Available online at www.ijournalse.org

Emerging Science Journal

(ISSN: 2610-9182)

Vol. 10, No. 1, February, 2026

Unveiling the Power of Intellectual Capital in Driving Financial Performance: A Deep Dive into the IT Sector

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Abstract

This study aims to theoretically and empirically investigate the relationship between intellectual capital (IC) and the financial performance of firms in the U.S. information technology (IT) sector, with a particular focus on Return on Assets (ROA) as a key performance indicator. Data were collected from 345 publicly listed IT companies over the period 2011–2022, yielding 1,792 firm-year observations. The research employed descriptive statistics, correlation matrices, box plot analyses, and multiple regression models to examine the effects of IC and its components, human capital efficiency, structural capital efficiency, and capital employed efficiency on financial outcomes. The analysis revealed that, contrary to conventional expectations and prior literature, IC exhibited a negative and statistically significant association with financial performance, highlighting potential inefficiencies in the utilization of intangible assets within the IT industry. These findings underscore the complexity of translating investments in IC into measurable financial gains, suggesting that firms may be overinvesting or misallocating resources in areas that do not yield immediate profitability. The novelty of this research lies in uncovering an unexpected inverse IC-performance link in a knowledge-intensive sector, thereby offering executives and policymakers new insights into how IC strategies should be re-evaluated and aligned with long-term value creation.

Keywords:

Digital Transformation; Intellectual Capital; Financial Performance; VAIC; Information Technology; Industry 4.0; Industry Performance; Knowledge Economy.

Article History:

Received:	14	April	2025
Revised:	20	November	2025
Accepted:	11	December	2025
Published:	01	February	2026

1- Introduction

The shift from an industry-based economy to a knowledge-based one is a notable impact of globalization. In this evolving landscape, businesses have been honing their intangible assets to stay competitive and ensure long-term success [1]. We can define a knowledge economy as a system where the primary drivers of growth and development are the creation, production, and application of knowledge. This is why it's often referred to as a "knowledge-based economy" [2]. The transition to Industry 4.0 brings about changes in employment, organizational structure, and the interplay between humans and robots. IC has become a crucial component of Industry 4.0, prompting experts to assert that strong IC capabilities are essential for full engagement in this emerging industrial era. IC refers to the collective actions taken by a company's employees, managers, and other stakeholders to enhance corporate performance [3]. In addition, IC is seen as an intangible yet valuable asset, and the primary driver of competitive advantage that impacts company innovation and performance [4]. The development of IC is significantly dependent on information, creativity, expertise, and valued skills. It is widely recognized as a crucial component of the technology-driven economy. Additionally, IC is viewed as a crucial intangible asset, providing businesses with a competitive advantage and enhancing their performance in a knowledge-based economy, where the creation, dissemination, and utilization of knowledge and information are the primary drivers of growth. Organizations are increasingly generating value by gathering, managing, and applying knowledge obtained from human expertise, organizational procedures, and social relationships rather than depending

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DOI: http://dx.doi.org/10.28991/ESJ-2026-010-01-08

only on labor or physical assets like land and raw commodities [5]. Human capital, organizational or structural capital, and social or relational capital are the three main components of intellectual capital. Each plays a unique and distinct role in the firm's capacity to innovate, adapt, and preserve its competitive advantage [6, 7]. Within the context of the IT sector, it has long been acknowledged that intellectual capital is a vital and strategic asset for companies, contributing significantly to improved financial performance and operational effectiveness. This is particularly accurate in knowledge-intensive sectors like telecommunications and IT, where employees' abilities, expertise, and inventiveness are frequently the most valuable resources.

Undoubtedly, IC has become an essential element of the administrative process, playing a crucial role in all areas of administration. The increased engagement not only magnifies the significance of management but also improves its efficiency [8]. At the organizational level, intellectual IC may account for more than 75% of a company's total worth [9]. Businesses with significant IC are better equipped to develop new ideas, put innovative plans into action, and maintain a competitive edge [10]. Research has indicated that IC has a positive impact on organizational productivity, which in turn improves the firm's financial and market performance. Businesses that use their IC well outperform their contemporaries monetarily and exhibit more growth potential in the future, which improves their standing in the market. Although this is true for all industries in general, knowledge-intensive industries like IT are where it is most noticeable [11]. However, the industrial background and IC's growth rate have an impact on this relationship. According to Gogan et al. (2016) [7], comprehending and effectively managing intellectual capital is therefore regarded as a strategic necessity for long-term value generation. Since the IT and telecommunications sectors heavily rely on human expertise, creativity, and technology, intellectual capital is especially important in these fields. These organizations' human capital is usually distinguished by high levels of technical expertise, flexibility, and potential for innovation. Research shows that because competent workers propel technical advancement and operational enhancements, investments in human capital within these industries have a favorable correlation with productivity and profitability [12].

In today's competitive landscape, organizations are increasingly turning to digital transformation (DT) to maximize their intellectual value. From a management perspective, DT is vital for maintaining competitiveness and profitability. Simply put, it's the revamp of business activities, processes, products, and models to fully leverage the potential of digital technologies [13]. For those organizations that understand the value and significance of IC, a digital transformation DT strategy should ideally answer fundamental questions like 'why', 'what', and 'who'. It should also present a compelling narrative for change [14].

In order to achieve DT, it is crucial to investigate how businesses may grow and make use of their IT departments. IT intellectual capital (ITIC), a crucial component of IT departments that offers enormous potential for businesses looking to leverage their departments' ability to propel successful DT, may be at the center of this effort [15]. These associates are especially important in the IT and telecom industries since businesses need to work together to create integrated goods or provide complete technological solutions. The telecom and IT sectors are well known for their constant need for innovation and a quick rate of change. Businesses with strong IC are better able to handle crises, seize new opportunities, and quickly adjust to changes in the market [12]. This allows them to continue growing and perform financially even in highly competitive environments. Various IT and telecom businesses have created proprietary valuation models to assess the potential of intangible assets, despite the fact that traditional accounting methods frequently fall short of accurately reflecting the value of intellectual capital. To determine the worth of intellectual capital, metrics like patent counts, innovation rates, and customer satisfaction levels have become crucial [16].

Few studies have examined the impact of ITIC's subdimensions on DT experimentally, despite its significance and unique characteristics. The influence of general IT use [17, 18] and IT capabilities [19] has been the primary focus of previous research on the antecedents of DT from an IT perspective. They have disregarded ITIC's function, though, which is essential for creating sophisticated IT skills and making efficient use of IT to assist DT. By highlighting the role of digital resources, digital infrastructures, and other related resources in enabling firms to create value and gain a competitive advantage through digital transformation, Wang et al. (2023) [20] illuminated the importance of DT practices in fostering a firm's physical asset efficiency and working capital management in a digital environment. on the particular kinds of DT techniques that may work best for various business sizes, industries, and ownership structures, which may provide useful information for companies. The study also failed to include the possible difficulties and roadblocks that businesses can run into while putting DT practices into effect, which could have an impact on the adoption and results of such projects.

IC, while not traditionally accounted for on balance sheets, is pivotal in a company's wealth generation [21]. This includes unseen elements like employee expertise, research initiatives, internal systems, and databases that give a competitive edge [22]. As Shahwan & Habib (2020) [23] suggested, it's the collective skills and competencies of employees that create a company's wealth. The recognition of this has led to an emphasis on efficient knowledge management, fueling the development of the knowledge economy. The importance of IC has soared as the knowledge economy's relevance has grown [24]. However, the way that IC is evaluated varies from study to study. While some research [25, 26] reveals inconclusive impacts on financial performance, others [27, 28] emphasize relational capital as the most crucial aspect in enhancing corporate success.

Irungu et al. (2017) [29] highlight the necessity for organizations to promptly and effectively react to market opportunities and challenges to stay competitive. A company that excels in attracting clients and managing market volatility can gain a leg up on its competitors. Manole et al. (2014) [30] define a company's competitiveness as its ability to deliver superior products promptly and at a price that beats the competition, thereby securing its market position. This capability can be showcased through quick adaptation to demand shifts and successful product diversification, driven by an innovative culture and an effective marketing strategy. In today's global trend, businesses lacking competitiveness tend to fail quickly. Darius (2022) [31] suggested a competitive advantage is an organization's ability to perform in a manner that's difficult for competitors to imitate, both now and in the future. In today's global trend, businesses lacking competitiveness tend to fail quickly. Darius (2022) [31] also highlighted that a competitive advantage is an organization's ability to perform in a manner that's difficult for competitors to imitate, both now and in the future.

IC is often seen as a key element in the production of goods and services. It adds value to businesses, potentially providing them with a competitive edge and enhancing the performance of SMEs [32]. This makes it critical to deepen our understanding of the relationship between IC and business performance, especially the financial performance of small businesses. As put by Rokhman et al. (2023) [33], IC represents the sum of all intangible assets that small and medium enterprises utilize to produce goods and services, thereby delivering added value to the company.

The research gap between IC and performance metrics for assessing the financial success of the US IT industry is evident from a thorough assessment of the literature. With an emphasis on ROA as a major performance metric, this study attempts to theoretically and empirically examine the relationship between IC and the financial success of companies in the USA IT industry. This research studies the impact of intellectual capital on financial performance. Our contribution to the literature is that IC's impact on organizational financial performance has not been studied in the USA market and in the IT industry. We also contribute to this stream of literature by answering the following question: "*Does IC have an impact on ROA*"? To our knowledge, those approaches were not studied in the USA market in the IT industry.

This paper's subsequent sections are organized as follows: A review of the literature and a description of the study framework are presented in the following section. The hypothesized relationship is proposed to investigate the direct and positive impact on ROA. We next go over the specifics of our empirical analysis technique before presenting and discussing the findings. Finally, we offer the conclusion and suggestions for the future, highlight the ramifications of our findings, and submit our discussions.

