The Influence of Intellectual Capital on Financial Performance: Quantile Analysis Approach

Rola Nowar[a]

[a] Faculty of Commerce, Cairo University, Egypt

Abstract

Intellectual capital (IC) is being increasingly investigated in fields experiencing change. In management accounting, such changes are visible in areas like strategic management accounting, and environmental management accounting. The relevance of non-financial information is increasingly greater, seeking information from intangible assets that can be used to judge the market value of firms. Given the importance of the theme and consistent growth of intangible assets in today's economy, this research aims to explore the influence of IC components on the financial performance of Egyptian firms listed in EGX100. To investigate the relationship between IC and firms' financial performance, secondary data were collected from Thomson Reuters DataStream for a sample of 30 firms listed in EGX 100, from 2017 to 2023 resulting in panel data of 210 firm-year observations. Quantile regression analysis is employed to explore the relationship between each component of IC and firms' financial performance. Quantile regression models revealed that not all the quantile models have the same calculated significance value (P-value) regarding the relationship between IC components (Value added human capital VAHC, Value added structural capital VASC, Value added relational capital VARC, Value added capital employed VACE) and financial performance measures represented by Return on Equity ROE, Return on Assets ROA, Earning per Share EPS, Price to Book ratio P/B ratio, and Tobin's Q. Modified Value Added Intellectual Coefficient (MVAIC) also have a positive significant impact on EPS, P/B, and Tobin's Q. Firm size is negatively and significantly related to accounting-based measures, firm age has a positive impact on accounting-based measures while leverage have negative relationship with most financial performance measures. Size of the sample, and the exclusion of financial institutions from the sample represent the main research limitations. The research contributes to literature through measuring the total and individual influence of the four components of IC on firms' financial performance using Quantile Regression Analysis which has not been employed before in investigating the relationship between IC and financial performance of Egyptian listed firms.

Keyword: quantile regression analysis; intellectual capital; human capital; structural capital; relational capital; capital employed; financial performance, EGX100.

1. Introduction

Raised production technology, financial market concerns with traditional business issues, improvement of customer satisfaction, and new product development are

now recognized to be firms' fundamental problems. Therefore, firms are beginning to understand and feel the need to manage their intellectual capital (IC) components and implement ways to achieve superior potential performance (Ahmed et al., 2020; Alvino et al., 2021; Salvi et al., 2020).

IC has played a crucial role in the value creation process of today's leading organizations. A firm's performance has been influenced by the existence of investment in IC. The emergence of IC has changed the information age into the creativity era. The major Nobel Prizes in Economic Sciences not only reveal the importance of knowledge for economic development but also confirm the importance of intangibles and IC of the world's largest companies as one of the most valuable assets. According to the International Accounting Standards (IASs), companies must highlight the importance of their advanced technology, strong brand name, and well-educated and experienced employee workforce. Thus, the key is to invest in IC that includes a firm's computer information systems for assessing accounting and reporting on the basis of knowledge assets (Shahwan & Habib, 2020; Ali et al., 2022; Desoky and Mousa, 2020).

Researchers are shifting to integrated reporting, the latest idea of an annual report, which emphasizes the importance of IC. Intellectual human resource is now being widely acknowledged as crucial and critical to business competitiveness as natural capital, therefore, it should be an input to the organization's value creation process (Obeidat et al., 2021). Analyzing the fair value of the firm's human capital, and employing fair value concepts, represent staff as assets (either identified or unidentified) and conveys their inherent shortage in the labor market. Any of the firm's present and potential employees' essential characteristics are represented by this fair value. Intangible assets as IC and/or goodwill or patents are included in the balance sheet of a firm. The task of intangible assets valuation is amongst accountants' most critical issues (Widiatmoko et al., 2020; Baker et al., 2022)

In general, IC refers to the internal resources that are essential in creating and maintaining the value of firms. The concept of IC is multidimensional because it encompasses various resources including employees' knowledge, skills, and abilities that distinguish one firm from another. Intellectual property, patents, and copyrights are the most important forms of IC (Paoloni et al.2020; Oliveira et al.2020). IC is a blend of knowledge management and human capital. Knowledge management is more concerned, for example, with organizational culture and knowledge that all employees share, while human capital emphasizes the management of individuals' knowledge, skills, and abilities that distinguish one person from another (Obeidat et al.2021)

Unfortunately, there is no consistent definition of IC. A lack of consistency can lead to confusion and misunderstanding among researchers, practitioners, financial professionals, and other interested parties. Researchers often do not define IC when investigating the relationship between IC and financial performance (Pigola et al., 2022). Researchers assume that readers perceive the concept of IC in the same way.

