How to assess the intellectual capital of firms in uncertain times: a systematic literature review and a proposed model for practical adoption

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Abstract

Purpose – Intellectual capital (IC) plays a crucial role in today's volatile business landscape, yet its measurement remains complex. To better navigate these challenges, the authors propose the Integrated Intellectual Capital Measurement (IICM) model, an innovative, robust and comprehensive framework designed to capture IC amid business uncertainty. This study focuses on IC measurement models, typically reliant on secondary data, thus distinguishing it from conventional IC studies.

Design/methodology/approach – The authors conducted a systematic literature review (SLR) and bibliometric analysis across Web of Science, Scopus and EBSCO Business Source Ultimate in February 2023. This yielded 2,709 IC measurement studies, from which the authors selected 27 quantitative papers published from 1985 to 2023.

Findings – The analysis revealed no single, universally accepted approach for measuring IC, with company attributes such as size, industry and location significantly influencing IC measurement methods. A key finding is human capital's critical yet underrepresented role in firm competitiveness, which the IICM model aims to elevate.

Originality/value – This is the first SLR focused on IC measurement amid business uncertainty, providing insights for better management and navigating turbulence. The authors envisage future research exploring the interplay between IC components, technology, innovation and network-building strategies for business resilience. Additionally, there is a need to understand better the IC's impact on specific industries (automotive, transportation and hospitality), Social Development Goals and digital transformation performance.

Keywords Performance, Measurement, Intellectual capital, Intangible assets, Business uncertainty, Turbulent environments, Systematic review

Paper type Research paper

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Introduction

Intellectual capital (IC) has enjoyed considerable attention in research and practice for over 3 decades. The current economy, which is highly competitive and digitized, has shifted attention towards intangible assets as companies strive to outdo each other in terms of innovation. Over the past 25 years, the investment share of intangibles has increased by 29% in the United States and ten European economies (Hazan *et al.*, 2021). In 2018, IC made up 84% of all enterprise value on the S&P 500 (one of the most important US stock market indexes). This is a massive increase from 68% in 1995 (Aon-Ponemon, 2020).

This paper focuses on IC measurement tools and models, which inherently differ from traditional IC studies due to the constraints and opportunities of utilizing secondary data, such as financial reports.

IC evaluation permits firms to comprehend intangible assets' value better, making more informed strategic decisions (Bontis, 1998; Edvinsson and Malone, 1997). Furthermore, it allows companies to identify and exploit their knowledge assets to bolster performance, spark innovation and enhance collaboration (Sveiby, 2001; Roos *et al.*, 2007). This makes the company more appealing to investors interested in the company's intellectual property and knowledge resources (Steward, 1997).

While there is no universally agreed-upon definition of IC, literature widely acknowledges that IC comprises various components (Kianto *et al.*, 2017; Asiaei *et al.*, 2018; Pedro *et al.*, 2018). Here, by IC, we refer to the combination of three elements: human, structural and relational capital (Edvinsson and Malone, 1997; Roos *et al.*, 1997). Human capital refers to the collective knowledge, skills and innovative potential embedded within an organization's personnel (Bontis, 1998; Youndt *et al.*, 2004). Structural capital encompasses the organization's systems, procedures and intellectual property, independent of its human components (Edvinsson and Malone, 1997; Roos *et al.*, 2007). Finally, relational capital refers to the valuable relationships and networks an organization has built with external entities such as clients, suppliers and stakeholders. These often become crucial during unpredictable market conditions (Sveiby, 1997; Nahapiet and Ghoshal, 1998).

Having detailed the components of IC—human, structural and relational—it becomes crucial to place these elements in the context of the dynamic and unpredictable business landscape where they operate. As explored in this study, business uncertainty pertains to the lack of clarity or predictability about future market conditions, economic trends or other factors that may impact a company's operations or profitability (Bennett and Lemoine, 2014).

Previous research has suggested identifying IC measurement models better to navigate political, technological, economic and environmental changes. For example, Ashton (2005) reported that conventional financial measurement and reporting systems have failed to keep up with the external business environment transformations and how companies have reacted to those changes. Since entrepreneurs face numerous challenges in turbulent and torn environments, measuring and leveraging IC has become vital to developing business resilience, thriving and surviving (Daou *et al.*, 2019).

Several studies have focused on the multiple facets of IC in the past decade. For example, Jalonen's (2012) systematic review found that uncertainty is a pervasive and inevitable aspect of the innovation process, affecting various stages from idea generation to commercialization. This study gives a valuable perspective on the relationship between IC and innovation in firms. However, the author did not look at methodologies for appraisal IC. Other more recent studies (Ali *et al.*, 2021; Lin and Edvinsson, 2021; Paoloni *et al.*, 2023) provided a comprehensive overview of IC topics and suggested several potential gaps in IC research. Still, they did not examine current uncertain business circumstances.

Although previous studies have provided valuable insights into the relationship between IC and innovation and have identified potential gaps in IC research, they have not explicitly addressed or developed methodologies for assessing IC in the face of unpredictable events

that might lead to adverse outcomes for firms. This presents an uncharted area of investigation in the field of IC research.

In light of this, our study poses three core questions: Which methods are most effective for measuring IC in uncertain environments? Which component of IC—human, structural or relational capital—enhances firm performance most effectively? Furthermore, can a universal model for IC measurement be developed in the context of business turbulence?

We aim to bridge this research gap by proposing a comprehensive IC measurement model adaptable to uncertain business environments. This will deepen the academic understanding of IC valuation methodologies and provide practical guidance for businesses navigating turbulence.

Here, to our knowledge for the first time, we conduct a systematic literature review (SLR) with qualitative synthesis and bibliometric analysis of study findings on IC measurement in uncertain contexts. Navigating the complexities of IC under uncertain conditions challenges traditional methodologies. The SLR methodology, enriched with qualitative synthesis and extended by bibliometric analysis, illuminates IC research trends, gaps and influential contributors, challenging traditional paradigms and potentially invigorating practice (Tranfield *et al.*, 2003).

Theoretical underpinnings

Interwoven with the contemporary global economy, business uncertainty emanates from diverse sources, such as political instability exemplified by Brexit and U.S.–China trade tensions (Boungou and Yatié, 2022), economic fluctuations visible in scenarios like the 2008 crisis and recent bank failures (Pandey *et al.*, 2023) and technological advancements (Brynjolfsson and McAfee, 2014). Further complexity arises from supply chain disruptions due to climate change (Lee and Klassen, 2016) and increasing demands for socioeconomic equity and fair practices in business operations (Cosa and Urban, 2023).

To navigate these complexities, strategically enhancing organizations' intellectual assets is vital to mitigate business turbulences (Herremans *et al.*, 2011; Khan and Ali, 2017). IC theories underscore the significance of knowledge management (KM) in driving organizational prowess and competitiveness (Bontis, 1998; Juma and McGee, 2006). A valuable theoretical structure to investigate KM within a firm's context is the resource-based view (RBV), which posits knowledge as the cornerstone for fostering and maintaining a firm's competitive advantage and long-term performance (Alavi and Leidner, 2001). The RBV also informs the knowledge-based view that treats knowledge as crucial for obtaining a sustained advantage (Carneiro, 2000; Cohen and Olsen, 2015). Firms now rely heavily on knowledge resources to successfully implement their products and services (Alavi and Leidner, 2001; Alegre *et al.*, 2013). Within this framework, IC emerges as essential, fortifying organizations against turbulence and underscoring the urgency of precise IC measurement techniques.

However, current IC assessment methodologies present challenges. Direct intellectual capital methods (DICMs) allow an in-depth analysis of IC components but can compromise reliability amid fluctuating valuations in crises. Market capitalization methods (MCMs), anchored in market perceptions, are vulnerable to speculative behaviors, notably during economic downturns. In parallel, both return on assets methods (ROA) and scorecard methods (SC) highlight the challenges of quantifying IC, revealing a dichotomy between tangible and intangible assets during periods of financial and market instability (Roos *et al.*, 2007; Sveiby, 2018).

Given these challenges, a pressing need emerges for a robust IC measurement methodology resilient to global business uncertainties. Therefore, our research trajectory introduces the Integrated Intellectual Capital Measurement (IICM) model, an innovative solution conceived to bridge existing gaps. We designed IICM to holistically capture both tangible and elusive aspects of IC in current uncertain times. By combining insights from

existing models and pioneering adaptations, our proposed model could affect how firms assess their IC strengths and weaknesses during turbulence, fostering organizational resilience and adaptability.

Methods

Following the guidance of Tranfield *et al.* (2003), our SLR methodically uncovers, assesses and assimilates all pertinent research, enabling rigorous inquiry into our targeted research questions. Adherence to the PRISMA checklist by Moher *et al.* (2015) bolsters the transparency and replicability of our study. In addition to the SLR, bibliometric analysis forms a key part of our research approach. It allows us to chart the trajectory of IC discourse over time, effectively identifying gaps and future research opportunities.