2- Literature Review and Hypotheses Development

2-1- IC Theories

Organizational efforts to safeguard IC are becoming increasingly important because of a rising understanding of the value of knowledge as the catalyst for constructing organizational success [34]. According to Agostini and Nosella (2019) [35], IC refers to the idea of identifying intangible assets as organizational core competencies and assessing employees' expertise within the company. Scholarly conceptions of IC remain controversial despite its critical significance in organizations [36, 37]. Bontis et al. (2018) [38] put forward that IC is an intangible asset that is not shown on an organization's balance sheet but is known to have a beneficial impact on organizational performance. Intellectual capital has come into the spotlight with progress in the field of knowledge. Essentially, it serves as a compass in determining the real worth of an organization. IC supplies vital operational and functional knowledge [39].

John Kenneth Galbraith first introduced the term intellectual capital in 1969. This term includes both intangible assets and ideological processes [40]. According to Nguyen (2023) [40], intellectual capital is a company's exceptional ability to combine and use its knowledge resources to create value and achieve future goals. While the definition of intellectual capital has varied over time, it's widely agreed upon that it consists of three elements: human, structural, and social capital.

IC, which encompasses a company's invaluable hidden assets, fills the gap between the market value of its stock and the replacement cost of its physical assets [41]. It represents the wealth of knowledge within a company and has attracted significant academic attention [42]. Key components of IC include human capital, structural capital, and relational capital [43, 44]. Understanding these categories is vital for exploring the diverse knowledge resources within organizations and acknowledging their importance in specific areas [45]. Studies have shown that IC increases a company's productivity, which improves its financial and market success. Businesses that make good use of their IC are found to beat their competitors financially and to have more room to grow in the future, which improves their reputation in the marketplace. This is true for all industries in general, but it is more noticeable in the knowledge-intensive IT sector. However, this link changes based on the industry context and the rate of IC expansion. As a result, managing and comprehending intellectual capital is seen as a strategic prerequisite for long-term value creation [5].

Over the past decade, there has been a significant shift in intellectual requirements as businesses become more complex. These changes are predominantly driven by human intellectual power, fueling economic advancements [46]. Companies are now making an impact not only through physical assets, but also through intangible ones like knowledge assets and customer relations [47]. Intangible capital includes innovation investments, human capital, and research and development capital [48]. Recently, IC has become a key tool for companies to adapt and thrive in a dynamic

environment. IC is seen as the effective use of a company's available knowledge, comprising both organizational and human capital. From a macroeconomic perspective, IC not only boosts a company's share in stock market indices but also contributes to economic growth [49]. Structural capital (SC) encompasses the establishment and enforcement of internal controls and policies inside a company, including business strategies, organizational networks, patents, and brand names [50]. Serbia saw the favorable influence of structural capital efficiency (SCE) [38], but Tanzania and Romania encountered the adverse effects of structural capital efficiency on business performance [51, 52]. Human capital refers to the combined knowledge and abilities possessed by employees that have economic worth [53]. Structural capital refers to the physical and organizational infrastructure that enables the development and utilization of human capital, as well as the systems and culture that promote the sharing of knowledge inside an organization [54].

The concepts of IC may vary depending on its scope. Based on this reasoning, an organization's IC can be utilized to generate additional advantages or resources that its employees can readily comprehend, such as value-based services and assets. The need to formalize, manage, and facilitate IC to create valuable assets was discussed in previous studies. He argued that the lack of IC might negatively affect a company and its projected value. Human capital is seen as a crucial component of IC, influencing its growth and overall improvement in performance [55].

IC theory aims to explore the process of generating value from an organization's resources. Most of the literature operates under the assumption that IC is present and undergoes dynamic development in the form of knowledge [53]. This enables firms to effectively deploy resources in accordance with the market environment, hence generating value and maintaining a competitive advantage [56].

Moreover, knowledge resources produced added value in creating a durable competitive advantage. According to Sardo et al. (2018) [41], in the past few years, IC has grown to be an asset for a company. Investors think that companies with efficient internal circulation could see increased profits and sales in the future. Value-added intellectual capital (VAIC), initially developed by Pulic (2000) [57], is used to quantify intellectual capital. According to Stewart & Ruckdeschel (1998) [58], IC refers to the knowledge, skills, and expertise of employees that contribute to gaining a competitive edge. It is considered an intangible asset, as suggested by Erik (1997) [53]. The concept of IC is defined differently by multiple researchers with diverse backgrounds [59, 60]. Human capital (HC) refers to the combined knowledge, skills, and adaptability of an organization's personnel. This collective expertise can have a positive impact on company performance, either in full or in part [61, 62]. It's widely recognized that information technology (IT) plays a key role in virtually all organizational operations. An extensive review of the literature underscores this point, showing a close relationship between IT usage and risk management activities [63].

IT capabilities (ITC) enhance innovation, boosting productivity and customer relationships, while reducing costs. Success isn't just about investing in IT, but also leveraging ITC in a changing business landscape. 'Capability' refers to unique skills needed to effectively utilize resources for superior performance [62]. ITC includes resources, skills, information, and relationships that allow effective management of IT applications and services, leading to innovation and superior performance. Therefore, managing intellectual capital with technologies to build ITC can add significant value. IT aids organizations in various ways, be it through improved decision-making, cultivating relationships with customers, business partners, suppliers, automating manual processes, or promoting organizational innovation. Therefore, understanding the role of IT capabilities and their proposed relationships with IC and frugal innovation is vital for achieving better business performance and making full use of IT capabilities [64].

2-2-Application of IC Theories in Various Aspects of Industries

Profitability, productivity, and market value are often affected by the total efficiency of IC, as stated by Cabrilo & Dahms (2018) [8], whereas human capital has a more extensive influence on profitability. Khalique et al. (2015) [65] discovered that human capital had a negligible effect on organizational performance in a distinct cultural setting. Regarding the pharmaceutical industry, intellectual capital is important, according to Chowdhury et al. (2019) [43]. It remains challenging for many businesses to effectively utilize their IT departments for digital transformation (DT) efforts. In order to achieve DT, it is crucial to investigate how businesses may grow and use their IT departments. IT intellectual capital (ITIC), a crucial component of IT departments with enormous potential for businesses looking to use these departments' power to drive successful DT, may be at the center of this attempt [66]. Performance, innovation, and DT are the main research issues, according to the keyword co-occurrence analysis, highlighting the increasing understanding of IC as a factor in business success. The thematic evolution study shows how IC research has evolved from basic studies on the performance of SMEs to more intricate subjects like digital IC and policy-driven research [67].

Pal & Soriya (2012) [68] contended that IC has a good effect on profitability but does not have a substantial influence on productivity and market value in the Indian pharmaceutical and textile sector. Sardo et al. (2018) [41] discovered a favorable correlation between intellectual capital efficiency in the current time and financial success by analyzing nonfinancial listed enterprises in 14 Western European nations. Mohammad & Bujang (2019) [69] utilized the VAIC model to compare the construction, finance, and plantation industries. Their analysis revealed that CEE positively influences ROA in these industries. In contrast, firms in the finance sector leverage HC and SC to generate value, while negative associations were found between HC and SC and ROA in the construction and plantation sectors. Sadalia et al. (2019) [70] discovered that Intellectual Capital (IC) had a notable beneficial impact on the financial performance,

namely Return on Assets (ROA), Return on Equity (ROE), and earnings per share, of 76 Indonesian enterprises. Vidyarthi (2019) [71] found that only human capital efficiency (HCE) had a substantial, but moderate impact on bank efficiency in India in a research on the influence of intellectual capital (IC).

Artificial intelligence (AI) is the ability of intelligent systems to perceive with action and learn with reasoning. Artificial intelligence can, however, replicate or even outperform human intelligence. One type of artificial intelligence system is machine learning, which entails creating statistical models and algorithms that let computers learn from data and make judgments or predictions. Natural language processing, recommendation systems, financial services, healthcare, cybersecurity, and energy are just a few of the many industries that use machine learning. The use of machine learning in issues pertaining to intellectual property, especially patents, has not, however, received much attention. Invisible, knowledge-based resources and procedures that raise an organization's worth from an internal and external standpoint make up intellectual capital [72].

Dabić et al. (2019) [37] found that there is a positive correlation between greater performance and a higher amount of intellectual capital (IC) in Croatian small and medium-sized firms (SMEs). Ousama & Fatima (2015) [73] have observed a positive correlation between them.

2-3- Financial Performance

Financial performance is a top priority for shareholders and business managers. Innovations are constantly sought for more effective management. Numerous factors influence a company's financial returns, with each business striving to identify and implement effective strategies to enhance its operations [74]. In today's digital economy, information technology has emerged as a critical tool for broadening marketing efforts and introducing new services. A key advantage of the digital marketplace is that customers can view products and place orders anytime, anywhere through a company’s website. Smart application of information technology can help reduce production costs and enhance competitiveness [75]. Understanding how businesses create and use intangible assets, like IC, to improve ESG performance and long-term competitiveness is crucial as ESG reporting becomes a crucial component in governance. Although IC's contribution to value creation makes it possible to view it as a key component of organizational success, experts continue to disagree about how to measure and categorize it. Numerous studies highlight several aspects of IC, each of which makes a distinct contribution to an organization's ability to innovate, adapt, and succeed [76].

In today's knowledge-driven landscape, IC is a key contributor to a firm's performance [77]. Several empirical studies have found a positive correlation between market value and intellectual capital performance [78, 79]. However, Cenciarelli et al. (2018) [80] observed a dip in market value in relation to intellectual capital performance. IC is a non-physical resource that, when combined with physical resources, can aid businesses in maintaining a competitive edge [81]. Prior studies have explored the relationship between IC and overall business performance [82, 33]. Financial performance measures the achievement of financial goals and the company's ability to yield effective results [83]. A study by Torre et al. (2021) [84] indicated a positive correlation between IC and financial performance. Furthermore, Xu & Liu's (2020) [21] highlighted how IC can boost performance in the Chinese manufacturing sector. In essence, they suggest that profitability is driven by physical capital, human capital, and structural capital. It is revealed from the studies that the majority of the research focused on the areas of value generation and value capture, with an emphasis on analyzing the connection between IC and business performance in terms of economic, financial, and organizational perspectives [85, 86].