However, a lack of consistency in the definition of IC has led to a lack of clarity and understanding of the concept that has polarized research findings regarding the relationship between IC and financial performance (Bellucci et al., 2021).

Literature has shown that three main components make up IC: human capital, structural capital, and relational capital. Human capital measures the contribution from individual employees in terms of knowledge, expertise, competencies, intentions, and individual effort for creating customer value and financial benefit (Gerhart & Feng, 2021). Typically, related measures are skills, judgment, tacit knowledge, training, and formal education. Training and expertise can be specified under the economic category of human capital as defined by Becker (1964). Behavioral researchers, on the other hand, have suggested that other features characterized education expenditure and production decision over time and individuals (Amjad et al.2021; Goldin, 2024).

Structural capital focuses on the components of IC that remain in the firm after the human capital has taken its part of the value creation pool. This can include organizational knowledge such as patents, copyrights, franchises, databases, code repositories, manuals, and publications. Relational capital can also be viewed from employees, connections to existing and potential business partners and clients (Jordão et al., 2020). Part of the relational capital represents the value of the relationship between the firm and its customers. It comprises the present value of projected future cash flows from existing and potential customers given a general customer profile. The customers aspect of the relational capital appears in the balance sheet of the firm incurring several acquisition and retention expenses over the lifetime of the customer (market intelligence, customer service) (Meyer, 2023; Duodu & Rowlinson, 2021).

IC represents an essential factor in creating sustainable business growth capabilities. IC is vital for an organization's long-term survival and growth because of post-industrial knowledge-based economies. Its relevance goes down to the micro level of today's individual firms. It supports financial success indirectly within the theory and empirical studies discussed (Ali and Anwar, 2021). In the financial field, it is considered an intangible asset. Therefore, a firm's financial success is believed to depend initially on an individual's knowledge and expertise in the form of human capital and other intangible assets. Researchers have also noted that if a firm wants to make a considerable change in the financial and business statistics, the appropriate utilization and management of its IC is essential (Beltramino et al., 2020; Obeidat et al., 2021).

Of the many factors/antecedents of firm financial performance, IC has been the interest of many researchers recently. Literature has been written and various statistical models used to reveal the impact and relationship of IC on firm financial performance. The influence of IC on the financial performance of the firm is the subject of an ongoing debate. Though many researchers have now agreed to the concept of the increasing importance of IC as a firm's value determinant and its

competitive advantage, no overall consensus has emerged yet, especially on the subject of the relationship between the components of the IC and the firm's financial performance and whether some components are more vital when compared to others (Xu & Liu, 2020; De Villiers & Sharma, 2020).

Egyptian firms are still in the early stage of applying modern information technology tools to witness significant IC development. Several firms are still relying on manual business processes to run their business needs. Majority of Egyptian firms, individuals, and governmental organizations are not familiar with IC proposals. Staff within the Egyptian firms have shown poor retention control and responsibility to identify the IC within their firms. In fact, intangible resources, which include IC, are more difficult to manage and achieve the ultimate end value of the firm (Shehata & Montash, 2020; Metawa et al., 2022; Khalifa et al., 2021).

The basic purpose of this research is to evaluate the influence of IC components, human capital; structural capital; relational capital, and capital employed on the financial performance of the Egyptian listed firms. In light of the increasing importance of intangible resources such as IC in creating firm value and sustaining the competitiveness of newly developed academic models, the research will use secondary data from Thomson Reuters DataStream to investigate and measure the relationship between each component of IC and firm financial performance. The research sample includes 30 firms listed on EGX 100 in a period spanning from 2017 to 2023. The research focus on the influence of each IC component on financial performance to identify areas that need to be developed in order to enhance performance. This can highlight the system's vulnerabilities and strengths of IC (Cartaxo et al., 2023; Arroyo-Barrigüete et al., 2023; Sharp & Munly, 2022). The research aims to contribute to literature through measuring the total and individual influence of the four components of IC on a firm's financial performance using Quantile Regression Analysis which has not been employed before regarding the relationship between IC and financial performance of Egyptian firms.

The next section provides theoretical framework, and hypotheses development. The research method including sample, data collection, variables measurement and research model is addressed in the third section. The empirical results are discussed in section four. Finally, the conclusion section.