Search strategy

We searched Web of Science, Scopus and EBSCO Business Source Ultimate on February 24, 2023. To ensure the broadest coverage possible, the expression "intellectual capital measurement" was split into two different keywords ("intellectual capital" and "measurement") because several studies did not use the sentence "intellectual capital measurement" in that exact order. Since IC is a broad concept with multiple meanings (Ramlee and Abu, 2004), following Evans *et al.* (2015), the search terms used were: "intellectual capital*," "intellectual asset*," "intangible asset*," "invisible asset*," "knowledge capital" and "knowledge asset*." Finally, following (Paoloni *et al.*, 2023), the abovementioned variations for IC with the keyword "measurement*" were paired (with the "*" wildcard to include both singular and plural versions). Table 1 represents the search strings used and the number of documents found.

Inclusion and exclusion criteria

Drawing on the work by Shinde *et al.* (2022), we defined the inclusion and exclusion criteria using the Population, Intervention, Context, Outcome, Time method.

Database	Search query	No. of documents
Web of Science	TS=("intellectual capital*" OR "intellectual asset*" OR "intangible asset*" OR "invisible asset*" OR "knowledge capital" OR "knowledge asset*") *AND* TS=("measurement*")	*870*
Scopus	TITLE-ABS-KEY ("intellectual capital*" OR "intellectual asset*" OR "intangible asset*" OR "invisible asset*" OR "knowledge capital" OR "knowledge asset*") *AND* TITLE-ABS-KEY ("measurement*")	*1,127*
EBSCO business source ultimate	(TI ("intellectual capital*" OR "intellectual asset*" OR "intangible asset*" OR "invisible asset*" OR "knowledge capital" OR "knowledge asset*") OR AB ("intellectual capital*" OR "intellectual asset*" OR "intangible asset*" OR "invisible asset*" OR "knowledge capital" OR "knowledge asset*") OR KW ("intellectual capital*" OR "intellectual asset*" OR "intangible asset*" OR "invisible asset*" OR "knowledge capital" OR "knowledge asset*")) *AND* (TI ("measurement*") OR AB ("measurement*") OR KW ("measurement*"))	*712*

Table 1. Database source and query executed

Note(s): The authors used different search queries tailored to each bibliographic database tool. Each database has its retrieval mechanisms, highlighting the diversity present in bibliographic systems
Source(s): Own elaboration

In summary, the focus was (1) retrieving peer-reviewed quantitative studies analyzing IC measurement methods in private firms; (2) only papers that considered the elements of uncertainty or turbulent environments that put long-term pressure on businesses (Brende and Sternfels, 2022), such as unstable commodity markets, increasing inflation, global health crises, climate-related hazards, significant changes in consumer behavior and industrial demands and digital transformation (Banholzer *et al.*, 2022); (3) only studies in English were included; and (4) papers were excluded if they focused on the IC conceptualization and IC research in universities, education, healthcare, nonprofit and public sectors, as the experiences about these topics have been examined in-depth elsewhere (Marr and Moustaghfir, 2005; Buonomo *et al.*, 2020; Paoloni *et al.*, 2020; Quarchioni *et al.*, 2022).

For identifying how to measure IC in firms and its impacts on financial and management performance, this selection did not include studies that focused solely on the reporting and disclosure of IC. Articles focused on meso- and macro-level analyses of IC (i.e. global, regional and national levels) were also excluded. Finally, we set a timespan to exclude studies published before 1985, as the main contribution to the field of IC started to be published after that year (Marr and Moustaghfir, 2005).

We did not perform the citation impact analysis because over 40% of articles included in our review have been published in the last three years. According to Dumay (2014), recent publications should be excluded from citation analysis since they need more time to be cited. Therefore, the article's impact analysis could have reported inaccurate results in our case. Figure 1 depicts the flowchart for the selection process of the articles. After applying inclusion/exclusion criteria, the search yielded 27 studies for inclusion in our review.

Data extraction and analysis

We extracted the title, author, journal, year and additional data from each article to evaluate the risk of bias, including research questions, quantitative methodology, sample size, time observation, industry, size of companies and main findings.

We performed a qualitative synthesis of uncertainty-related issues and findings. To classify the studies, we used Webster and Watson's (Webster and Watson, 2002) method that categorizes each work based on its core theme. By doing this, we can qualitatively synthesize the specific topic advanced by each study included (Massaro *et al.*, 2016), which helps us understand their primary objective. This approach streamlines and enhances our comparative analysis, allowing us to distill the diverse and intricate strands of thought within the IC measurement research landscape.

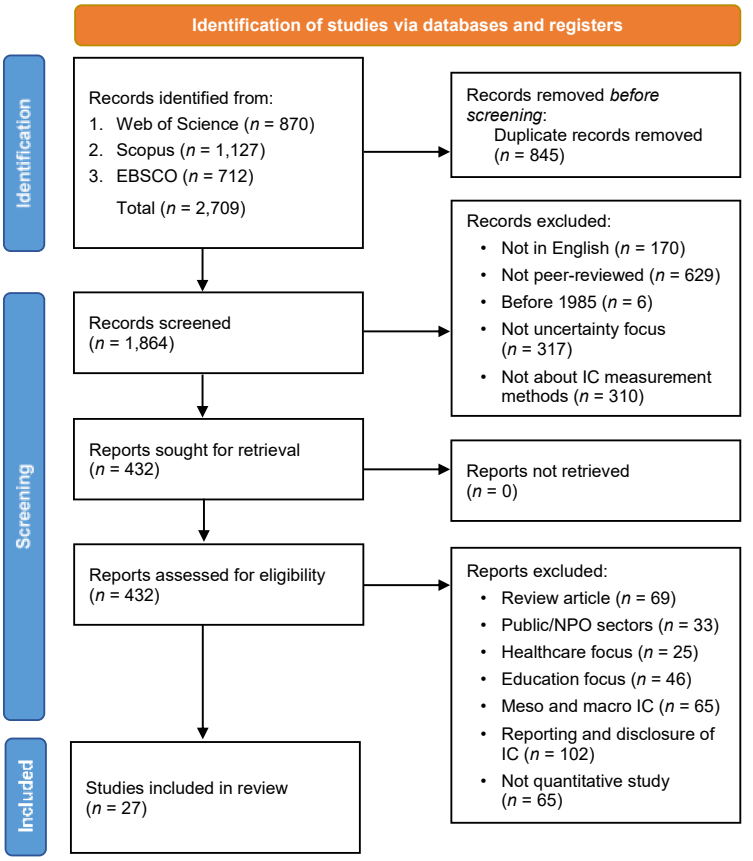
The 27 included studies analyzing alternative IC assessment models examined five areas of uncertainty: (1) digital transformation, (2) environmental impact, (3) financial crisis, (4) social impact and (5) turbulent environments. Table 2 presents the final sample of 27 quantitative articles included in the systematic review.

Co-occurrence analysis

To gain further insights into the selected articles, we conducted a co-occurrence analysis to measure the words and concepts most used and how they are interconnected (Borgatti *et al.*, 2009; Radhakrishnan *et al.*, 2017). We analyzed the links between keywords in the 27 papers using network-clustering algorithms in VOSviewer 1.6.19.

Results

We first present the overall characteristics of the 27 included studies. Next, we describe the main findings by the uncertainty context analyzed.



Source(s): Own elaboration based on Moher *et al*. (2015)

Figure 1.
PRISMA flowchart for screening and inclusion

Overall characteristics of included studies

To provide the reader with a comprehensive overview of the main characteristics of our article sample, we reviewed four organizational setting components: (1) the firms' location, (2) the country's economic development, (3) the industrial sector and (4) the firm size. We selected the first two organizational settings as units of analysis because cultural differences impact autonomy and social interactions, making IC measurement models vary by country (Hofstede *et al.*, 2010). Regarding the industrial sector, the impact of IC on a company's performance varies depending on the industry (Tan *et al.*, 2007). Finally, firm size affects operational structures, with unique needs for large and small businesses in acquiring knowledge and organizing operations (Buenechea-Elberdin, 2017).

Out of the 27 articles we reviewed, 12 were carried out in Asia, 10 in Europe, one in Australia, one in multiple countries (Italy and Pakistan) and the remaining three studies did not report such data.

