key findings
4	Tayles et al. (2007)	112 surveys (NA) Malaysia	Increase in the level of IC is related with development in management accounting practices in terms of performance measurement, planning and control, capital budgeting, and risk management. As the level of IC investment increases the firms tend to adopt more advanced value-based management accounting practices and rely on a mixture of financial and non-financial measures
(B) other consequences of ICD			
5	Beattie and Smith (2013)	11 interview cases (NA) UK	The concept of business model is holistic and should drive IC disclosure and there are calls for integrated disclosure around the central business model story
6	Ndou et al. (2018)	1 case study (2017) Albania	There is a variety of IC disclosure channels, however, universities rely more on online social media for IC disclosure. In addition, classifying IC disclosure into three categories, social engagement and regional development category is the highest level of indicators disclosed, followed by competence development category, and finally technology transfer and innovation

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