2. Theoretical framework and hypotheses development

The existing literature underlines that the disclosure of the IC has a positive impact on the quality of the financial reporting (Salvi et al.2020; De Villiers & Sharma, 2020; Ali et al.2022), however, most of the studies highlight that IC is not accounted for at market value in most of the cases because of the absence of clear, homogeneous and easily measurable indicators. Mousa (2015) and Jarrar and Abu Zaid (2016) highlighted the shortage of empirical research for the efficiency of financial performance of IC in emerging economies like Egypt.

2.1 Theoretical framework / Theories underlying the relationship between IC and firm performance

The theories underlying accounting literature are many in general and management accounting in particular. There is an agency theory that looks at solving problems of conflict of interest, contingency theory that looks at the determinants that surround the firm and impose on it a particular pattern or performance, the institutional theory that looks at transferring the successes of other businesses to another. Resource-based view theory highlights and predicts the fundamentals of firm performance and achieving competitive advantage. Knowledge-based view theory stresses the strategic role of knowledge into the firm that should be managed in order to achieve a competitive advantage. However, this research adopts both resource-based view theory and knowledge-based view theory.

Resource-based view Theory

The resource-based view theory is a theoretical framework that is widely used in the areas of strategic management and the evaluation of a firm's performance. This theoretical framework was developed in the 1980s and 1990s when several academic studies were dedicated to addressing the issue of what makes some firms more successful than others. There is insufficient evidence that the competitive advantage theory explains why some firms are successful in comparison to others in satisfying the market, especially in an environment characterized by rapid changes, globalization, and product innovation (Barney et al.2021; Pereira & Bamel, 2021; Lubis, 2022).

The success of a firm is based on resources because a resource is defined as productive assets owned by a firm, such as the existence of patents, a strong brand, the experience of specialists, specific information, knowledge, and the skills of employees. Besides that, the solutions of other theories are focused on the environmental and context aspects but neglect the internal organization that is responsible for using the environmental and context resources, which can be considered unique based on existing processes and routines, causality, and investment, as knowledge capital (Semieniuk et al.2022; Mayer, 2021). Consequently, firms need to develop a body of knowledge to excel in everyday tasks, and this refers to using employees to create, propagate, and develop their knowledge using resources (Miranti2022).

Knowledge-based view theory

According to this theory, knowledge is the most strategically significant resource. The managerial challenge of the firm is to manage knowledge both as a meaningful purpose and as a source of human and strategic action. The knowledge-based view of the firm suggests that competitive advantages are generated by the human capital, internal capabilities, and specific resources (Pereira & Bamel, 2021). The theory indicates that capability or resource-based competitive advantage is valuable. It discusses those capabilities as factors which are responsible for the performance

difference. Successful managers must, therefore, work hard to identify and manage these capabilities effectively (Cooper et al., 2023; Grant & Phene, 2022).

This theory compels firms to put less emphasis on financial results and more on the role of IC knowledge because it is considered as the most significant source of knowledge which could provide superior performance. The real challenge under this theory is to transform assets in terms of knowledge such that knowledge creation becomes an ongoing sustainable process and a permanent, ever-growing financial and market value-producing activity (Ahmed et al.2020; Salvi et al.2020). The knowledge-based view of the firm defines the hierarchical mapping process that demonstrates the interaction of knowledge. It consists of four consecutive levels about how knowledge and its associated strategic human resource management (SHRM) progressively develop and shape the nature of human resource management. At the core of these four levels is the embedded tenet that value-adding activities are fueled by human and intellectual assets. Organizations that recognize the symbiotic relationship and intricate links between knowledge and SHRM are well positioned to create value for their stakeholders (Xu & Liu, 2020).

2.2 IC components

The components of the IC addressed in the accounting literature are varied and multiple. IC includes for example Human Capital, Customer Capital, Structural Capital, Social Capital, Technological Capital, Spiritual Capital (Khalique et al., 2011). Although there are multiple IC components, there is consensus that the IC consists of: three main components: human capital, structural capital, relational capital.

Human capital is the value-added that each employee generates because of their skills and competencies. It differs from IC in that it can be evaluated in terms of labor market values. At the level of the firm, the value of the IC lies in its employees, that is, in the people who apply their knowledge to solve problems, design, market and sell products or services. Human capital measures the costs of training, staffing, etc., and cannot be separated from human abilities, neither is easily transferable beyond the border of the firm (Goldin, 2024; Lise & Postel-Vinay, 2020; Wachter, 2020).