Regarding the country's economic development, we followed the new World Bank country classifications by income level (2022–2023). The World Bank's classifications denote high-income economies as those with a gross national income (GNI) per capita greater than $13,205 (e.g. United States, Germany). Upper-middle-income economies have a GNI per capita

Authors	Uncertainty domain	Sector	Setting (sample size and timeframe)	IC measurement method
Edvinsson *et al.* (2000)	Digital Transformation	Cross-sectional	• n = 11 • Not reported	The Digital IC-landscape
Bonsón *et al.* (2008)	Digital Transformation	Banking	• n = 54 • 2005	Intangibles Ratio (Intangible Assets/ Total Assets)
Turovets (2021)	Digital Transformation	Manufacturing	• n = 340 • 2009–2018	Russian GAAP
Izzo *et al.* (2022)	Digital Transformation	Financial Technology	• n = 10 • 2016–2018	VAIC™
Peykani *et al.* (2022)	Digital Transformation	Automotive	• n = 10 • 2013–2017	Robust Window Data Envelopment Analysis (RWDEA)
Ishaq (2021)	Environmental Impact	Consumers of electronics and household appliances	• n = 980: Italy (n = 452) and Pakistan (n = 528) • 2017–2018	Green Brand Equity
Asiaei *et al.* (2022)	Environmental Impact	Information Technology (n = 8), Bank (n = 17), Agriculture (n = 6), Manufacturing (n = 74)	• n = 105 • Not reported	Green Intellectual Capital
Asiaei *et al.* (2023)	Environmental Impact	Information Technology (n = 8), Bank (n = 17), Agriculture (n = 6), Manufacturing (n = 74)	• n = 105 • Not reported	Green Intellectual Capital
Śledzik (2013)	Financial Crisis	Banking	• n = 20 • 2005–2009	VAIC™
Tseng *et al.* (2013)	Financial Crisis	Information Technology	• n = 2,493 • 2001–2009	Four metrics: Operation profit per employee, R&D intensity, Current capital turnover rate, Revenue growth rate
Al-Musali and Ismail (2016)	Financial Crisis	Banking	• n = 224 • 2008–2010	VAIC™
Patel and Guedes (2017)	Financial Crisis	Hospitality	• n = 1,647 • 2007–2014	Return on Intangible Assets (ROIA)
Ousama *et al.* (2020)	Financial Crisis	Banking	• n = 31 • 2011–2013	VAIC™
Moutinho *et al.* (2021)	Financial Crisis	Banking	• n = 58: Spain (n = 42) and Portugal (n = 16) • 2011–2013	VAIC™
Massingham *et al.* (2011)	Social Impact	Naval Defense Industry	• n = 118 • Not reported	Human Capital Value Measurement (HCVM)
Iazzolino and Laise (2016)	Social Impact	Cross-sectional	• n = 1,000 • 2010–2012	VAIC™
Jain *et al.* (2017)	Social Impact	Cross-sectional	• n = 384 • Not reported	Knowledge-Based Theory of the Firm (Sveiby, 2001)
Soetanto and Liem (2019)	Social Impact	Cross-sectional	• n = 127 • 2010–2017	Modified Value Added Intellectual Capital (MVAIC)

(*continued*)

Table 2. The final sample of 27 quantitative articles included in the SLR

Authors	Uncertainty domain	Sector	Setting (sample size and timeframe)	IC measurement method
Kozera-Kowalska (2020)	Social Impact	Agriculture	• n = 120 • 2005–2018	Intellectual Sources of Value Added (ISVA)
Šebestová and Popescu (2022)	Social Impact	Not reported	• n = 278 • Not reported	Human Capital Investment
Juma and Payne (2004)	Turbulent Environments	Biotechnology, Computer Hardware, Computer Software, Telecommunication	• Not reported • 1996–2001	Economic Value Added (EVA™) and Market Value Added (MVA™)
Bozbura and Beskese (2007)	Turbulent Environments	N/A (Survey of academics and professionals)	• N/A (Survey of academics and professionals) • N/A (Survey of academics and professionals)	Organizational Capital Measurement
Campisi and Costa (2008)	Turbulent Environments	Biomedical	• n = 22 • 2002–2004	Data Envelopment Analysis for IC Management
Kale (2009)	Turbulent Environments	Construction	• n = 1 • Not reported	Fuzzy Intellectual Capital Index (FICI)
Liao *et al.* (2010)	Turbulent Environments	Biopharmaceutical	• n = 20 • Not reported	49 metrics to evaluate the three IC dimensions
Soheilirad *et al.* (2017)	Turbulent Environments	Cross-sectional	• n = 339 • Not reported	Intellectual Capital Multiple Criteria Decision Support (ICMCDS) System
Tarnóczi and Kulcsár (2021)	Turbulent Environments	Agriculture, Construction, Manufacturing, Wholesale Trading, Retail Trade, and Transportation	• n = 1,340: Hungary (n = 653) and Romania (n = 687) • 2014–2018	VAIC™

Table 2.

Source(s): Own elaboration

between $4,256 and $13,205 (e.g. China, Brazil), lower-middle-income economies between $1,086 and $4,255 (e.g. India, Vietnam) and low-income economies less than $1,085 (e.g. Afghanistan, Somalia). These categories are updated annually. We found 14 out of 27 studies performed in high-income countries. Two studies were conducted in upper-middle-income countries and six in lower-middle-income countries. In addition, two studies analyzed countries with different income classifications.

Most articles analyzed cross-sectional industries (n = 8), followed by banks and financial companies (n = 6). Two studies investigated the biomedical sector, two examined information and communication technology and two explored manufacturing firms. Another four articles focused on agriculture, automotive, hospitality and naval defense industry. The remaining three studies did not report any industrial sector information.

We followed the World Bank standards to identify the size category of firms (International Finance Corporation, 2008). Twenty-one out of 27 studies did not report the size of the companies. Two studies (Bozbura and Beskese, 2007; Ishaq, 2021) did not investigate firms, but they surveyed consumers or experts to validate their hypotheses. Of the remaining four studies that investigated firms, Campisi and Costa (2008) explored small and medium

enterprises, two examined medium and large firms (Asiaei *et al.*, 2022, 2023) and one analyzed medium firms (Kale, 2009).

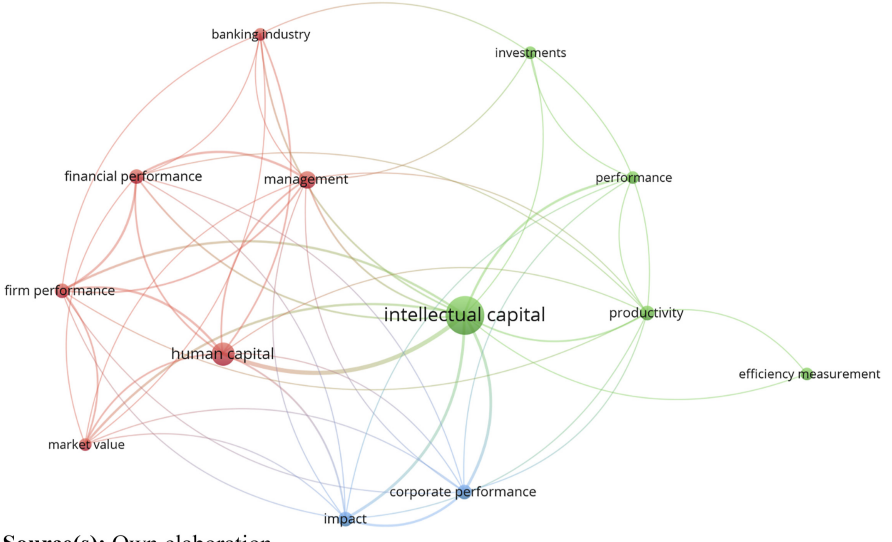
In the co-occurrence analysis of all keywords, 13 out of 264 keywords met the threshold of at least three occurrences, producing three clusters (human capital, IC and corporate performance), 52 links and a total link strength of 90 (Figure 2). The top repetitions were IC (n = 18), human capital (n = 8) and management (n = 5). We highlight that among IC components, the most prominent capital is human capital to the point that it forms a cluster itself. Finally, while many studies examined structural capital, sometimes named organizational capital, it is worth considering that the studies included do not prioritize relational capital as the foremost factor.

Uncertainty contexts

Theme 1: digital transformation (n = 5). The advent of digital transformation presents a significant pivot point for IC measurement, transitioning from traditional methods to digitized operations. Edvinsson *et al.* (2000) championed this shift, presenting the Digital IC-landscape methodology applied to 11 diverse firms. They illustrated how visualizing IC complexity significantly influences strategic performance, fostering knowledge transfer and efficient IC management.

A study by Turovets (2021) further emphasized this transition, examining the impact of intangible assets on Russian manufacturing firms (2009–2018). Despite a currency crisis, the synergy between intangible assets and knowledge accumulation enhanced technical efficiency, particularly in high-tech firms.