2-3-1- IC and Financial Performance

There has been a lack of consensus on the concept of IC in the past, and now, there is no universally accepted definition of intellectual capital. To assess the efficiencies of IC, researchers have utilized the widely used method known as the value-added intellectual coefficient (VAIC). This method was initially proposed by Pulic [57] in 2000 and has since been further refined by other scholars such as Bayraktaroglu et al. (2019) [42], Soewarno & Tjahjadi (2020) [87], and Yousaf (2022) [82]. VAIC is calculated by considering three components: CEE, which represents capital employed efficiency; SCE, which represents structural capital efficiency; and HCE, which represents human capital efficiency. The impact of IC aspects on business financial performance in emerging nations is subject to conflicting research findings.

Prior research typically evaluates business performance based on three distinct dimensions: The company's financial performance can be assessed through metrics such as Earnings Before Interest and Tax (EBIT) or Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) for earnings, Return on Assets (ROA), Return on Equity (ROE), Gross Profit Margin (GPM), Net Profit Margin (NPM), or Market-to-Book Ratio (MB) for profitability, and Asset Turnover Ratio (ATO) and Employee Productivity (EP) for productivity [21].

The return on assets is calculated by dividing the profit or loss for a specific period by the total assets, as stated in the annual reports. The return on assets measures the financial institutions' capacity to earn revenue from their total asset base. The investors use this ratio to assess the proficiency of an organization's management. The accounting measure of performance is widely recognized as an effective indicator of organizational success [88, 89]. ROA offers insights into the amount of value that has been brought to the organization [90].

In their research on intellectual capital (IC), Urošević et al. (2024) [91] reviewed various studies from both domestic and international academic institutions, which consistently identify a significant and positive impact of IC on financial performance, commonly measured by return on assets (ROA). For instance, Soeawarno & Tjahjadi (2020) [87] conducted a study of 235 banks in Indonesia, revealing a statistically significant and positive effect of structural capital on ROA, and similarly, human capital showed a positive impact on ROA, while relational capital's effect on ROA was not confirmed. In a study by Githaiga (2023) [92], examining 53 banks in East Africa, the results showed that human capital efficiency (HCE), structural capital efficiency (SCE), and invested capital positively affected ROA, with SCE having the strongest influence. Demartini & Beretta (2020) [93] also emphasized that IC has a significant and positive impact on financial metrics such as sales revenue, ROI, and net profit, highlighting the critical role of IC in small and medium-sized enterprises. Mondal & Ghosh (2012) [94] also found that IC, particularly HCE, positively impacts profitability and productivity, which is measured by ROA in their studies. Furthermore, studies by Pirogova et al. (2020) [95] and Rehman et al. (2016) [96] found that a lack of awareness and investment in IC limited its effect on financial results, particularly in industries like trade and banking. Mukaro et al. (2023) [97] observed a negative effect of IC on ROA in Turkey, attributing this to the imbalance in the employment of skilled and unskilled labor in certain sectors. Other studies, like those by Skhvediani et al. (2023) [98] and Janošević et al. (2013) [99], confirmed a positive relationship between IC and ROA across different industries and regions. These findings underline the importance of IC, particularly human and structural capital, in driving ROA as a key indicator of organizational performance. Thus, these findings provide strong evidence for the following hypotheses.

H₁: IC has a significant and positive impact on ROA.

3- Research Design

To facilitate a more thorough analysis of the impact of IC on financial performance, we have chosen to utilize relevant data from publicly listed firms. Through the meticulous selection of suitable metrics and the application of an empirical framework, our objective is to ascertain the presence of any possible relationship between these variables.

3-1- Sample Selection and Data Sources

This study employs a sample that was derived from the Refinitiv database, focusing specifically on the entire USA IT sector. The sample consisted of publicly listed companies, encompassing the time frame from 2011 to 2022. Moreover, the firm-year data for these selected companies were aggregated, with careful attention to excluding any missing or incomplete financial data for the specified variables. The resulting dataset, comprising 1792 firm-year observations for the 345 companies under study, was utilized in our analysis. Outliers were not manually removed; instead, the data were winsorized at the 2nd and 98th percentiles to minimize the influence of extreme values while retaining the integrity of the sample. Additionally, robustness checks were conducted using alternative specifications to ensure that the results were not driven by outlier effects. The processing of the collected data was carried out using the STATA software package.

3-2- Variables

3-2-1- Explained Variable

This investigation employs profitability as an indicator for assessing performance. It serves as the dependent variable within the analytical models. It is quantified utilizing a singular financial performance metric: return on assets (ROA), calculated as *net profit after tax/total assets* [100-102].

3-2-2- Explanatory Variables

The Value-Added Intellectual coefficient (VAIC) = HCE + SCE + CEE measures a firm's intellectual capital efficiency. Human Capital Efficiency (HCE = VA/HC) assesses the contribution of human capital, where VA (Value Added) = P + C + D + A (operating profits, employee costs, depreciation, and amortization), and HC is total employee-related costs. Structural Capital Efficiency (SCE = SC/VA) evaluates structural capital's role, where SC = VA – HC. Capital Employed Efficiency (CEE = VA/invested capital) measures physical and financial capital efficiency. A higher VAIC enhances Return on Assets (ROA) by optimizing resource utilization, improving profitability, and fostering innovation.

3-2-3- Control Variables

The control variables include the firm size [100], which is measured by the logarithm value of total assets. Loss is a dummy variable where firm years with operating profit equal to or less than zero are measured as 1 and the others as 0. COVID variable is a dummy variable where the COVID period years 2020 and 2021 are measured as 1 and the others as 0. GDP is measured as GDP growth (annual %). The variables are summarized in Table 1, given below.

Table 1. Explanation of variables

Type of variable	Variables
Explained variables	Return on Assets (ROA) = net profit after tax/total Assets
Explanatory variables	Value added Intellectual Coefficient (VAIC) = HCE+SCE+CEE
	Human Capital Efficiency (HCE) = VA/HC
	Structural Capital Efficiency (SCE) = SC/VA
	Capital Employed Efficiency (CEE) = VA/invested capital
Control variables	Size = log of total assets
	Loss = Firm years with operating profit equal to or less than zero are measured as 1, and the others as 0.
	COVID = COVID period years 2020 and 2021 are measured as 1, and the others as 0.
	GDP = GDP growth (annual %)

VA is the sum of operating profits (P), employee costs (C), and depreciation and amortization of assets (D and A). SC represents the difference between VA and HC (SC = VA – HC); HC is the sum of all employee-related costs

3-3- Research Model

The two-stage least squares (2SLS) regression is applied to correct endogeneity when analysing the effect of IC (VAIC and its components) on ROA. In the first stage, instrumental variables generate fitted values for IC, mitigating bias from simultaneity or omitted variables. In the second stage, these fitted values are regressed on ROA, yielding consistent estimates of IC's impact on profitability. Models 1 to 4 (Figure 1) test the effect of the VAIC and its three components (i.e., CEE, HCE, and SCE) on ROA.

Model 1: Impact of HCE on ROA

$$ROA_{it}=\alpha_{10}+\alpha_{11}HCE_{it}+\alpha_{12}Size_{it}+\alpha_{13}Loss_{it}+\alpha_{14}Covid_{it}+\alpha_{15}GDP_{it}+Fixed\ effects_{it}+\varepsilon_{1it} \quad (1)$$

Model 2: Impact of SCE on ROA

$$ROA_{it}=\alpha_{20}+\alpha_{21}SCE_{it}+\alpha_{22}Size_{it}+\alpha_{23}Loss_{it}+\alpha_{24}Covid_{it}+\alpha_{25}GDP_{it}+Fixed\ effects_{it}+\varepsilon_{2it} \quad (2)$$

Model 3: Impact of CEE on ROA

$$ROA_{it}=\alpha_{30}+\alpha_{31}CEE_{it}+\alpha_{32}Size_{it}+\alpha_{33}Loss_{it}+\alpha_{34}Covid_{it}+\alpha_{35}GDP_{it}+Fixed\ effects_{it}+\varepsilon_{3it} \quad (3)$$

Model 4: Impact of VAIC on ROA

$$ROA_{it}=\alpha_{40}+\alpha_{41}VAIC_{it}+\alpha_{42}Size_{it}+\alpha_{43}Loss_{it}+\alpha_{44}Covid_{it}+\alpha_{45}GDP_{it}+Fixed\ effects_{it}+\varepsilon_{4it} \quad (4)$$

Where ROA is the dependent variable, IC (VAIC and its components) are independent variables, and size, loss-making firms, COVID, and GDP are the control variables. The fixed effects are proxied by Year with ε_{it} representing the error term, included in the model.

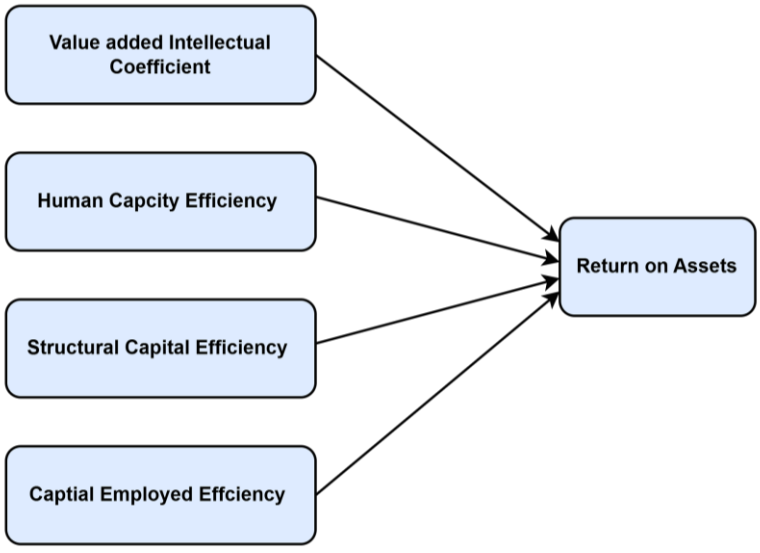

Figure 1. Regression model

Figure 2 summarizes the sequential steps of the study, from data collection and sample selection through variable definition, econometric modelling, diagnostic testing, and final robustness analysis.