In essence, human capital refers to the skills, knowledge, creativity, and wisdom of the employees, managers, and all other staff of a firm. In other words, human capital encompasses attributes and contributions such as experience, education, expertise, intellectual capabilities, and competencies. Intellectual capabilities refer to skills of keeping consistency, according to the potential to use and actual use in all same periods. It had been controversial what type of expenses included in human capital. Cost type expenses, running type expenses like training, and education were important, where products include intellectual gain (Flores et al., 2020). Organization and retention of attracting expertise and talented individuals are considered to be important parts of the efforts aimed at improvement of human capital creation. Human capital creation is defined as a process of building and increasing the favorable values of personal and technical knowledge (Jafari-Sadeghi et al., 2020). Thus, the guidance of experts and talented individuals in acquiring

knowledge, the key parameter will be the investment necessary to achieve the benefits created by such learning (Goldin, 2024). However, there are few studies that have investigated this relationship between human capital and financial performance of the firm. Thus, the first hypothesis is:

H_{01}: Value added human capital VAHC as a component of IC has no significant influence on firms' financial performance

Structural capital on a material level really takes a physical shape in organizational blueprints and patents. Organizational hierarchies, routines, organizational culture, and management processes require varying resources and time. It has a cognitive element structured according to an abstract blueprint, different from human capital, and can take a firm identity belonging to the organization (Crouzet et al.2022; Ausat et al.2023). Like physical or human capital, structural capital also earns money. Intangible both in creation and evaluation, firm identity, penetration, and customer goodwill earnings through performance and product life cycle in the brand are indicators of structural capital (Delfanti & Frey).

While professionally structural capital is very much part of an organization, problems occur when, due to frequent mergers and restructuring, the firm's hierarchy comes in the way of agility and decision-making. This need to change has led to the increased understanding of the need to have an organization built for agility and competence. This arguably is the role of structural capital, of which training, skills trade, and organizational structuring are components (Mahmood & Mubarik, 2020; Ausat et al.2023; Sarwenda, 2020).

While over time individual employees and managers may come and go, organizational structural capital can be relatively stable. An R&D process may evolve with the research being guided by organizational memory and organizational tasks being facilitated by patents, blueprints, and protocols. The community within the firm appreciates organization goodwill (which shows efficiency and earnings), and community members also act to create goodwill. Frequent changing of the firm's organizational structural model can wear out organizational memory, thereby suppressing efficiency and innovation in the organization and the products. Organizational training and organization cultures are a means to preserve and enhance organizational memory and hence firm investment and resources.

Structural capital has an intimate relationship with human resources and organizational processes, and unlike the former, adds value to the firm. Quantifiable factors like organizational hierarchy, standard procedures and protocols, patents, trademarks, and copyright cannot survive by themselves. The proofs of their effectiveness are evident only in relation to the commitment and motivation of the people involved in the process (Beltramino et al., 2020; Pradana et al., 2020; Yusliza et al., 2020). However, there are few studies that have investigated relationship between structural capital and financial performance of the firm. Thus, the second hypothesis is:

H_{02}: Value added structural capital VASC a component of IC has no significant influence on firms' financial performance

Relationships based on trust, formal exchanges, and collaboration mechanisms were some of the functions of social capital that could be adequately exploited in the structure of the modern firms. They had the ability to generate more profit for the firm, contributing to its strategic positioning in the market (Alshwayat et al.2021; Zhang et al.2021; O'Connor et al., 2020).

Value is not added just by reducing costs, but by managing relationships and fostering a trust climate. By managing day-to-day transactions, large implicit costs such as that resulting from distrust are reduced (Huang et al., 2021; Ozgun et al., 2022). In the case of clients, trust between the customer and the supplier can lead to transaction cost reductions, increased satisfaction, and the development of more business (Salehi et al., 2022). In the case of suppliers, trust tends to delivery deadlines and good performance, which are important in the provision of value chains (Huang et al., 2020; Roeck et al.2020; Padgett et al., 2020). However, there are few studies that have investigated relationship between relational capital and financial performance of the firm. Thus, the third hypothesis is:

H_{03}: Value added relational capital VARC as a component of IC has no significant influence on firms' financial performance.

Firms are established in order to make profits by developing their firm-related activities and consuming goods and services. Firms main aim is to use the factors of production (labor, capital, and management) efficiently, which constitute the capital employed CE, to maximize the welfare of shareholders, and earn long-term sustainable profit. In broad terms, the ability of a firm to create value can be assessed by the efficiency of the factors it uses. Thus, the fourth hypothesis is:

H_{04}: Value added capital employed VACE has no significant influence on firms' financial performance.