Izzo *et al.* (2022) evaluated the influence of digital industrialization on human capital within the Italian Fintech sector, utilizing Pulić's VAIC™. This methodology quantifies organizations' efficiency in value creation through tangible assets and IC. It provides a metric to evaluate how effectively IC contributes to organizational performance and competitiveness (Pulić, 2000, 2004). Izzo *et al.* (2022) found that while VAIC™ did not significantly impact firm profitability, human capital emerged as a crucial strategic asset for competitiveness in knowledge-intensive firms.



Source(s): Own elaboration

Figure 2.
Co-occurrence analysis

Bonsón *et al.* (2008) undertook a multicountry analysis of 54 European banking firms, studying the link between intangible assets' presence and the sophistication of banking information systems. Interestingly, a higher Intangibles Ratio did not correspond with an advanced system.

Lastly, Peykani *et al.* (2022) advanced VAIC™ by proposing the Robust Window Data Envelopment Analysis (RWDEA) model to assess decision-making under uncertain conditions. The study affirmed RWDEA's reliability amid large volumes of uncertain data.

Overall, these studies emphasize the necessity for evolving IC measurement tools in tandem with the digital landscape, highlighting the intricate interplay between IC, digitalization and firm performance.

Theme 2: environmental impact (n = 3). Three studies investigated the intersection of IC and environmental performance, shedding light on the interplay between IC and ecological considerations.

Asiaei *et al.* (2022) examined how 105 varied Iranian companies use environmental performance measurement to convert green IC into enhanced economic and environmental outcomes. The study identified that technological systems, patents and employee knowledge as resources augment environmental performance and influence performance measurement. The role of stakeholder relationships in ecological performance became apparent only when utilizing environmental performance measurement.

Subsequently, Asiaei *et al.* (2023) explored the capacity of green IC, denoting a company's aptitude for green innovation, to boost sustainable practices within the same sample. Although no direct link between green IC and environmental performance emerged, the study inferred that green resources, including human, structural and relational capital, could spur green innovation. Firms demonstrating such innovation achieved superior environmental performance.

Finally, Ishaq (2021) devised an innovative "Green Brand Equity" scale to assess green brand value from consumer perspectives. The scale utilized a cross-cultural survey of 980 consumers in Italy and Pakistan, encapsulated facets like corporate image, trust, repurchase intentions and brand loyalty. The proven effectiveness of this scale provides managers with a valuable tool to gauge brand equity and optimize resource allocation.

Collectively, these studies underscore the intertwining of IC and environmental performance, emphasizing the significance of ecological considerations within IC. They indicate the utility of IC measurement tools in helping companies balance economic and environmental performance.

Theme 3: financial crisis (n = 6). Six papers probed the value of IC measurement methodologies during economic downturns, accentuating IC's strategic significance for businesses.

Tseng *et al.* (2013) studied how business strategy impacts the IC-financial performance relationship. Analyzing 2,493 IT firms on the Taiwan Stock Exchange (2001–2009), they measured IC using operational profit per employee, R&D intensity, capital turnover rate and revenue growth rate. The study confirmed IC's substantial influence on strategic and financial performance. Patel and Guedes (2017) assessed IC in 1,647 Portuguese hospitality firms (2007–2014) using Return on Intangible Assets (ROIA). Findings suggested that increasing returns on fixed and intangible assets significantly affected operating profit.

Four studies emphasized IC's relationship with firm performance in banking, measured via VAIC™.

Al-Musali and Ismail (2016) found a strong positive correlation between VAIC™ and financial performance indicators (ROE, ROA) within 224 GCC banks (2008–2010). Ousama *et al.* (2020) employed VAIC™ to study IC in 31 Islamic banks in the GCC (2011–2013). They noted a positive correlation between IC and financial performance. However, the average IC was lower than in studies on Islamic banks in Pakistan and Malaysia, indicating potential IC

underutilization. Moutinho *et al.* (2021) used VAIC™ to assess 58 Iberian banks (2013–2016). Their research stressed the essential role of human capital investment in shaping overall performance. Finally, Śledzik (2013) applied VAIC™ to 10 Polish and 10 European banks (2005–2009), identifying human capital efficiency as a key IC contributor.

These studies underscore IC's strategic role during financial crises, stressing the importance of practical IC measurement tools for navigating these periods.

Theme 4: social impact (n = 6). Six studies tackled the question: Can investing in human resources, a social development objective, foster a more equitable, prosperous society?

Iazzolino and Laise (2016) presented a VAIC™-based accounting framework to assess the societal sustainability of knowledge-intensive and traditional firms, using data from 1,000 Italian firms (2010–2012). They found that knowledge-intensive firms invest more in human capital, which is crucial for value creation.

Šebestová and Popescu (2022) surveyed 278 Czech entrepreneurs to comprehend their strategies around human capital investment. Results showed that companies (192) reinvested nearly half (47.7%) of their profits, with only 20% directed toward human resources, generating approximately 14% annual return.

Massingham *et al.* (2011) surveyed 118 Royal Australian Navy technical workers to counteract subjectivity in human capital valuation. They introduced a methodology integrating self-reporting, 360-degree peer review and personality ratings, facilitating more objective measurements.

Two studies in lower-middle-income countries examined IC's impact on performance, focusing on wealth creation and sustainability.

First, Soetanto and Liem (2019) analyzed IC's influence on the market value and financial performance of 127 Indonesian firms (2010–2017) using a modified VAIC™. While IC significantly boosted performance, with structural capital playing a pivotal role, there was no significant relationship with market value. However, capital employed had a positive, significant relationship in high-knowledge industries. Second, Jain *et al.* (2017) surveyed 384 SMEs in Rajasthan, India, investigating the impact of corporate social responsibility on performance. They found it marginally positive, with IC playing a substantial role, though competitive advantage had no significant mediating impact.

Lastly, Kozera-Kowalska (2020) assessed if IC aids agriculture's shift toward sustainability, proposing a new metric, Intellectual Source of Value Added (ISVA). Data from 120 Polish farms (2005–2018) suggested that agricultural entities, though perceived as low-knowledge, efficiently utilize IC, making ISVA more suitable than VAIC™.

In summary, these studies underscore the potential of IC, particularly in human resources, to enhance societal prosperity and equity. They also highlight the importance of choosing the most suitable IC measurement tools for different sectors, contributing to a more comprehensive understanding of IC's social impact.

Theme 5: turbulent environments (n = 7). The seven studies on this theme examine how IC influences firms in highly volatile and unpredictable market or economic conditions.

Three of these studies investigate IC's effect on financial performance. Juma and Payne (2004) assessed intangible assets in various tech industries using Economic Value Added (EVA™) and Market Value Added (MVA™) methods, concluding that these measures did not provide distinctive benefits over traditional performance metrics. Campisi and Costa (2008) also found that increased investment in intangible assets did not necessarily improve business performance in Italian SMEs. Contrarily, Tarnóczi and Kulcsár (2021) found VAIC™ positively impacted firm profitability in a study comparing companies in Hungary and Romania.

The remaining four studies proposed new IC measurement models for managing intangibles in turbulent environments. Soheilirad *et al.* (2017) presented the Intellectual Capital Multiple Criteria Decision Support (ICMCDS) System after finding IC increased

productivity and creativity in Iranian manufacturing companies. Liao *et al.* (2010) underscored the importance of employee satisfaction and strategic alliances in biopharmaceutical companies. For construction businesses, Kale (2009) introduced the Fuzzy Intellectual Capital Index (FICI) model to understand intangible resource movement better. Lastly, Bozbura and Beskese (2007) identified the "Implementation rate of new ideas" as a pivotal indicator for measuring organizational capital in uncertain situations.

In sum, these studies highlight the complexity of measuring and leveraging IC in turbulent environments. They provide insights into IC's impact on financial performance and new models for managing IC. As volatility and uncertainty continue to shape business landscapes, these findings and tools will become increasingly crucial for firms aiming to leverage their intangible assets optimally.

Discussion

A practical model for developing an IC measurement tool

This study aimed to explore how to measure IC in a climate of business uncertainty. We found no consensus about the best IC measurement tool. This lack of agreement appears to relate to considerable differences in firms' location, industry, size and performance dimensions (e.g. financial, social and environmental). Differing IC tools could yield markedly varying pictures of performance and, in some cases, contradictory patterns. Next, there is widespread recognition that human capital is a critical resource during business volatility; however, few IC tools currently incorporate human capital metrics such as employee satisfaction, turnover rate, on-job-training and personality ratings.

IC measurement is a multidimensional challenge, requiring a broad understanding of a firm's intangible assets. Recognizing that no single IC measurement model significantly outperforms its counterparts and the rapid transformations instigated by the digital era, we embarked on developing a comprehensive, adaptable and resilient framework: The IICM model.

Building upon the insights and strengths of various IC measurement models, we integrated the best ingredients of the previous IC measurement models from pioneering works included in this review. We aimed to devise a model that acknowledges IC's multifaceted nature, ensures adaptability in the face of digital transformation, maintains industry-specific flexibility and utilizes quantitative and qualitative indicators, all while sustaining robustness amid uncertainty.