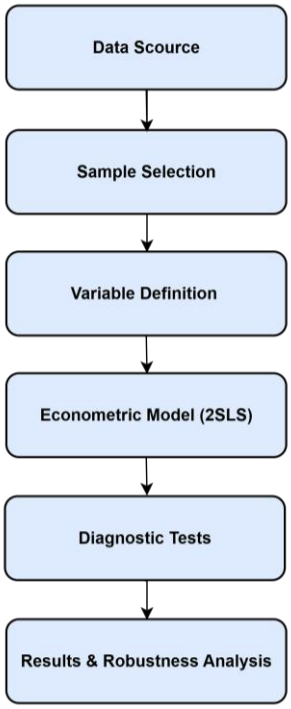

Figure 2. Research methodology workflow

4- Results and Discussion

4-1- Descriptive Statistics

As a part of data analysis, the preliminary stage was to perform descriptive statistics.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	1,792	-0.3177146	1.023212	-5.87466	0.2492383
HCE	1,792	2.0031	11.67092	-40.66013	39.92414
SCE	1,792	0.9166213	2.1758	-6.836938	8.043643
CEE	1,792	0.1003092	1.157391	-4.242718	4.294279
VAIC	1,792	3.166251	13.69777	-43.18139	48.31597
Size	1,792	19.5758	2.765597	12.10138	24.44867
Loss	1,792	0.5446429	0.498142	0	1
Covid	1,792	0.2739955	0.4461312	0	1
GDP	1,792	2.253182	2.127973	-2.213469	5.800206

Table 2 elucidates descriptive statistics wherein the average ROA is recorded at -0.318; this negative ROA signifies that a substantial proportion of the firms within the sample exhibit pronounced unprofitability, while the standard deviation reflects a moderate dispersion throughout the sample. The average HCE is determined to be 2.003; however, the considerable standard deviation (11.671) and extensive range (spanning from -40.66 to 39.92) imply significant variability among the firms. SCE and CEE present average values of 0.917 and 0.100, respectively, accompanied by standard deviations of 2.176 and 1.157, indicating a moderate level of deviation across the sample. VAIC displays an average value of 3.166, coupled with a high standard deviation of 13.698 and a range extending from -43.181 to 48.316, which denotes a wide disparity in intellectual capital performance across the firms. The variable representing firm size has an average of 19.576 and a comparatively lower standard deviation of 2.766, thereby suggesting reduced variability in firm size relative to other variables. The firm size ranges between 12.101 and 24.449. The loss dummy variable exhibits an average of 0.545, which denotes that approximately 54.5% of the firms within the dataset reported incurring a loss. Additionally, the dummy variable pertaining to Covid displays an average of 0.274, indicating that nearly 27.4% of the observations originate from the Covid period. The mean GDP is calculated at 2.253%, with a standard deviation of 2.128. The minimum value (-2.213) and maximum value (5.800) illustrate the fluctuations within the macroeconomic environment throughout the duration of the study.

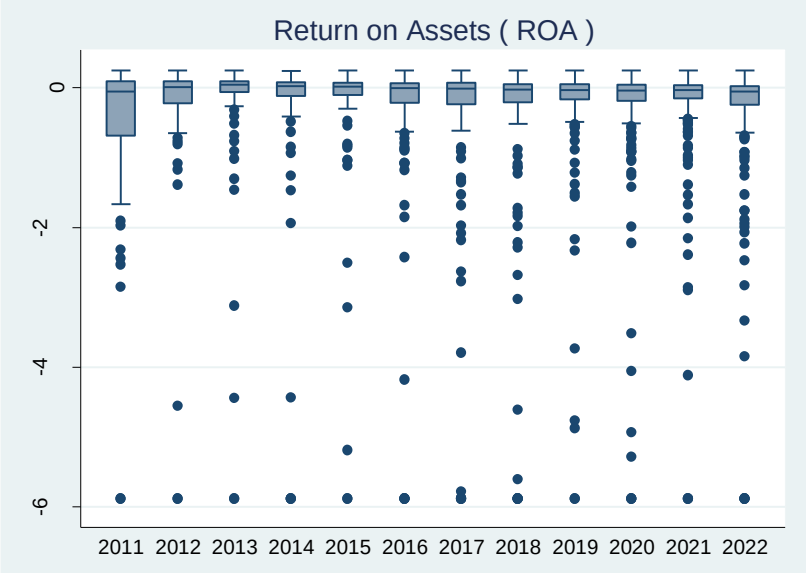

Figure 3. Box plot of return on assets (ROA)

Figure 3 displays the distribution of ROA over the period from 2011 to 2022 using a Box plot. The box plot technique displays the five-number summary as a central box with whiskers that extend to the non-outlying values. As observed in the two figures, for all the individual years discussed, the median is not roughly centred between the quartiles, and the whiskers are not of similar length; thus, we conclude that the per-year data distribution for ROA over the period of the study is skewed.

Table 3. Correlation among the variables

Variables	ROA	HCE	SCE	CEE	VAIC	size	Loss	Covid	GDP	VIF
ROA	1									
HCE	0.214***	1								1.43
SCE	-0.204***	-0.031	1							1.02
CEE	-0.025	0.149***	-0.051**	1						1.04
VAIC	0.138***	0.898***	0.247***	0.283***	1					1.28
size	0.604***	0.281***	-0.081***	0.028	0.227***	1				1.22
Loss	-0.339***	-0.542***	0.146***	-0.196***	-0.465***	-0.399***	1			1.57
Covid	0.041*	-0.040*	0.013	0.003	-0.022	0.085***	0.067***	1		1.02
GDP	0.014	0.001	0.043*	0.02	0.017	0.019	-0.006	-0.064***	1	1

**** p<0.01, ** p<0.05, * p<0.1*

Table 3 presents the outcomes of the correlation analysis conducted. In the context of univariate correlation, HCE, SCE, VAIC, Size, Loss, and COVID exhibit a significant correlation with ROA; however, with the exception of Size, all other variables demonstrate a weak correlation coefficient. The Variance Inflation Factor (VIF) results provided in Table 3 suggest the absence of multicollinearity within the regression models, as the VIF for all explanatory variables remains below the conventional threshold of ten.

Table 4. Breusch-Pagan/Cook-Weisberg test: Heteroskedasticity

Model	chi2(1)	Prob > chi2	Inference
Model 1	2983.91	0.0000	Heteroskedasticity
Model 2	2991.57	0.0000	Heteroskedasticity
Model 3	3022.22	0.0000	Heteroskedasticity
Model 4	3004.69	0.0000	Heteroskedasticity
Wooldridge test: Autocorrelation			
Model	**Test Statistic**	**p-value**	**Inference**
Model 1	F(1, 249) = 43.282	0.0000	Autocorrelation
Model 2	F(1, 249) = 43.018	0.0000	Autocorrelation
Model 3	F(1, 249) = 41.465	0.0000	Autocorrelation
Model 4	F(1, 249) = 42.407	0.0000	Autocorrelation

The diagnostic tests presented in Table 4 reveal significant econometric concerns across all four models. The Breusch-Pagan/Cook-Weisberg test indicates the presence of heteroskedasticity, as evidenced by extremely high chi-square statistics and p-values of 0.0000 for all models, suggesting non-constant variance in the error terms. Additionally, the Wooldridge test for autocorrelation reports F-statistics with highly significant p-values (0.0000), confirming the existence of first-order serial correlation. These violations of classical OLS assumptions undermine the reliability of fixed effects estimators and render GMM potentially inefficient under such conditions. Consequently, to address endogeneity and ensure robust inference, it is appropriate to proceed with Two-Stage Least Squares (2SLS) regression estimation.

4-2- Regression Results

In Table 5 and Figure 4 given below, HCE exhibits a deleterious and highly significant influence on ROA (coefficient = -0.0182, $p < 0.01$). This implies that for each one-unit augmentation in HCE, ROA diminishes by 0.0182 units. While one might expect human capital to have a positive effect on financial success, this negative correlation could indicate inefficiencies or less-than-ideal returns on human capital investments. From a managerial standpoint, this suggests that simply increasing investment in human resources does not guarantee financial gains unless aligned with performance-based outcomes and strategic utilization. ROA is significantly impacted negatively by SCE (coefficient = -0.197, $p < 0.01$). This suggests that businesses are not effectively utilizing their SCE to improve financial performance, as higher SCE is associated with lower ROA. This phenomenon might arise from ineffective utilization of internal resources or an incapacity to transmute structural capital into fiscal advantages. This points to the need for firms to reassess whether their internal knowledge systems and organizational routines are genuinely value-enhancing or simply adding bureaucratic burden without financial returns. CEE reveals a negative and statistically significant effect on ROA (coefficient = -0.319, $p < 0.05$). This insinuates that enterprises exhibiting greater efficiency in the deployment of their capital employed actually experience a decline in ROA, which is paradoxical and may reflect inadequate capital allocation or management within the organizations.

This paradox could reflect strategic misallocations of capital or poor investment choices that diminish overall firm value. Managers must critically evaluate capital deployment strategies to ensure alignment with value creation. VAIC demonstrates a negative and significant effect on ROA (coefficient = -0.0328, $p < 0.01$). Given that VAIC serves as a composite measure of intellectual capital efficiency, the negative coefficient implies that augmented intellectual capital efficiency, as quantified by VAIC, does not convert into superior financial performance for the USA IT sector.