2.3 IC and financial performance

IC is regarded as one of the prime determinants of financial performance in the knowledge-based global economy. It has received a lot of attention from various stakeholders such as investors, customers, employees, and employers to visualize its impact on financial performance because it is perceived as a driver of a firm's stock price (Ousama et al., 2020). It also affects a firm's stock price and can be a measure of its success. The driving force behind this concept is that customers have shifted from cost to value-based consumption, and investors demand it as a substitute for all the financial balances. Despite the extensive attention to explore the extent of this relation, there is still a need to conduct more investigation to conclude a lot of mixed results (Xu & Liu, 2020; Ahmed et al., 2020).

The relationship between IC and financial performance has grown dramatically in the last decades. The market is more concerned about the firm's intangible capital than cash and physical assets. Customers, suppliers, employees, and technology are

increasingly recognized to be more important ways to profit than cost control, margin improvement, capacity utilization, or cycle time reduction. IC represents a firm's future earning capability, and it is the only measure that can indicate whether a firm will survive in the future (Xu & Liu, 2020; Ahmed et al., 2020; Hutahayan, 2020).

The relationship between IC and financial market is multi-disciplinary research, thus a significant body of literature tackle the association from different frameworks and contexts. Many of these studies have been conducted using both the value driver theory framework and the measures of IC (Dumay et al., 2020; Serenko & Bontis, 2022; Chen & Wu, 2020).

Many authors have focused on financial markets in their studies of the effect of IC on firm value, and the dependent variable for many research efforts has been the stock market value measured by market to book ratio, and the Tobin Q ratio. The result of most of this research shows that the market value can be explained by financial measures as well as the concepts of the IC approach (Sukesti et al., 2021; Jihadi et al., 2021; Sari and Sedana, 2020). Firms that are capable of developing and utilizing effective relationships with their market partners and customers have significant advantages over their competitors. Technological investments, employees' competence, customer and marketing processing capability, brand and product reputation, brand equity, are the important factors through which firms can achieve sustainable competitive advantage (Aggarwal, 2020; Tarigan et al., 2021; Ferraris et al., 2020).

Subsequent studies on the relationship between IC and firm performance have garnered useful implications, recognizing that IC is the most essential driver of wealth and growth. In fact, evaluating firm performance based on tangible-assets measures, do not provide a comprehensive picture of how great firms perform and differ from competitors (Xu & Liu, 2020). Firms tend to rely increasingly on intangible assets rather than tangible-assets or traditional physical and financial assets. Alvino et al. (2021) revealed a positive relationship between IC and financial performance. IC is a confidential source of competitive advantage and financial performance in the high-tech industry (Prasetyo and Kistanti, 2020).

However, prior studies addressing the relationship between IC and financial performance have garnered mixed implications as a result of diverse research methodologies, sample characteristics, and exchange economies. IC, as non-financial performance measures, is significantly related to the firm's future value compared to traditional financial measures (Salvi et al., 2020; Xu & Liu, 2020; Kadim et al., 2020). Chen et al. (2005) provided empirical evidence regarding the relationship between structural capital and firm performance across 57 human-resource-based firms listed on the Toronto stock market. The results revealed a positive relationship between structural capital and firm performance, which provided the "micro" evidence for the role of IC as drivers of firm performance.

Most previous studies have investigated the relationship between IC and financial performance directly. However, few studies have investigated the mediating effect

of innovation on the relationship between IC and financial performance. Researchers suggest that IC can generate economic value for a firm only if it applies this knowledge through its business processes to innovate products and services that meet customer needs. Thus, IC may enhance a firm's financial performance or, ultimately, create value by enhancing its capabilities to innovate (Wang et al., 2021; Ozgun et al., 2022; Aljuboori et al., 2021)

A previous study indicated that IC can be an important antecedent of innovation for high-tech firms. The outputs of the IC components can be transformed into types of knowledge. Knowledge, which is seen as an IC component, helps firms develop a capability to compete effectively in the market. As for the capability of a firm, it covers the skills in process development, skills in human resource management, and skills in using advanced technology. The effect of human resource management on the financial performance in technology-intensive industries is determined by embedded R&D activities (Xu & Liu, 2020). Furthermore, patents can be regarded as significant evidence for innovation, and R&D activities represent the innovation ability to obtain patents. Intangible assets created by human knowledge and skills in intellectual development can undoubtedly promote innovation (Obeidat et al., 2021; Ahmed et al.2020).