The subsequent sections elucidate how the IICM model effectively integrates these elements, promoting a comprehensive, dynamic and resilient approach to IC measurement.

Multidimensional analysis. Drawing inspiration from the VAIC™ model (Pulić, 2000, 2004; Izzo *et al.*, 2022), the IICM acknowledges the multifaceted nature of IC, divided into human capital, structural capital and relational capital. These distinct components offer an organization's comprehensive view of IC, capturing the full range of intangible assets that can drive performance.

Adaptability. The IICM must be sensitive to the rapid changes of digital transformation, as suggested by the Digital IC-landscape model (Edvinsson *et al.*, 2000). The model should incorporate mechanisms for these changes, ensuring its continued relevance in an increasingly digital business environment.

Contextual flexibility. Learning from the insights gained from the application of the data envelopment analysis for IC management (Campisi and Costa, 2008) and the Fuzzy Intellectual Capital Index (FICI) (Kale, 2009), our model must be adaptable to different industry contexts. A one-size-fits-all approach to IC measurement may lead to oversights or inaccuracies; hence, a flexible framework tailored to specific sectors and company sizes is vital.

Quantitative and qualitative indicators. Echoing the approach taken by the ICMCDS System (Soheilirad *et al.*, 2017) and the FICI, the IICM incorporates both quantitative and qualitative indicators. Doing so can provide a more well-rounded perspective on IC, capturing not just measurable aspects but also intangible elements that may be perceived or qualitative.

Robustness to uncertainty. Building on the robustness of the RWDEA model (Peykani *et al.*, 2022), the IICM model must maintain its reliability when faced with uncertain or complex data. This would allow it to be applied even in volatile market conditions, providing valuable insights despite the uncertainty.

IICM model design. Each dimension is critical to capturing a comprehensive picture of an organization's IC. By incorporating qualitative and quantitative elements across multiple facets of IC, the IICM model seeks to provide a more nuanced, accurate and actionable evaluation of IC than traditional methods.

The IICM model proposes an integrative, adaptable and robust approach to measuring IC. It incorporates different dimensions of IC, acknowledges the impact of digital transformation, provides industry-specific flexibility and uses quantitative and qualitative measures. While we propose the IICM as a promising way forward, we recognize the need for further empirical validation and iteration to refine this model and confirm its applicability and effectiveness across various contexts.

The metrics of the IICM model. The IICM model articulates various components and their corresponding quantitative and qualitative measures, all substantiated by scholarly research.

We acknowledge that several metrics can be measured both qualitatively and quantitatively. For example, qualitative metrics like "corporate culture" and "employee motivation" can be gauged by survey methodologies, resulting in quantitative outcomes for further analyses. Conversely, metrics such as the "efficiency of knowledge management systems," typically measured quantitatively, can also be explored through qualitative techniques (e.g. expert interviews), indicating the often dual-natured applicability of these metrics.

We classified measures as "quantitative" or "qualitative" based on their predominant usage and assessment approach in the included papers, as delineated in Table 3. Future iterations of the IICM model could further explore this dual nature, refining and recategorizing metrics to enhance methodological approaches in IC measurement.

Offering a unified, all-inclusive snapshot of the IC dimensions and their respective measures, this table sheds light on the multifaceted nature of IC. As a robust tool for practitioners and researchers, it facilitates a comprehensive and easily navigable evaluation of the interplay between intangible assets and organizational performance through a holistic amalgamation of vital elements derived from prior models. However, it is critical to note that, as with all models, the IICM will necessitate continuous refinement and validation to keep pace with evolving organizational contexts and market dynamics.

Critical IC components in business turbulence

Our analysis revealed that human capital remains a prominent theme in IC research, as evidenced by its high frequency of occurrence and distinct clustering. This reiterates that human capital, encapsulating employees' knowledge, skills and innovation capabilities, remains at the crux of IC research (Bontis, 1998; Youndt *et al.*, 2004). The high occurrence of human capital underlines the view that the strength of an organization's human resources forms the bedrock of its intellectual wealth and is crucial to realizing corporate objectives.

Interestingly, despite the prominence of human capital, structural capital emerged as the most frequently appearing component of IC. The emphasis on structural capital, which includes organizational processes, databases and culture, underlines its fundamental role in shaping a firm's IC. It highlights the increasing recognition that how a firm structures and organizes its

IC component	Quantitative measures	Qualitative measures	Study references
Human capital	• Workforce education level • Employee retention rate • Investments in training and development	• Employee motivation • Leadership quality • Corporate culture	Soheilirad *et al.* (2017)
Structural capital	• Number of patents held • Efficiency of knowledge management systems • Sophistication of ICT infrastructure	• Degree of process standardization • Strength of organizational culture • Robustness of internal communication channels	Bozbura and Beskese (2007), Liao *et al.* (2010)
Relational capital	• Client retention rates • Breadth and depth of strategic partnerships • Level of brand recognition	• Customer satisfaction • Partner trust • Corporate reputation	Edvinsson *et al.* (2000), Bonsón *et al.* (2008)
Digital capital	• Data volume • Sophistication of data analysis capabilities • Quality of digital infrastructure • Extent of digitization across business processes	• Degree of digital culture adoption • Digital leadership • Digital innovation	Edvinsson *et al.* (2000), Izzo *et al.* (2022)
Innovation capital	• R&D spending • Number of new product launches • Speed of product development cycles	• Openness to new ideas • Efficacy of innovation processes • Strength of innovative culture	Turovets (2021)
Tangible assets	• Company's physical assets • Financial resources	–	Peykani *et al.* (2022)
Business performance indicators	• Financial profitability • Market share • Customer satisfaction • Employee productivity	–	Juma and Payne (2004), Tarnóczi and Kulcsár (2021)
Adaptability indicators	• Implementation rate of new ideas • Investment in R&D • Company's ability to respond to market changes	–	Kale (2009), Izzo *et al.* (2022)

Source(s): Own elaboration

Table 3.
Key components and indicators of the integrated intellectual capital measurement (IICM) model

knowledge significantly contributes to its overall IC and can catalyze corporate performance (Edvinsson and Sullivan, 1996; Bontis, 2001). This finding points towards the need for organizations to manage and leverage their structural capital effectively for enhanced performance.

The relatively lower occurrence of relational capital emphasizes its underexplored status in IC research. Our analysis shows that while external communication plays a crucial role in connecting the firm with its stakeholders and building its reputation (Nahapiet and Ghoshal, 1998), there seems to be a lack of sufficient understanding in this area compared to other IC components. This underscores a potential research gap and provides a compelling avenue for

future IC research to enhance our comprehension of the role and impact of relational capital in the IC context. The "Future Research" section will elaborate on this aspect.

Limitations

As with all SLRs, ours has several important limitations.

First, because of the heterogeneity between studies in the research questions, research setting and IC assessment methodologies examined, it was not possible to perform a meta-analysis. To address this limitation, we structured the review by uncertainty contexts to allow for the identification of main patterns and key themes across study findings.

Second, the review excluded qualitative studies because we looked for empirical applications of IC measurement methods in practice. We also excluded studies within the public or nonprofit sector that could have contributed to the analysis.

Third, the search focused on peer-reviewed articles. Excluding other sources may have been lost some studies. Nevertheless, we addressed this limitation by utilizing multiple databases and looking across a wide range of article focus. In addition, we did not restrict our search to journals with specific topics or rankings.

The studies themselves also had a series of weaknesses. We found only 27 studies focused on IC measurement under business uncertainty conditions. The current turbulent era should stimulate a deepen exploration of this topic. Furthermore, the majority of studies focused on the IT and financial industries. There is a need in future studies to investigate other sectors, including automotive, transportation and hospitality companies, as these industries produce several social and ecological impacts. In addition, the studies did not cover all relevant locations equally; more than half of these involved high-income countries. Finally, among IC components, relational capital seems to be the least studied.

Future research

Our SLR reveals compelling avenues for future research in IC measurement.

The underexplored sectors like automotive and tourism warrant attention to IC management. Building on Secundo *et al.* (2020), a deep dive into United Nations' Social Development Goals, specifically green development, fair work and gender equality, could broaden our understanding of IC implications.

The IC assets' impact on digital transformation performance is another notable area that lacks sufficient exploration. Though innovative IC measurement models related to digital transformation have been proposed, they remain to be evaluated or operationalized through specific instruments. Additionally, Verhoef *et al.* (2021) suggest a potential for gauging performance improvements at various stages of digital transformation—a facet overlooked in existing studies.