This challenges the conventional belief that intellectual capital is inherently beneficial to financial outcomes and suggests that IC should be managed with clear performance metrics, industry benchmarks, and strategic targets. In Table 5, across all models, diverse components of intellectual capital (HCE, SCE, CEE, and VAIC) exhibit negative and significant effects on ROA, which is unexpected considering that intellectual capital is conventionally presumed to bolster firm performance. This could be a sign of inefficiencies in the way these companies use their intellectual property or challenges converting intangible assets into cash. These findings underscore the importance for corporate leaders to not only invest in intellectual capital but to ensure its effective alignment with the firm's core financial objectives. Mismanaged or misaligned IC strategies may erode rather than enhance value, particularly in innovation-intensive sectors like IT.

On the other hand, ROA is positively and significantly correlated with firm size, indicating that larger organizations typically have better financial results. The COVID variable has exerted a profound negative influence on firm performance, whereas GDP growth positively affects financial results. The Loss variable encapsulates the anticipated detrimental impact of financial setbacks on firm performance. The p-value, as per Anderson Canonical Correlation LM Statistic, is 0.000 across all models, indicating that the instruments employed in the regression are valid. This examination suggests that the instruments are correlated with the endogenous variables but not with the error terms, thereby affirming the suitability of the instrumental variables approach. The Durbin-Wu-Hausman Test indicates the prevalence of endogeneity. The p-value is significant in all models as delineated in Table 5. This infers that the endogeneity issue is present, yet the application of Two-Stage Least Squares (2SLS) remedies it.

Table 5. Regression results

VARIABLES	Model 1	Model 2	Model 3	Model 4
	ROA	ROA	ROA	ROA
HCE	-0.0182***			
	(0.00)			
SCE		-0.197***		
		(0.04)		
CEE			-0.319**	
			(0.13)	
VAIC				-0.0328***
				(0.00)
Size	0.213***	0.202***	0.201***	0.216***
	(0.01)	(0.01)	(0.01)	(0.01)
Loss	-0.395***	-0.0764	-0.340***	-0.553***
	(0.07)	(0.05)	(0.08)	(0.07)
Covid	-5.309***	-4.310***	-5.414***	-5.240***
	(1.47)	(1.54)	(1.55)	(1.57)
GDP	1.400***	1.140***	1.432***	1.395***
	(0.39)	(0.40)	(0.41)	(0.41)
Constant	-7.050***	-6.309***	-6.919***	-6.973***
	(0.83)	(0.86)	(0.87)	(0.88)
Observations	1,424	1,424	1424	1424
R-squared	0.356	0.31	0.291	0.269
Controls year effect	Yes	Yes	Yes	Yes
Anderson canon. corr. LM statistic = P value	0.000	0.000	0.000	0.000
Durbin-Wu-Hausman = P value	0.000	0.000	0.0261	0.000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

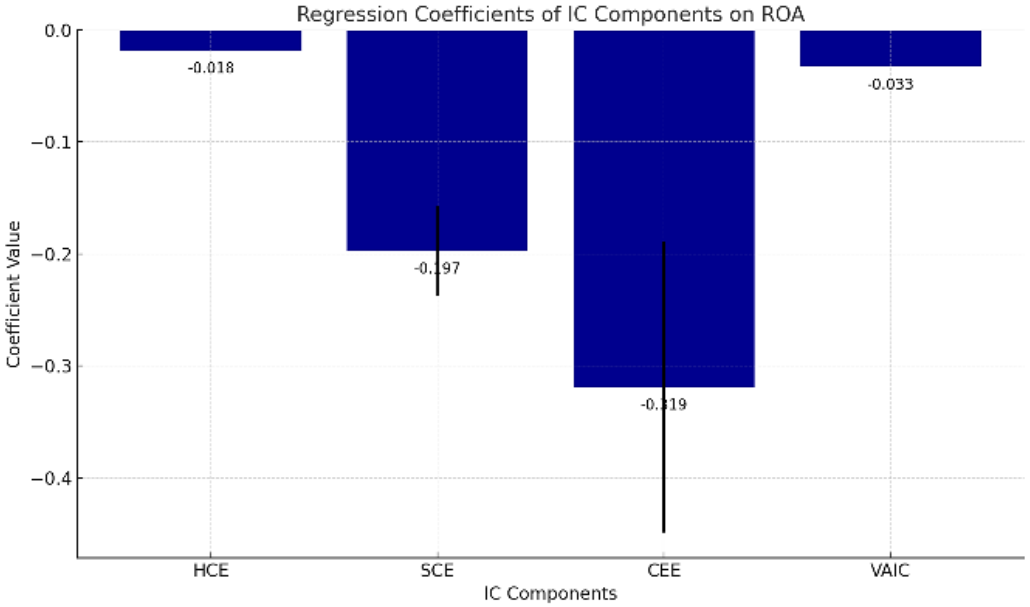

Figure 4. Regression coefficients

4-2-1 Robustness Analysis

In addition to our regression results in Table 5, we carried out a robustness analysis with the help of 2SLS techniques. For this purpose, we split our dataset into two subsets, one including firms with positive ROA values and the other including firms with zero or negative ROA values. We further examined the relationship between IC and ROA as displayed in Table 6.

Table 6. Regression results with robustness analysis (Firms with positive ROA v/s Firms with zero or negative ROA)

VARIABLES	Firms with positive ROA Model 4	Firms with zero or negative ROA Model 4
VAIC	0.00199***	-0.110***
	(0.0004)	(0.0224)
Size	-0.00243*	0.707***
	(0.00)	(0.04)
Loss	-0.0556***	-0.74
	(0.02)	(0.49)
Covid	-0.223	-20.21***
	(0.22)	(7.49)
GDP	0.0608	5.267***
	(0.06)	(1.96)
Constant	-0.00715	-24.13***
	(0.13)	(4.15)
Observations	544	659
R-squared	0.048	0.253
Controls year effect	Yes	Yes
Anderson canon. corr. LM statistic = P value	0.000	0.000
Durbin-Wu-Hausman = P value	0.0001	0.000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Regression results for firms with zero or negative ROA align with the findings of our main model regarding the VAIC-ROA relationship presented in Table 6. However, results for firms with positive ROA contradict these findings. Upon further analysis, while the observed positive coefficient for profit-making firms is statistically significant, its magnitude remains negligible. In contrast, the coefficient for loss-making firms is substantially more material. This suggests that the results of the main model, which includes all firms, are largely driven by loss-making firms. Moreover, even among profit-making firms, IC does not appear to be a significant driver of profitability in the IT sector.

To further investigate the heterogeneity in firm behaviour, the dataset was stratified into two subsets: one comprising large firms and the other comprising small firms, based on the average firm size threshold delineated in Table 7. This disaggregated analysis reveals that the primary findings of the main regression model, which encompasses the full sample, are predominantly influenced by the small firm segment. The magnitude and statistical significance of the coefficients in the small firm model suggest that the overall results are not uniformly distributed across firm sizes, thereby underscoring the disproportionate explanatory power and influence exerted by smaller firms within the dataset.

Table 7. Regression results with robustness analysis (Firms with Large size v/s Firms with small size)

VARIABLES	Firms with Large size Model 4	Firms with Small size Model 4
VAIC	0.00793***	-0.151***
	(0.0007)	(0.0511)
Size	0.00581**	1.129***
	(0.00)	(0.09)
Loss	-0.0867***	-2.143***
	(0.01)	(0.77)
Covid	-0.780*	-13.01
	(0.42)	(10.64)
GDP	0.206*	3.461
	(0.11)	(2.84)
Constant	-0.559**	-25.91***
	(0.23)	(6.28)
Observations	817	523
R-squared	0.381	0.104
Controls year effect	Yes	Yes
Anderson canon. corr. LM statistic = P value	0.000	0.000
Durbin-Wu-Hausman = P value	0.0001	0.000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Competing theoretical perspectives also provide insight into the negative IC–ROA association. From a resource-drain perspective, intensive IC investments may inflate costs and erode short-term profitability, contrasting with the value-creation predictions of the resource-based view. Agency theory further suggests that managerial overinvestment in IC can reflect inefficiencies or empire-building rather than value generation. Similarly, dynamic capabilities theory highlights that IC expenditures often yield long-term innovation benefits, while accounting measures like ROA capture only immediate costs. Finally, institutional theory points to mimetic pressures in highly competitive IT markets, where IC investments may sustain legitimacy but fail to translate into superior profitability.

Unlike most prior studies reporting a positive relationship between intellectual capital (IC) and financial performance, our findings reveal a significant negative association between VAIC and ROA in the U.S. IT sector. This divergence may stem from high IC costs, inefficient utilization, and the short-term nature of ROA as a performance measure. While studies in emerging markets and less saturated sectors often observe immediate IC benefits, our results suggest that in competitive, innovation-driven environments, IC investments may not yield instant returns. Robustness checks further reveal that these effects are more pronounced among smaller and loss-making firms. This indicates the need for context-specific evaluation of IC effectiveness, emphasizing strategic alignment over scale of investment.

5- Conclusion

This study attempts to investigate if there is a significant impact of IC on the financial performance of IT firms in U.S. and determine if this impact is positive or negative. VAIC served as a proxy for firms' IC while ROA was used as a measure of financial performance. In addition to examining the impact of VAIC on ROA, we also tested the individual effects of its components HCE, SCE, and CEE on ROA. Contrary to our expectations, the regression results revealed an inverse relationship between VAIC, as well as its three components, and ROA. Considering that most of the firms in our sample operate at a loss, a negative HCE-ROA relationship indicates that U.S. IT firms spend heavily on employee costs but do not always achieve immediate financial returns. A negative SCE-ROA relationship suggests that structural capital does not translate into profitability possibly due to high sunk costs in IT infrastructure and innovation. And finally, a negative CEE-ROA relationship indicates that financial and physical assets efficiency is not the primary driver of financial performance in the IT sector. IT firms rely more on scalability, innovation, and market trends than on traditional capital efficiency. Generally speaking, IT firms prioritize long-term growth over short-term profitability, therefore VAIC impact on ROA may not be immediately visible.