Accounting literature did not only address the direct influence of IC on the financial performance of the firm or on the mediating influence of IC on relation to the firm performance, but rather extended the literature to address the moderated influence of IC on the financial performance of the firm. Property rights achievements, financial risk, and firm size are three possible sources of disparity in the impact of promoting IC. Property rights may offset IC. The impact of IC on performance should be enhanced where policies are designed to foster firm IC. Property rights have an enhancement effect on the influence of innovative capital and structural capital on financial performance as well as innovation performance. The elements of IC are important for firm value and economic benefits (Neves et al., 2021; Khurshid et al., 2022; Liu et al., 2021). Small and middle-sized firms prefer new methods that will enable them to improve their IC. Small and middle-sized firms especially have a surprising ability to employ and improve their human capital capability. The IC concept is based on the systematic creation of value and sparking innovation. This means the economic environment in which the organization is inserted is the factor that makes it create an economy of knowledge (Xu & Liu, 2020; Marzo & Bonnini, 2023).

2.4 IC and management accounting

Management accounting is the one profession that can provide interfaces for and report on IC investments and results in cumulative data that is both financial and non-financial. Although the inherent characteristic of management accounting deals with valuing IC, relatively little research addressing management accounting techniques either traditional or strategic or IC studies has considered and integrated the relationship between IC and management accounting techniques. IC is an

explicit definition of knowledge, competence, and the emerging occurrence of intangible assets. As such, it is a volatile mix of information, knowledge, experience, drive, and potential. Modern firms rely on IT-based knowledge communication and management accounting systems to deliver value in terms of creating products, services, and enhancing shareholder wealth (Hutahayan, 2020; Asiaei et al.2022; Paoloni et al.2020).

IC, among the most critical resources of a firm, has a direct effect on the strategic performance of a business. At the same time, management accounting, by providing information required to manage this resource, has an important role in the efficient and effective use of IC (Dumay et al., 2020). Mouritsen et al. (2005) analyzed the utilization of IC information in management accounting models. They examined the compatibility and identified the strengths and weaknesses of the Sveiby model and the balanced scorecard, in establishing the standard for IC. Additionally, they assessed standard indicators to aid firms in reducing expenses associated with non-material assets by determining their IC paying capacity.

Literature presents various approaches to the integration of management accounting and IC management into one management concept, such as activity-based costing (ABC) and resource-based management (RBM), balanced scorecard (BSC), linking IC and knowledge management, and intellectual asset valuation. The relationship between IC and accounting has been studied mainly from a financial reporting perspective in previous studies (Hutahayan, 2020; Asiaei et al.2022). However, there are few studies that have actually tried to present practically oriented tools of IC management to support management accounting. Integrated evidence gathered through survey research and case studies of how investors use the developed management accounting techniques for performance analysis and evaluation is also lacking (Nicholls2020; Alabdullah2022; Alvarez et al.2021).

Management accountants are now seen as business partners and possess specific analytical techniques that can contribute significantly to the management of knowledge that is the foundation of the IC. Management accountants may, however, be viewed in a more strategic perspective unique from other support service professionals as they are in a unique position to help firms deal with not only its general value orientation but also with the specifics of its IC (Hadid & Al-Sayed, 2021). It is precisely management accountants' familiarity with data and the behavior of organizations using these data that can contribute materially to understand the IC problems and challenges (Kroon et al.2021; Andreassen, 2020). Management accountants can help link the organization investment in its knowledge organization to business performance. They can also provide a critical integrating business perspective on the dual impacts of the organizations rewards and information technology on the management of the knowledge workers that form the knowledge organization (Albertini et al.2021; Abeysekera, 2021).

Moreover, practical-oriented tools for management accounting of IC, developed by integrating management accounting and IC management, will enable management

to identify the value drivers that are the direct contributors to the creation of the firm economic value. This will no longer depend only on the external assessment of such value by the investors. It will also help investors to select self-determined value drivers and their key performance indicators in the course of performance analysis and evaluation when they are making decisions about the investment attractiveness of firms (Dumay et al., 2020; Hutahayan, 2020; Nguyen and Doan, 2020).