Our co-occurrence analysis offers intriguing trajectories for future research in the IC realm. The prevalence of human capital in IC emphasizes its central role in knowledge creation and innovation (Kale, 2009; Massingham *et al.*, 2011). Further studies could explore the interface between human capital and technology, its role in enhancing industry resilience and refining metrics within IC measurement models.

Structural capital's dynamism prompts myriad research opportunities, such as its role in idea implementation, knowledge sharing and innovation in digital workplaces (Bozbura and Beskese, 2007; Iazzolino and Laise, 2016; Moutinho *et al.*, 2021; Asiaei *et al.*, 2022). Research should explore how IC impacts organizational resilience and interacts with other components to enhance overall corporate performance. Innovative methodologies for structural capital quantification could fortify IC models.

Finally, despite its less pronounced status, relational capital deserves scholarly focus. Understanding its role in navigating uncertainty, the impact of digital engagement strategies

on it, and its interaction with other IC components under uncertain conditions could prove fruitful (Kianto *et al.*, 2017; Soheilirad *et al.*, 2017; Ishaq, 2021; Asiaei *et al.*, 2023). Formulating robust measurement methods and indicators for relational capital will augment our understanding of IC, facilitating firms to leverage their networks for resilience and success.

Practical implications

The findings have important implications for practice. The IICM model proposed in this study is a sophisticated and adaptable framework for analyzing a firm's intangible assets. The reason for its creation was the recognition that no single model for measuring IC is widely accepted, and the rapid advancement of digital technology has made this situation even more complex. The IICM model is an all-encompassing, durable and flexible measurement tool incorporating the best features from earlier IC models (Edvinsson *et al.*, 2000; Campisi and Costa, 2008; Kale, 2009; Soheilirad *et al.*, 2017; Izzo *et al.*, 2022; Peykani *et al.*, 2022).

The model distinguishes itself by its multidimensional nature, incorporating various aspects of IC, including human capital, structural capital and relational capital. This broad scope offers a comprehensive assessment of an organization's IC, thereby driving its performance.

To ensure its continued relevance in the digital age, the IICM model incorporates adaptability features inspired by the digital IC-landscape model (Edvinsson *et al.*, 2000). This flexibility ensures the model maintains utility across different industry contexts, thus avoiding the pitfalls of a one-size-fits-all approach.

The model also embraces quantitative and qualitative indicators, enabling a well-rounded evaluation of IC. It combines measurable aspects with intangible elements, thus presenting a more accurate portrayal of a firm's IC. Moreover, the IICM model inherits the robustness of the RWDEA model (Peykani *et al.*, 2022). It exhibits reliability when handling uncertain or complex data, making it suitable for volatile market conditions.

Practitioners using the IICM model can expect a comprehensive, flexible, and reliable methodology for evaluating IC. It combines diverse dimensions of IC, caters to the impacts of digital transformation and presents flexible industry-specific utility while combining quantitative and qualitative measures. Nonetheless, it is essential to underline the necessity for further empirical validation and iteration to refine this model, ensuring its applicability and effectiveness across various contexts.

Reflecting back on the financial crisis of 2008, its ripples are still felt by practitioners. Many companies lost billions of euros in a single day, marking it as a crisis. However, the present uncertainty might alternatively be perceived as an opportunity crisis. For instance, Markets and Markets Research (2023) projects the digital transformation market to surpass $1,549 billion by the close of 2027. Furthermore, firms can sustain employee motivation and foster customer relationships by actively combating inflation.

In periods of heightened uncertainty, companies urgently need effective IC measurement to respond and adapt to evolving economic and social landscapes swiftly. Firms risk being ill-equipped for unexpected events without such measures, particularly around human capital. Assessing IC may appear akin to measuring the "immeasurable," and a single method may not fit all scenarios.

The salient aspect here is not merely measurement but learning and value creation through measurement. Instead of suggesting a one-size-fits-all method, our research highlights the potential benefits of a strategic, tailored approach to IC measurement.

Companies can enhance their ability to handle uncertainty and turn potential crises into growth opportunities by incorporating financial and nonfinancial metrics, including social impact, environmental sustainability, and the creative capabilities of their employees. A pivotal starting point could be introducing specialized training programs focused on IC. By

enhancing employee comprehension and capabilities regarding IC, organizations unlock their innate capacity to manage and utilize IC resources more effectively.

Moreover, establishing cross-functional teams dedicated to IC management is an effective strategy to oversee and integrate IC aspects across departments holistically. Such an approach encourages dynamic interaction and the exchange of knowledge and innovative ideas, enriching the organization's collective IC. By taking these pragmatic steps, organizations can navigate the complexities of IC management, fostering a robust infrastructure that catalyzes their journey toward sustainable success.

References

Al-Musali, M. and Ismail, K. (2016), "Cross-country comparison of intellectual capital performance and its impact on financial performance of commercial banks in GCC countries", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 9 No. 4, pp. 512-531, doi: 10.1108/IMEFM-03-2015-0029.

Alavi, M. and Leidner, D.E. (2001), "Knowledge management and knowledge management systems: conceptual foundations and research issues", *MIS Quarterly*, Vol. 25 No. 1, pp. 107-136, doi: 10.2307/3250961.

Alegre, J., Sengupta, K. and Lapiedra, R. (2013), "Knowledge management and innovation performance in a high-tech SMEs industry", *International Small Business Journal*, Vol. 31 No. 4, pp. 454-470, doi: 10.1177/0266242611417472.

Ali, M.A., Hussin, N., Haddad, H., Al-Araj, R. and Abed, I.A. (2021), "Intellectual capital and innovation performance: systematic literature review", *Risks*, Vol. 9 No. 9, p. 170, doi: 10.3390/risks9090170.

Aon-Ponemon (2020), "Financial statement impact of intellectual property and cyber assets report", *Global Edition*, available at: https://www.aon.com/thought-leadership/ponemoninstitutereport.jsp (accessed 27 March 2023).

Ashton, R.H. (2005), "Intellectual capital and value creation: a review", *Journal of Accounting Literature*, Vol. 24, pp. 53-134.

Asiaei, K., Jusoh, R. and Bontis, N. (2018), "Intellectual capital and performance measurement systems in Iran", *Journal of Intellectual Capital*, Vol. 19 No. 2, pp. 294-320, doi: 10.1108/JIC-11-2016-0125.

Asiaei, K., Jusoh, R., Barani, O. and Asiaei, A. (2022), "How does green intellectual capital boost performance? The mediating role of environmental performance measurement systems", *Business Strategy and the Environment*, Vol. 31 No. 4, pp. 1587-1606, doi: 10.1002/bse.2971.

Asiaei, K., O'Connor, N., Barani, O. and Joshi, M. (2023), "Green intellectual capital and ambidextrous green innovation: the impact on environmental performance", *Business Strategy and the Environment*, Vol. 32 No. 1, pp. 369-386, doi: 10.1002/bse.3136.

Banholzer, M., Dreischmeier, R., LaBerge, L. and Libarikian, A. (2022), "Business building: the path to resilience in uncertain times", McKinsey, available at: https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/business-building-the-path-to-resilience-in-uncertain-times (accessed 24 March 2023).

Bennett, N. and Lemoine, J. (2014), "What VUCA really means for you", *Harvard Business Review*, Vol. 92 Nos 1/2, p. 27, available at: https://ssrn.com/abstract=2389563

Bonsón, E., Escobar, T. and Flores, F. (2008), "Operational risk measurement in banking institutions and investment firms: new European evidences", *Financial Markets, Institutions and Instruments*, Vol. 17 No. 4, pp. 287-307, doi: 10.1111/j.1468-0416.2008.00142.x.

Bontis, N. (1998), "Intellectual capital: an exploratory study that develops measures and models", *Management Decision*, Vol. 36 No. 2, pp. 63-76, doi: 10.1108/00251749810204142.

Bontis, N. (2001), "Assessing knowledge assets: a review of the models used to measure intellectual capital", *International Journal of Management Reviews*, Vol. 3 No. 1, pp. 41-60, doi: 10.1111/1468-2370.00053.

Borgatti, S.P., Mehra, A., Brass, D.J. and Labianca, G. (2009), "Network analysis in the social sciences", *Science*, Vol. 323 No. 5916, pp. 892-896, doi: 10.1126/science.1165821.

Boungou, W. and Yatié, A. (2022), "The impact of the Ukraine–Russia war on world stock market returns", *Economics Letters*, Vol. 215, 110516, doi: 10.1016/j.econlet.2022.110516.

Bozbura, F. and Beskese, A. (2007), "Prioritization of organizational capital measurement indicators using fuzzy AHP", *International Journal of Approximate Reasoning*, Vol. 44 No. 2, pp. 124-147, doi: 10.1016/j.ijar.2006.07.005.

Brende, B. and Sternfels, B. (2022), "Resilience for sustainable, inclusive growth", McKinsey, available at: https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/business-building-the-path-to-resilience-in-uncertain-times (accessed 24 March 2023).