Several possible explanations can be offered for the above counterintuitive results. The first explanation is reverse causality, where firms struggling with poor financial performance lack the resources to invest in human capital. However, rather than benefiting from structural capital efficiency, these firms may suffer from an overall decline in IC effectiveness, relying on their existing assets in a way that does not translate into improved profitability. This suggests that existing structural capital alone is not enough to drive profitability, reinforcing the idea that IC investments require both HC and SC for value creation. Another explanation can be the inefficient utilization of IC despite significant investment. Investing in human capital and structural capital incurs high operating costs, in the form of salaries, training, recruitment, and amortization expenses. This effect is particularly pronounced in the IT sector, where skilled professionals command high wages, training programs are expensive, and R&D staff salaries, along with structural investments, contribute heavily to period costs. If the returns from these investments fail to outweigh their costs, profitability will decline. A third explanation for our results relates to the forward-looking nature of IC investments. While IC investments often generate long-term benefits, ROA measures short-term financial performance, creating a misalignment between investment timing and profitability realization. A fourth possible explanation for these results lies in the intense competition within the U.S. IT sector. Due to industry's rapid innovation cycles and aggressive market competition, IT firms are often forced to continuously reinvest in intellectual capital just to maintain their market position, rather than to drive immediate profitability. High competition exerts downward pricing pressure, making it difficult for firms to translate IC investments into higher profit margins in the short term.

In conclusion, based on the above results, we suggest that U.S. IT companies must weigh the costs and benefits while making strategic IC expenditures. They should specifically refrain from making investments just to stay ahead of the competition, rather than concentrating on profitability and long-term growth. However, as IC investments usually do not result in rapid financial returns and their efficacy should be assessed over an extended period of time, they must set reasonable expectations. This is a serious problem, as it may be challenging to determine whether these investments are actually providing value, because delayed returns can mask inefficiencies in IC utilization. Additionally, the management of IT companies should put more emphasis on the effective use of IC than on the quantity of the investment. As was previously mentioned, one of the main causes of the negative IC-ROA association may be inefficient IC use. Therefore, rather than continuously increasing IC investments, which could further deteriorate financial performance, firms should concentrate on optimizing the effectiveness of their current IC through improved knowledge management, automation, and process optimization when expected financial gains do not materialize. Last but not least, IT companies need to understand that SC investments like databases, patents, and IT infrastructure by themselves are insufficient to boost ROA. Rather than being viewed as a stand-alone value generator, they must make sure that SC enhances HC investments.

This study focused on the relationship between intellectual capital, proxied by VAIC, and financial performance, proxied by ROA, in the U.S. IT sector. Additionally, the scope of this research could be expanded to other knowledge-intensive industries, such as biotech and fintech, to determine whether the findings of this study are sector-specific or generalizable. Lastly, similar studies could incorporate alternative firm performance indicators, such as market performance or other financial metrics, to provide a more comprehensive assessment of IC's true value.

6- Declarations

6-1- Author Contributions

Conceptualization, S.D. and L.K.; methodology, S.F.H.Z.; software, S.D.; validation, S.D. and R.D.; formal analysis, S.F.H.Z.; investigation, R.D.; resources, S.D.; data curation, S.D.; writing—original draft preparation, S.D. and L.K.; writing—review and editing, L.K., R.D., and S.F.H.Z.; visualization, R.D.; supervision, R.D. and S.F.H.Z.; project administration, S.D. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6-4- Institutional Review Board Statement

Not applicable.

6-5- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

6-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

7- References

[1] Gupta, K., Goel, S., & Bhatia, P. (2020). Intellectual Capital and Profitability: Evidence from Indian Pharmaceutical Sector. Vision, 24(2), 204–216. doi:10.1177/0972262920914108.

[2] Ali, S., Murtaza, G., Hedvicakova, M., Jiang, J., & Naeem, M. (2022). Intellectual capital and financial performance: A comparative study. Frontiers in Psychology, 13. doi:10.3389/fpsyg.2022.967820.

[3] Mahmood, T., & Mubarik, M. S. (2020). Balancing innovation and exploitation in the fourth industrial revolution: Role of intellectual capital and technology absorptive capacity. Technological Forecasting and Social Change, 160, 120248. doi:10.1016/j.techfore.2020.120248.

[4] Abualoush, S. H., Obeidat, A. M., Tarhini, A., Masa'deh, R., & Al-Badi, A. (2018). The role of employees' empowerment as an intermediary variable between knowledge management and information systems on employees' performance. VINE Journal of Information and Knowledge Management Systems, 48(2), 217–237. doi:10.1108/VJIKMS-08-2017-0050.

[5] Demiraj, E. (2025). the Mediating Role of Intellectual Capital in the ESG - Performance Relationship: Evidence from the U.S. It Industry. Pressacademia, 2. doi:10.17261/pressacademia.2025.1982.

[6] Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. Academy of Management Journal, 48(3), 450–463. doi:10.5465/AMJ.2005.17407911.

[7] Gogan, L. M., Artene, A., Sarca, I., & Draghici, A. (2016). The Impact of Intellectual Capital on Organizational Performance. Procedia - Social and Behavioral Sciences, 221, 194–202. doi:10.1016/j.sbspro.2016.05.106.

[8] Cabrilo, S., & Dahms, S. (2018). How strategic knowledge management drives intellectual capital to superior innovation and market performance. Journal of Knowledge Management, 22(3), 621–648. doi:10.1108/JKM-07-2017-0309.

[9] Maqableh, T. N., Maqableh, A. N., & Maqableh, H. N. (2023). The Impact of Intellectual Capital on Performance of Service and Industrial Firms in Middle East. Lecture Notes in Networks and Systems, Springer International Publishing, 557: 499–513. doi:10.1007/978-3-031-17746-0_40.

[10] Parimarma, L. A. I., & Kufepaksi, M. (2023). The Effect of Intellectual Capital on Company Value of Banking Companies in Indonesia. Journal Economy and Currency Study (JECS), 5(1), 16–29. doi:10.51178/jecs.v5i1.1309.

[11] Tan, H. P., Plowman, D., & Hancock, P. (2007). Intellectual capital and financial returns of companies. Journal of Intellectual Capital, 8(1), 76–95. doi:10.1108/14691930710715079.

[12] Bai, F., Shang, M., Huang, Y., & Liu, D. (2024). Digital investment, intellectual capital and enterprise value: evidence from China. Journal of Intellectual Capital, 25(1), 210–232. doi:10.1108/JIC-07-2022-0149.

[13] Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. International Journal of Information Management, 63, 102466. doi:10.1016/j.ijinfomgt.2021.102466.

[14] Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. Journal of Business Research, 122, 889–901. doi:10.1016/j.jbusres.2019.09.022.

[15] Pang, B., Zhang, M., Chen, Y., Chen, M., & Yang, R. (2025). Unlocking digital transformation: the impact of IT intellectual capital and market turbulence. Internet Research, 1253302. doi:10.1108/INTR-04-2024-0632.

[16] Duc, K. H., Tai, D. D., & Van Hau, N. (2025). the Impact of Intellectual Capital on Financial Performance in Information Technology and Telecommunications Firms. Financial and Credit Activity: Problems of Theory and Practice, 4(63), 264–278. doi:10.55643/fcaptp.4.63.2025.4775.

[17] Holmström, J. (2022). From AI to digital transformation: The AI readiness framework. Business Horizons, 65(3), 329–339. doi:10.1016/j.bushor.2021.03.006.

[18] Chatterjee, S., Chaudhuri, R., Vrontis, D., & Jabeen, F. (2022). Digital transformation of organization using AI-CRM: From microfoundational perspective with leadership support. Journal of Business Research, 153, 46-58. doi:10.1016/j.jbusres.2022.08.019.

[19] Zhang, X., Xu, Y. Y., & Ma, L. (2023). Information technology investment and digital transformation: the roles of digital transformation strategy and top management. Business Process Management Journal, 29(2), 528–549. doi:10.1108/BPMJ-06-2022-0254.

[20] Wang, X., Li, Y., Tian, L., & Hou, Y. (2023). Government digital initiatives and firm digital innovation: Evidence from China. Technovation, 119, 102545. doi:10.1016/j.technovation.2022.102545.

[21] Xu, J., & Liu, F. (2020). The Impact of Intellectual Capital on Firm Performance: A Modified and Extended VAIC Model. Journal of Competitiveness, 12(1), 161–176. doi:10.7441/joc.2010.01.10.

[22] Kweh, Q. L., Lu, W. M., Tone, K., & Nourani, M. (2022). Risk-adjusted banks' resource-utilization and investment efficiencies: does intellectual capital matter? Journal of Intellectual Capital, 23(3), 687–712. doi:10.1108/JIC-03-2020-0106.

[23] Shahwan, T. M., & Habib, A. M. (2020). Does the efficiency of corporate governance and intellectual capital affect a firm's financial distress? Evidence from Egypt. Journal of Intellectual Capital, 21(3), 403–430. doi:10.1108/JIC-06-2019-0143.

[24] Do Rosário Cabrita, M. (2009). Intellectual capital: A phenomenon of interrelationships. International Journal of Business and Systems Research, 3(2), 229–256. doi:10.1504/IJBSR.2009.024864.

[25] Soytas, M. A., Denizel, M., & Durak Usar, D. (2019). Addressing endogeneity in the causal relationship between sustainability and financial performance. International Journal of Production Economics, 210, 56–71. doi:10.1016/j.ijpe.2019.01.016.