Regarding management accounting techniques and IC measurement, there are various methods for assessing intangible assets and incorporating them into financial statements. One key distinction in the literature is the type of criteria used to evaluate these intangibles, which can be either qualitative or quantitative. The decision to use one over the other depends largely on whether the intangible asset has a market value or not. If it does, the asset can be valued using market prices and reflected in the financial accounts. If it does not have a market value, the firm may use widely accepted criteria or measurement models for its valuation (Barker et al., 2022; Xiong et al., 2022; Moro-Visconti, 2024).

The basic idea behind the concept of IC is to recognize and manage it. If the value creating capacity of IC needs to be achieved and effectively measured, then models should be developed and followed. Hence numerous researchers developed models that allowed firms to recognize and describe their IC. Some of these models are better than others, other models are very complex and difficult to use, and it can be concluded that many managers find it very difficult to implement these models (Jardon & Martinez-Cobas, 2021 ; Batubara et al.,2021 ; Zaytsev et al., 2020).

The most common traditional and conceptual IC measurement approches/models proposed in literature include: Leif Edvinsson's Skandia navigator, Balanced Scorecard, Skandia IC Management model, Balanced Business Scorecard, and Balanced performance Measurements (Benková et al., 2020; Ali and Anwar, 2021). Some of these IC measurement models, such as the Skandia navigator, Balanced scorecard with IC categories, and extended IC report, feature more than twenty indicators and effectively measure value-adding factors to capital. These measures have also been associated with explicit performance criteria. The use of these business applications has so far been successful in several leading organizations globally and has led to the actual creation of values and returns to investors (Kianto et al.2020).

Marr et al. (2004) divided IC measurement methodologies into three main theoretical models: (1) accounting or valuation based, (2) supplementary or concurrent figures, and (3) pure IC statements. The first measurement framework that received significant attention in the IC field is the multi-dimensional framework of Value-Added Intellectual Coefficient (VAIC) developed by Pulic (Hoang et al., 2020). Pulic measured the IC value with human, structural, and capital capabilities, using specific subfactors for evaluation of the structure of commonly used financial indicators (Rehman et al., 2024; Ali et al., 2021).

VAIC was proposed by Pulic in his doctoral thesis in 1998. It measures value added generated by a firm and the capital employed. The VAIC uses a set of major balance sheet and profit and loss account items instead of physical components of IC (Yousaf, 2022). Since they represent the 'hard results' in practice, the identified financial statements items can be used for the measurement of IC with reference to the following separate subcomponents: value added, human capital, structural capital, and capital employed. Pulic defined IC as the difference between the value added and the capital employed; in other words, the IC is expected to represent the firm's economic value in excess of that created by the capital employed (Kiraz & Açikgöz, 2021; Hussain et al., 2020).

The literature regarding the usage of VAIC has been in demand; empirical studies about both firms' and countries' datasets have been widely presented to indicate the profitability of the ratio for shareholders. However, these studies were not always consistent regarding the influence of each of these three main components of IC. Despite the literature that didn't not support some underlying assumptions of VAIC, and the fact that it didn't measure relational capital, the ratio was proved to be a relevant proxy for the value-creating intangibles of IC (Singla, 2020).

Numerous studies have been conducted to measure the intangible human capital of firms, with a focus on the tension between performance evaluation and the criteria used for these evaluations. The literature on the economics of human resources has highlighted the importance of understanding what is being evaluated and the messages conveyed to workers through these criteria and tasks. Some researchers consider these evaluation effects within wage theories, while others incorporate them into incentive theories (Van et al., 2022; Zhao et al., 2022). These effects are closely linked to information, evaluation, monitoring, control, and motivation, providing valuable insight into how a firm values its intangible human capital (Al-Delawi et al., 2023).

The role of relational capital in value creation is of significant strategic importance and should not be underestimated. Many firms dedicate significant efforts to strengthen their relationships with customers, effectively motivate employees, maintain positive partnerships with external firms, and improve knowledge sharing. The creation of value heavily depends on relational capital when tangible and intangible assets are utilized in complex services and processes for customers. However, human relations are intricate, implicit, and challenging to define and articulate, making them difficult to design and measure (Ritala et al., 2021; Zhang et al., 2020; Obeidat et al., 2021). Some researchers adopted the Modified Value-Added Intellectual Coefficient (MVAIC) model in order to address the shortcomings of the original VAIC model and to more fully measure value-added (Xu and Wang, 2018; Dalwai and Mohammadi, 2020). In addition to the three components of IC: human capital, structural capital, capital employed, relational capital is also incorporated in MVAIC (Xu and Wang, 2018; Dalwai and Mohammadi, 2020). Thus, the fifth hypothesis is:

H_{05}: MVAIC has no significant influence on firms' financial performance.