Brynjolfsson, E. and McAfee, A. (2014), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W. W. Norton & Company, New York, NY.

Buenechea-Elberdin, M. (2017), "Structured literature review about intellectual capital and innovation", *Journal of Intellectual Capital*, Vol. 18 No. 2, pp. 262-285, doi: 10.1108/JIC-07-2016-0069.

Buonomo, I., Benevene, P., Barbieri, B. and Cortini, M. (2020), "Intangible assets and performance in nonprofit organizations: a systematic literature review", *Frontiers in Psychology*, Vol. 11, p. 729, doi: 10.3389/fpsyg.2020.00729.

Campisi, D. and Costa, R. (2008), "A DEA-based method to enhance intellectual capital management", *Knowledge and Process Management*, Vol. 15 No. 3, pp. 170-183, doi: 10.1002/kpm.312.

Carneiro, A. (2000), "How does knowledge management influence innovation and competitiveness?", *Journal of Knowledge Management*, Vol. 4 No. 2, pp. 87-98, doi: 10.1108/13673270010372242.

Cohen, J.F. and Olsen, K. (2015), "Knowledge management capabilities and firm performance: a test of universalistic, contingency and complementarity perspectives", *Expert Systems with Applications*, Vol. 42 No. 3, pp. 1178-1188, doi: 10.1016/j.eswa.2014.09.002.

Cosa, M. and Urban, B. (2023), "A systematic review of performance measurement systems and their relevance to social enterprises", *Journal of Social Entrepreneurship*, pp. 1-29, doi: 10.1080/19420676.2023.2236628.

Daou, A., Joseph, J., Yousif, D.S., Fathallah, R. and Reyes, G. (2019), "Intellectual capital and resilience in torn societies", *Journal of Intellectual Capital*, Vol. 20 No. 4, pp. 598-618, doi: 10.1108/JIC-01-2019-0008.

Dumay, J. (2014), "15 years of the Journal of Intellectual Capital and counting: a manifesto for transformational IC research", *Journal of Intellectual Capital*, Vol. 15 No. 1, pp. 2-37, doi: 10.1108/JIC-09-2013-0098.

Edvinsson, L. and Malone, M.S. (1997), *Intellectual Capital: Realizing Your Company's True Value by Finding its Hidden Brainpower*, Harper Business, New York, NY.

Edvinsson, L. and Sullivan, P. (1996), "Developing a model for managing intellectual capital", *European Management Journal*, Vol. 14 No. 4, pp. 356-364, doi: 10.1016/0263-2373(96)00022-9.

Edvinsson, L., Kitts, B. and Beding, T. (2000), "The next generation of IC measurement – the digital IC-landscape", *Journal of Intellectual Capital*, Vol. 1 No. 3, pp. 263-273, doi: 10.1108/14691930010350819.

Evans, J.M., Brown, A. and Baker, G.R. (2015), "Intellectual capital in the healthcare sector: a systematic review and critique of the literature", *BMC Health Services Research*, Vol. 15 No. 556, pp. 1-14, doi: 10.1186/s12913-015-1234-0.

Hazan, E., Smit, S., Woetzel, J., Cvetanovski, B., Krishnan, M., Gregg, B., Perrey, J. and Hjartar, K. (2021), "Getting tangible about intangibles: the future of growth and productivity", McKinsey Global Institute, available at: https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/getting-tangible-about-intangibles-the-future-of-growth-and-productivity (accessed 25 March 2023).

Herremans, I.M., Isaac, R.G., Kline, T.J. and Nazari, J.A. (2011), "Intellectual capital and uncertainty of knowledge: control by design of the management system", *Journal of Business Ethics*, Vol. 98 No. 4, pp. 627-640, doi: 10.1007/s10551-010-0642-7.

Hofstede, G., Hofstede, G.J. and Minkov, M. (2010), *Cultures and Organizations: Software of the Minds*, 3rd ed., McGraw-Hill, New York, NY.

Iazzolino, G. and Laise, D. (2016), "Value creation and sustainability in knowledge-based strategies", *Journal of Intellectual Capital*, Vol. 17 No. 3, pp. 457-470, doi: 10.1108/JIC-09-2015-0082.

International Finance Corporation (2008), *Financing Micro, Small, and Medium Enterprises: an Independent Evaluation of IFC's Experience with Financial Intermediaries in Frontier Countries*, World Bank Publications, available at: http://hdl.handle.net/10986/6485 (accessed 30 March 2023).

Ishaq, M. (2021), "Multidimensional green brand equity: a cross-cultural scale development and validation study", *International Journal of Market Research*, Vol. 63 No. 5, pp. 560-575, doi: 10.1177/1470785320932040.

Izzo, F., Tomnyuk, V. and Lombardo, R. (2022), "4.0 digital transition and human capital: evidence from the Italian Fintech market", *International Journal of Manpower*, Vol. 43 No. 4, pp. 910-925, doi: 10.1108/IJM-04-2021-0255.

Jain, P., Vyas, V. and Roy, A. (2017), "Exploring the mediating role of intellectual capital and competitive advantage on the relation between CSR and financial performance in SMEs", *Social Responsibility Journal*, Vol. 13 No. 1, pp. 1-23, doi: 10.1108/SRJ-04-2015-0048.

Jalonen, H. (2012), "The uncertainty of innovation: a systematic review of the literature", *Journal of Management Research*, Vol. 4 No. 1, pp. 1-47, doi: 10.5296/jmr.v4i1.1039.

Juma, N. and McGee, J. (2006), "The relationship between intellectual capital and new venture performance: an empirical investigation of the moderating role of the environment", *International Journal of Innovation and Technology Management*, Vol. 3 No. 4, pp. 379-405, doi: 10.1142/S0219877006000892.

Juma, N. and Payne, G.T. (2004), "Intellectual capital and performance of new venture high-tech firms", *International Journal of Innovation Management*, Vol. 8 No. 3, pp. 297-318, doi: 10.1142/S1363919604001076.

Kale, S. (2009), "Fuzzy intellectual capital Index for construction firms", *Journal of Construction Engineering and Management*, Vol. 135 No. 6, pp. 508-517, doi: 10.1061/(ASCE)CO.1943-7862.0000014.

Khan, S.N. and Ali, E.I.E. (2017), "The moderating role of intellectual capital between enterprise risk management and firm performance: a conceptual review", *American Journal of Social Sciences and Humanities*, Vol. 2 No. 1, pp. 9-15, doi: 10.20448/801.21.9.15.

Kianto, A., Sáenz, J. and Aramburu, N. (2017), "Knowledge-based human resource management practices, intellectual capital and innovation", *Journal of Business Research*, Vol. 81, pp. 11-20, doi: 10.1016/j.jbusres.2017.07.018.

Kozera-Kowalska, M. (2020), "Intellectual capital: ISVA, the alternative way of calculating creating value in agricultural entities-case of Poland", *Sustainability*, Vol. 12 No. 7, p. 2645, doi: 10.3390/su12072645.

Lee, S.Y. and Klassen, R.D. (2016), "Firms' response to climate change: the interplay of business uncertainty and organizational capabilities", *Business Strategy and the Environment*, Vol. 25 No. 8, pp. 577-592, doi: 10.1002/bse.1890.

Liao, P.-J., Huang, C.-H. and Hsu, K.-H. (2010), "Indicators and standards for measuring intellectual capital of companies in the emerging industry: exemplified by biopharmaceutical companies", *International Journal of Services and Standards*, Vol. 6 Nos 3-4, pp. 221-235, doi: 10.1504/ijss.2010.038670.

Lin, C.Y.Y. and Edvinsson, L. (2021), "Reflections on JIC's twenty-year history and suggestions for future IC research", *Journal of Intellectual Capital*, Vol. 22 No. 3, pp. 439-457, doi: 10.1108/JIC-03-2020-0082.

Markets and Markets Research (2023), "Digital transformation market by component, technology (cloud computing, big data and analytics, mobility and social media management, cybersecurity, AI), deployment mode, organization size, business function, vertical and region – global forecast to 2027", Report, available at: https://www.marketsandmarkets.com/Market-Reports/digital-transformation-market-43010479.html (accessed 10 April 2023).

Marr, B. and Moustaghfir, K. (2005), "Defining intellectual capital: a three-dimensional approach", *Management Decision*, Vol. 43 No. 9, pp. 1114-1128, doi: 10.1108/00251740510626227.

Massaro, M., Dumay, J. and Guthrie, J. (2016), "On the shoulders of giants: undertaking a structured literature review in accounting", *Accounting, Auditing and Accountability Journal*, Vol. 29 No. 5, pp. 767-801, doi: 10.1108/AAAJ-01-2015-1939.