[26] Mutuc, E. B., & Cabrilo, S. (2022). Corporate social responsibility, intellectual capital and financial performance: evidence from developed and developing Asian economies. Review of Managerial Science, 16(4), 1227–1267. doi:10.1007/s11846-022-00542-8.

[27] Momani, K. M. d. K. Al, Jamaludin, N., & Abdullah, W. Z. W. (2021). the Effect of Relational Capital on the Intellectual Capital and Firm Performance Nexus: Evidence from the Jordanian Industrial Sector. Journal of Sustainability Science and Management, 16(5), 307–326. doi:10.46754/JSSM.2021.07.019.

[28] Laghi, E., Di Marcantonio, M., Cillo, V., & Paoloni, N. (2022). The relational side of intellectual capital: an empirical study on brand value evaluation and financial performance. Journal of Intellectual Capital, 23(3), 479–515. doi:10.1108/JIC-05-2020-0167.

[29] Irungu, A., & Arasa, R. (2017). Factors Influencing Competitiveness of Small and Medium Enterprises (SMEs) in Nairobi County, Kenya. Journal of Economics and Behavioral Studies, 9(2(J)), 161–173. doi:10.22610/jebs.v9i2(j).1658.

[30] Manole, D. S., Nisipeanu, E., & Decuseara, R. (2014). Study on the competitiveness of small and medium-sized enterprises (SMEs) in Vâlcea County. Theoretical and Applied Economics, 21(4), 113-130.

[31] Darius, B. (2022). Intellectual Capital Development and Competitive Advantage. International Journal of Academic Management Science Research (IJAMSR), 6(7), 1-8.

[32] Hina, K., Ahmad, N. H., Khalique, M., & Khan, I. (2020). Intellectual capital in SMEs of Azad Jammu and Kashmir, Pakistan. International Journal of Learning and Intellectual Capital, 17(3), 267–279. doi:10.1504/IJLIC.2020.109921.

[33] Rokhman, M. T. N., Armanu, Setiawan, M., & Rofiaty. (2023). The implementation of resource-based theory in the relationship between intellectual capital and entrepreneurship orientation and performance-mediated innovation ability in MSMEs. International Journal of Management and Sustainability, 12(1), 44–58. doi:10.18488/11.v12i1.3270.

[34] Arsawan, I. W. E., Koval, V., Suhartanto, D., Harbar, Z., & Maslennikov, Y. (2022). Employee-Driven Innovation Capability: the Role of Knowledge, Creativity, and Time Sufficiency. Intellectual Economics, 16(2), 138–165. doi:10.13165/IE-22-16-2-08.

[35] Agostini, L., & Nosella, A. (2019). Inter-organizational relationships involving SMEs: A bibliographic investigation into the state of the art. Long Range Planning, 52(1), 1–31. doi:10.1016/j.lrp.2017.12.003.

[36] Castillo, A. E., Pacheco, G. V., Fernandez, L. H., Manotas, E. N., Borrero, T. C., & Silva, J. (2019). Factorial analysis in the intellectual capital's dimensions on micro, small and medium-sized export enterprises. Procedia Computer Science, 160, 567–572. doi:10.1016/j.procs.2019.11.046.

[37] Dabić, M., Lažnjak, J., Smallbone, D., & Švarc, J. (2019). Intellectual capital, organisational climate, innovation culture, and SME performance: Evidence from Croatia. Journal of Small Business and Enterprise Development, 26(4), 522–544. doi:10.1108/JSBED-04-2018-0117.

[38] Bontis, N., Janošević, S., & Dženopoljac, V. (2015). Intellectual capital in serbia's hotel industry. International Journal of Contemporary Hospitality Management, 27(6), 1365–1384. doi:10.1108/IJCHM-12-2013-0541.

[39] Yilmaz, A. A., & Tuzlukaya, S. E. (2024). The relation between intellectual capital and digital transformation: a bibliometric analysis. International Journal of Innovation Science, 16(2), 244–264. doi:10.1108/IJIS-08-2022-0145.

[40] Nguyen, N. T. (2023). The Impact of Intellectual Capital on Service Firm Financial Performance in Emerging Countries: The Case of Vietnam. Sustainability (Switzerland), 15(9), 7332. doi:10.3390/su15097332.

[41] Sardo, F., Serrasqueiro, Z., & Alves, H. (2018). On the relationship between intellectual capital and financial performance: A panel data analysis on SME hotels. International Journal of Hospitality Management, 75, 67–74. doi:10.1016/j.ijhm.2018.03.001.

[42] Bayraktaroglu, A. E., Calisir, F., & Baskak, M. (2019). Intellectual capital and firm performance: an extended VAIC model. Journal of Intellectual Capital, 20(3), 406–425. doi:10.1108/JIC-12-2017-0184.

[43] Chowdhury, L. A. M., Rana, T., & Azim, M. I. (2019). Intellectual capital efficiency and organisational performance: In the context of the pharmaceutical industry in Bangladesh. Journal of Intellectual Capital, 20(6), 784–806. doi:10.1108/JIC-10-2018-0171.

[44] Zheng, C., Islam, M. N., Hasan, N., & Halim, M. A. (2022). Does intellectual capital efficiency matter for banks' performance and risk-taking behavior? Cogent Economics and Finance, 10(1), 2127484. doi:10.1080/23322039.2022.2127484.

[45] Barak, M., & Sharma, R. K. (2024). Analyzing the Impact of Intellectual Capital on the Financial Performance: A Comparative Study of Indian Public and Private Sector Banks. Journal of the Knowledge Economy, 15(4), 20320–20348. doi:10.1007/s13132-024-01901-4.

[46] Gupta, J., Rathore, P., & Kashiramka, S. (2023). Impact of Intellectual Capital on the Financial Performance of Innovation-Driven Pharmaceutical Firms: Empirical Evidence from India. Journal of the Knowledge Economy, 14(2), 1052–1076. doi:10.1007/s13132-022-00927-w.

[47] Cheikh, I. Ben, & Noubbigh, H. (2019). The Effect of Intellectual Capital Drivers on Performance and Value Creation: The Case of Tunisian Non-financial Listed Companies. Journal of the Knowledge Economy, 10(1), 147–167. doi:10.1007/s13132-016-0442-0.

[48] Yano, G., & Shiraishi, M. (2020). Financing of Physical and Intangible Capital Investments in China. Emerging Markets Finance and Trade, 56(6), 1351–1376. doi:10.1080/1540496X.2018.1562889.

[49] Teplova, T. V., & Sokolova, T. V. (2019). Building the Index of Efficiency of FDI Transformation: Economic Development and Intellectual Capital. Emerging Markets Finance and Trade, 55(10), 2164–2184. doi:10.1080/1540496X.2018.1525356.

[50] Piermartini, R. (2004). The Role of Export Taxes in the Field of Primary Commodities; WTO Discussion Papers 4; World Trade Organization (WTO), Economic Research and Statistics Division: Geneva, Switzerland.

[51] N. Isanzu, J. (2015). Impact of Intellectual Capital on Financial Performance of Banks in Tanzania. Journal of International Business Research and Marketing, 1(1), 17–24. doi:10.18775/jibrm.1849-8558.2015.11.3002.

[52] Sumedrea, S. (2013). Intellectual Capital and Firm Performance: A Dynamic Relationship in Crisis Time. Procedia Economics and Finance, 6, 137–144. doi:10.1016/s2212-5671(13)00125-1.

[53] Edvinsson, L. (1997). Developing intellectual capital at Skandia. Long Range Planning, 30(3), 366–373. doi:10.1016/s0024-6301(97)90248-x.

[54] Erik Sveiby, K. (1997). The Intangible Assets Monitor. Journal of Human Resource Costing & Accounting, 2(1), 73–97. doi:10.1108/eb029036.

[55] McDowell, W. C., Peake, W. O., Coder, L. A., & Harris, M. L. (2018). Building small firm performance through intellectual capital development: Exploring innovation as the "black box." Journal of Business Research, 88, 321–327. doi:10.1016/j.jbusres.2018.01.025.

[56] Kamukama, N. (2013). Intellectual capital: Company's invisible source of competitive advantage. Competitiveness Review, 23(3), 260–283. doi:10.1108/10595421311319834.

[57] Pulic, A. (2000). VAIC - An accounting tool for IC management. International Journal of Technology Management, 20(5–8), 702–714. doi:10.1504/ijtm.2000.002891.

[58] Stewart, T., & Ruckdeschel, C. (1998). Intellectual capital: The new wealth of organizations. Performance Improvement, 37(7), 56–59. doi:10.1002/pfi.4140370713.

[59] Ahmed, S. S., Guozhu, J., Mubarik, S., Khan, M., & Khan, E. (2020). Intellectual capital and business performance: the role of dimensions of absorptive capacity. Journal of Intellectual Capital, 21(1), 23–39. doi:10.1108/JIC-11-2018-0199.

[60] Wang, X., Sadiq, R., Khan, T. M., & Wang, R. (2021). Industry 4.0 and intellectual capital in the age of FinTech. Technological Forecasting and Social Change, 166, 120598. doi:10.1016/j.techfore.2021.120598.

[61] Lee, C. C., & Lin, C. K. (2019). The major determinants of influencing the operating performance from the perspective of intellectual capital: Evidence on CPA industry. Asia Pacific Management Review, 24(2), 124–139. doi:10.1016/j.apmrv.2018.01.006.

[62] Li, X., Nosheen, S., Haq, N. U., & Gao, X. (2021). Value creation during fourth industrial revolution: Use of intellectual capital by most innovative companies of the world. Technological Forecasting and Social Change, 163, 120479. doi:10.1016/j.techfore.2020.120479.

[63] Saeidi, P., Saeidi, S. P., Gutierrez, L., Streimikiene, D., Alrasheedi, M., Saeidi, S. P., & Mardani, A. (2021). The influence of enterprise risk management on firm performance with the moderating effect of intellectual capital dimensions. Economic Research-Ekonomska Istrazivanja, 34(1), 122–151. doi:10.1080/1331677X.2020.1776140.