Massingham, P., Nguyen, T.N.Q. and Massingham, R. (2011), "Using 360 degree peer review to validate self-reporting in human capital measurement", *Journal of Intellectual Capital*, Vol. 12 No. 1, pp. 43-74, doi: 10.1108/14691931111097917.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P. and Stewart, L.A. and PRISMA-P Group (2015), "Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement", *Systematic Reviews*, Vol. 4 No. 1, pp. 1-9, doi: 10.1186/2046-4053-4-1.

Moutinho, V., Vale, J., Bertuzi, R., Bandeira, A.M. and Palhares, J.A. (2021), "Two-stage DEA model to evaluate the performance of iberian banks", *Economies*, Vol. 9 No. 3, p. 115, doi: 10.3390/economies9030115.

Nahapiet, J. and Ghoshal, S. (1998), "Social capital, intellectual capital, and the organizational advantage", *Academy of Management Review*, Vol. 23 No. 2, pp. 242-266, doi: 10.5465/amr.1998.533225.

Ousama, A., Hammami, H. and Abdulkarim, M. (2020), "The association between intellectual capital and financial performance in the Islamic banking industry: an analysis of the GCC banks", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 13 No. 1, pp. 75-93, doi: 10.1108/IMEFM-05-2016-0073.

Pandey, D.K., Hassan, M.K., Kumari, V. and Hasan, R. (2023), "Repercussions of the Silicon Valley Bank collapse on global stock markets", *Finance Research Letters*, Vol. 55 Part B, 104013, doi: 10.1016/j.frl.2023.104013.

Paoloni, N., Mattei, G., Dello Strologo, A. and Celli, M. (2020), "The present and future of intellectual capital in the healthcare sector: a systematic literature review", *Journal of Intellectual Capital*, Vol. 21 No. 3, pp. 357-379, doi: 10.1108/JIC-10-2019-0237.

Paoloni, P., Modaffari, G., Ricci, F. and Della Corte, G. (2023), "Intellectual capital between measurement and reporting: a structured literature review", *Journal of Intellectual Capital*, Vol. 24 No. 1, pp. 115-176, doi: 10.1108/JIC-07-2021-0195.

Patel, P.C. and Guedes, M.J. (2017), "Surviving the recession with efficiency improvements: the case of hospitality firms in Portugal", *International Journal of Tourism Research*, Vol. 19 No. 5, pp. 594-604, doi: 10.1002/jtr.2132.

Pedro, E., Leitão, J. and Alves, H. (2018), "Intellectual capital and performance: taxonomy of components and multi-dimensional analysis axes", *Journal of Intellectual Capital*, Vol. 19 No. 2, pp. 407-452, doi: 10.1108/JIC-11-2016-0118.

Peykani, P., Gheidar-Kheljani, J., Saen, R. and Mohammadi, E. (2022), "Generalized robust window data envelopment analysis approach for dynamic performance measurement under uncertain panel data", *Operational Research*, Vol. 22 No. 5, pp. 5529-5567, doi: 10.1007/s12351-022-00729-7.

Pulić, A. (2000), "VAIC™–an accounting tool for IC management", *International Journal of Technology Management*, Vol. 20 Nos 5-8, pp. 702-714, doi: 10.1504/IJTM.2000.002891.

Pulić, A. (2004), "Intellectual capital–does it create or destroy value?", *Measuring Business Excellence*, Vol. 8 No. 1, pp. 62-68, doi: 10.1108/13683040410524757.

Quarchioni, S., Paternostro, S. and Trovarelli, F. (2022), "Knowledge management in higher education: a literature review and further research avenues", *Knowledge Management Research and Practice*, Vol. 20 No. 2, pp. 304-319, doi: 10.1080/14778238.2020.1730717.

Radhakrishnan, S., Erbis, S., Isaacs, J.A. and Kamarthi, S. (2017), "Novel keyword co-occurrence network-based methods to foster systematic reviews of scientific literature", *PloS One*, Vol. 12 No. 3, e0172778, doi: 10.1371/journal.pone.0172778.

Ramlee, M. and Abu, A. (2004), "Malaysia transitions toward a knowledge-based economy", *Journal of Technology Studies*, Vol. 30 No. 3, pp. 51-61, doi: 10.21061/jots.v30i3.a.8, available at: https://files.eric.ed.gov/fulltext/EJ905143.pdf

Roos, G., Roos, J., Dragonetti, N.C. and Edvinsson, L. (1997), *Intellectual Capital: Navigating the New Business Landscape*, MacMillan Press, London.

Roos, G., Pike, S. and Fernström, L. (2007), *Managing Intellectual Capital in Practice*, Routledge, London.

Šebestová, J. and Popescu, C. (2022), "Factors influencing investments into human resources to Support company performance", *Journal of Risk and Financial Management*, Vol. 15 No. 1, p. 19, doi: 10.3390/jrfm15010019.

Secundo, G., Ndou, V., Del Vecchio, P. and De Pascale, G. (2020), "Sustainable development, intellectual capital and technology policies: a structured literature review and future research agenda", *Technological Forecasting and Social Change*, Vol. 153, 119917, doi: 10.1016/j.techfore.2020.119917.

Shinde, R., Patil, S., Kotecha, K., Potdar, V., Selvachandran, G. and Abraham, A. (2022), "Securing AI-based healthcare systems using blockchain technology: a state-of-the-art systematic literature review and future research directions", *arXiv Preprint*, arXiv: 2206.04793, doi: 10.48550/arXiv.2206.04793.

Śledzik, K. (2013), "The intellectual capital performance of polish banks: an application of VAIC™ model", *Financial Internet Quarterly 'e-Finanse'*, Vol. 9 No. 2, pp. 92-100, doi: 10.2139/ssrn.2175581.

Soetanto, T. and Liem, P. (2019), "Intellectual capital in Indonesia: dynamic panel approach", *Journal of Asia Business Studies*, Vol. 13 No. 2, pp. 240-262, doi: 10.1108/JABS-02-2018-0059.

Soheilirad, S., Sofian, S., Mardani, A., Zavadskas, E.K., Kaklauskas, A. and Darvishvand, J.M. (2017), "The relationship between non-financial stakeholders and capital structure", *Engineering Economics*, Vol. 28 No. 4, pp. 363-375, doi: 10.5755/j01.ee.28.4.16812.

Steward, T.A. (1997), *Intellectual Capital, The New Wealth of Nations*, Nicholas Brealey, London.

Sveiby, K.E. (1997), *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*, Berrett-Koehler, San Francisco, CA.

Sveiby, K.E. (2001), "A knowledge-based theory of the firm to guide in strategy formulation", *Journal of Intellectual Capital*, Vol. 2 No. 4, pp. 344-358, doi: 10.1108/14691930110409651.

Sveiby, K.E. (2018), "Measuring intangibles: suggested indicators with cases", available at: https://www.sveiby.com/files/pdf/measuringintangibles-suggestedindicators.pdf (accessed 12 October 2023).

Tan, H.P., Plowman, D. and Hancock, P. (2007), "Intellectual capital and financial returns of companies", *Journal of Intellectual Capital*, Vol. 8 No. 1, p. 76-95, doi: 10.1108/14691930710715079.

Tarnóczi, T. and Kulcsár, E. (2021), "Comparative analysis of value added intellectual capital at small and medium enterprises", *Annals of the University of Oradea, Economic Science Series*, Vol. 30 No. 2, pp. 260-271, doi: 10.47535/1991auoes30(2)027.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207-222, doi: 10.1111/1467-8551.00375.

Tseng, K.-A., Lan, Y.-W., Lu, H.-C. and Chen, P.-Y. (2013), "Mediation of strategy on intellectual capital and performance", *Management Decision*, Vol. 51 No. 7, pp. 1488-1509, doi: 10.1108/MD-03-2012-0143.

Turovets, Y. (2021), "Intangible assets and the efficiency of manufacturing firms in the age of digitalisation: the Russian case", *Engineering Management in Production and Services*, Vol. 13 No. 1, pp. 7-26, doi: 10.2478/emj-2021-0001.

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N. and Haenlein, M. (2021), "Digital transformation: a multidisciplinary reflection and research agenda", *Journal of Business Research*, Vol. 122, pp. 889-901, doi: 10.1016/j.jbusres.2019.09.022.

Webster, J. and Watson, R.T. (2002), "Analyzing the past to prepare for the future: writing a literature review", *MIS Quarterly*, Vol. 26 No. 2, pp. xiii-xxiii, available at: http://www.jstor.org/stable/4132319

Youndt, M.A., Subramaniam, M. and Snell, S.A. (2004), "Intellectual capital profiles: an examination of investments and returns", *Journal of Management Studies*, Vol. 41 No. 2, pp. 335-361, doi: 10.1111/j.1467-6486.2004.00435.x.

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