[64] Jayabalan, J., Dorasamy, M., Raman, M., Sambasivan, M., & Harun, S. (2021). Unleashing frugal innovation in private higher education institutions via intellectual capital: a systematic literature review. F1000Research, 10, 1109. doi:10.12688/f1000research.73329.1.

[65] Khalique, M., Bontis, N., bin Shaari, J. A. N., & Isa, A. H. M. (2015). Intellectual capital in small and medium enterprises in Pakistan. Journal of Intellectual Capital, 16(1), 224–238. doi:10.1108/JIC-01-2014-0014.

[66] Abuseta, H., Iyiola, K., & Aljuhmani, H. Y. (2025). Digital Technologies and Business Model Innovation in Turbulent Markets: Unlocking the Power of Agility and Absorptive Capacity. Sustainability, 17(12), 5296. doi:10.3390/su17125296.

[67] Musman, M., Muda, S., Hussin, A. H., Ismail, N., Mohamed Sadique, R. B., & Saleh, S. H. (2025). A Decade of research on intellectual capital and SMES performance in the ASEAN region: a bibliometric analysis of its impact. Future Business Journal, 11(1), 189. doi:10.1186/s43093-025-00614-7.

[68] Pal, K., & Soriya, S. (2012). IC performance of Indian pharmaceutical and textile industry. Journal of Intellectual Capital, 13(1), 120–137. doi:10.1108/14691931211196240.

[69] Mohammad, H. S., & Bujang, I. (2019). Does intellectual capital influence firms' financial performance? A comparative analysis into three Malaysian industries. International Journal of Business and Society, 20(1), 260–276.

[70] Sadalia, I., Daulay, I. E., Marlina, L., & Muda, I. (2019). The influence of intellectual capital towards financial performance with brand value as an intervening variable. Quality - Access to Success, 20(168), 79–85.

[71] Vidyarthi, H. (2019). Dynamics of intellectual capitals and bank efficiency in India. Service Industries Journal, 39(1), 1–24. doi:10.1080/02642069.2018.1435641.

[72] Wang, M. H., & Che, H. C. (2024). Intellectual capital forecasting for invention patent through machine learning model. Journal of Intellectual Capital, 25(7), 129–150. doi:10.1108/JIC-12-2023-0286.

[73] Ousama, A. A., & Fatima, A. H. (2015). Intellectual capital and financial performance of Islamic banks. International Journal of Learning and Intellectual Capital, 12(1), 1–15. doi:10.1504/IJLIC.2015.067822.

[74] Akgün, A. İ., & Türkoğlu, S. P. (2024). Intellectual capital and performance of listed firms during the global financial crisis: the effects of legal origin. International Journal of Organizational Analysis, 32(4), 759–785. doi:10.1108/IJOA-01-2023-3587.

[75] Zeinali, K., Zadeh, F. H., & Hosseini, S. H. (2019). Evaluation of the impact of information technology capital and intellectual capital on future returns of companies in the capital market. International Journal of Learning and Intellectual Capital, 16(3), 239–253. doi:10.1504/IJLIC.2019.100541.

[76] Amitrano, C. C., Hani Gheith, M., Troise, C., & Cappa, F. (2025). Individual and organizational intellectual capital, ESG dimensions and competitive advantage: a focus on Italian SMEs. Journal of Intellectual Capital, 1–21. doi:10.1108/jic-12-2024-0411.

[77] Dwiputri, R. M., Suyono, E., & Laksana, R. D. (2023). Intellectual capital, green innovation, and financial performance: The mediating role of sustainability. International Journal of Management and Sustainability, 12(3), 448–462. doi:10.18488/11.v12i3.3477.

[78] Sydler, R., Haefliger, S., & Pruksa, R. (2014). Measuring intellectual capital with financial figures: Can we predict firm profitability? European Management Journal, 32(2), 244–259. doi:10.1016/j.emj.2013.01.008.

[79] Sardo, F., & Serrasqueiro, Z. (2017). A European empirical study of the relationship between firms' intellectual capital, financial performance and market value. Journal of Intellectual Capital, 18(4), 771–788. doi:10.1108/JIC-10-2016-0105.

[80] Cenciarelli, V. G., Greco, G., & Allegrini, M. (2018). Does intellectual capital help predict bankruptcy? Journal of Intellectual Capital, 19(2), 321–337. doi:10.1108/JIC-03-2017-0047.

[81] Weqar, F., Sofi, Z. A., & Haque, S. M. I. (2020). Nexus between intellectual capital and business performance: evidence from India. Asian Journal of Accounting Research, 6(2), 180–195. doi:10.1108/AJAR-07-2020-0064.

[82] Yousaf, M. (2022). Intellectual capital and firm performance: evidence from certified firms from the EFQM excellence model. Total Quality Management and Business Excellence, 33(13–14), 1472–1488. doi:10.1080/14783363.2021.1972800.

[83] Daraba, D., Wirawan, H., Salam, R., & Faisal, M. (2021). Working from home during the corona pandemic: Investigating the role of authentic leadership, psychological capital, and gender on employee performance. Cogent Business and Management, 8(1), 1885573. doi:10.1080/23311975.2021.1885573.

[84] Torre, C., Tommasetti, A., & Maione, G. (2020). Technology usage, intellectual capital, firm performance and employee satisfaction: the accountants' idea. TQM Journal, 33(3), 545–567. doi:10.1108/TQM-04-2020-0070.

[85] Abdallah, A. S., Amin, H., Abdelghany, M., & Elamer, A. A. (2025). Antecedents and consequences of intellectual capital: a systematic review, integrated framework, and agenda for future research. Management Review Quarterly, 75(4), 3067–3118. doi:10.1007/s11301-024-00454-9.

[86] Yin, J., & Xu, J. (2025). Intellectual capital, digital transformation and firms' financial performance: Evidence from ecological protection and environmental governance industry in China. PLoS ONE, 20(1), 316724. doi:10.1371/journal.pone.0316724.

[87] Soewarno, N., & Tjahjadi, B. (2020). Measures that matter: an empirical investigation of intellectual capital and financial performance of banking firms in Indonesia. Journal of Intellectual Capital, 21(6), 1085–1106. doi:10.1108/JIC-09-2019-0225.

[88] Zaidi, S. F. H., Ali, O., & Thanasi-Boçe, M. (2023). Factors Influencing Consumer Acceptance of Mobile Payment during the COVID-19 Pandemic & Usage Continuance Intent: A Quantitative Study. Emerging Science Journal, 7(5), 1551–1573. doi:10.28991/ESJ-2023-07-05-07.

[89] Bikker, J. A., & Vervliet, T. M. (2018). Bank profitability and risk-taking under low interest rates. International Journal of Finance and Economics, 23(1), 3–18. doi:10.1002/ijfe.1595.

[90] Ting, I. W. K., & Lean, H. H. (2009). Intellectual capital performance of financial institutions in Malaysia. Journal of Intellectual Capital, 10(4), 588–599. doi:10.1108/14691930910996661.

[91] Urosević, A., Dukić, A., & Markovic, Z. (2024). The impact of intellectual capital on ROA as a significant indicator of financial performance. BizInfo Blace, 15(1), 27–34. doi:10.5937/bizinfo2401027u.

[92] Githaiga, P. N. (2023). Intellectual capital and bank performance: the moderating role of income diversification. Asia-Pacific Journal of Business Administration, 15(4), 509–526. doi:10.1108/APJBA-06-2021-0259.

[93] Demartini, M. C., & Beretta, V. (2020). Intellectual capital and SMEs' performance: A structured literature review. Journal of Small Business Management, 58(2), 288–332. doi:10.1080/00472778.2019.1659680.

[94] Mondal, A., & Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. Journal of Intellectual Capital, 13(4), 515–530. doi:10.1108/14691931211276115.

[95] Pirogova, O., Voronova, O., Khnykina, T., & Plotnikov, V. (2020). Intellectual capital of a trading company: Comprehensive analysis based on reporting. Sustainability (Switzerland), 12(17), 7095. doi:10.3390/su12177095.

[96] Ul Rehman, W., Ur Rehman, H., & Mujaddad, H. G. (2016). Level of Intellectual Capital Disclosure Across Indian and Pakistani Companies. Pakistan Economic and Social Review, 54(1), 81–96. https://www.jstor.org/stable/26616700

[97] Mukaro, C. T., Deka, A., & Rukani, S. (2023). The influence of intellectual capital on organizational performance. Future Business Journal, 9(1), 31. doi:10.1186/s43093-023-00208-1.

[98] Skhvediani, A., Koklina, A., Kudryavtseva, T., & Maksimenko, D. (2023). The Impact of Intellectual Capital on the Firm Performance of Russian Manufacturing Companies. Risks, 11(4), 76. doi:10.3390/risks11040076.

[99] Janošević, S., Dženopoljac, V., & Bontis, N. (2013). Intellectual capital and financial performance in Serbia. Knowledge and Process Management, 20(1), 1–11. doi:10.1002/kpm.1404.

[100] Dsouza, S., K, K., Kayani, U. N., & Nasseredine, H. (2023). Variables that sway the capital structure! Evidence from the US automotive industry. Cogent Social Sciences, 10(1), 2293309. doi:10.1080/23311886.2023.2293309.

[101] Habibniya, H., Dsouza, S., Rabbani, M. R., Nawaz, N., & Demiraj, R. (2022). Impact of Capital Structure on Profitability: Panel Data Evidence of the Telecom Industry in the United States. Risks, 10(8), 157. doi:10.3390/risks10080157.

[102] Demiraj, R., Dsouza, S., & Abiad, M. (2022). Working Capital Management Impact on Profitability: Pre-Pandemic and Pandemic Evidence from the European Automotive Industry. Risks, 10(12), 236. doi:10.3390/risks10120236.