3. Research Method

3.1 Sample and data collection

To investigate the relationship between IC and firms' financial performance, data was collected from a sample of 30 firms listed in EGX 100 using Thomson Reuters DataStream, and depending on a cross-section time series (panel data) covering the period from 2017 to 2023, resulting in a total of 210 firm-year observations. The sample was limited to 30 firms based on two criteria. First, firm should not be operating within financials sector due to its high levels of leverage, and different nature of risks. Second, firms' annual financial statements' data, especially data relevant to IC components measures, should be available for at least five consecutive years. The sample was distributed across eight industries, including basic materials, consumer discretionary, consumer staples, energy, health care, industrials, real estate, and telecommunication. Table (1) presents the distribution of firms across the eight industry sectors.

Table (1) Distribution of sample across industry sectors

Sectors	Basic Materials	Consumer Discretionary	Consumer Staples	Energy	Health Care	Industrials	Real Estate	Telecom	Total
Frequency	35	21	42	7	14	21	56	14	210
Percent	16.70%	10%	20%	3.30%	6.70%	10%	26.70%	6.70%	100%

3.2 Research Model

Based on reviewing prior literature, the research model shows the relation among a set of variables which serves the research objective. Therefore, hypotheses are formulated within research model. Each hypothesis has a background addressed in the literature. Figure (1) shows the research model which includes two types of variables: main and control variables. Main variables include both IC components and firms' financial performance. Control variables include firm size, firm age, and leverage.

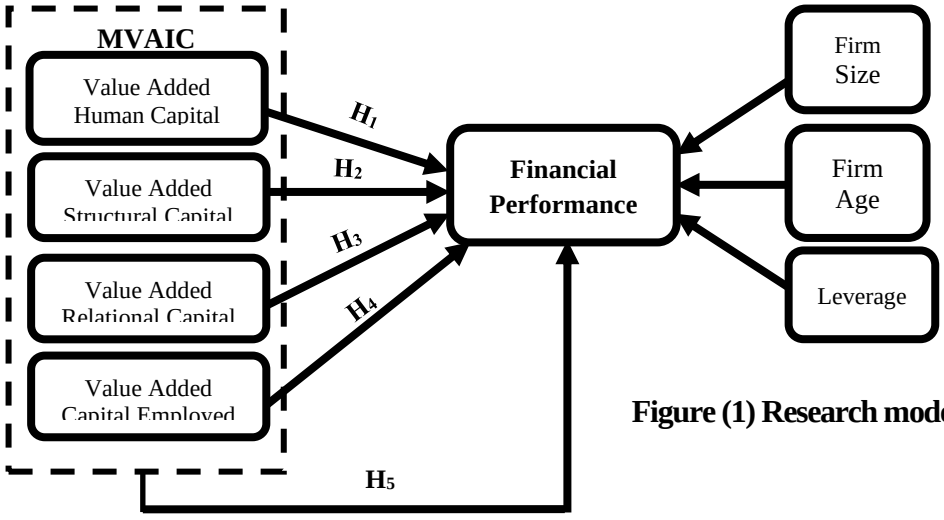

Figure (1) Research model

The relationship between IC and firm financial performance, as presented by the research model, has been investigated through the following two sets of equations. The first set of equations investigates the impact of four components of IC on each of the five indicators of firm financial performance, representing the first four hypotheses as follows:

$$Q_\tau(ROE_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} VAHC_{it} + \beta_{1\tau} VASC_{it} + \beta_{1\tau} VARC_{it} + \beta_{1\tau} VACE_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (1)$$

$$Q_\tau(ROA_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} VAHC_{it} + \beta_{1\tau} VASC_{it} + \beta_{1\tau} VARC_{it} + \beta_{1\tau} VACE_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (2)$$

$$Q_\tau(EPS_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} VAHC_{it} + \beta_{1\tau} VASC_{it} + \beta_{1\tau} VARC_{it} + \beta_{1\tau} VACE_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (3)$$

$$Q_\tau(P/B_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} VAHC_{it} + \beta_{1\tau} VASC_{it} + \beta_{1\tau} VARC_{it} + \beta_{1\tau} VACE_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (4)$$

$$Q_\tau(Tobin's\ Q_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} VAHC_{it} + \beta_{1\tau} VASC_{it} + \beta_{1\tau} VARC_{it} + \beta_{1\tau} VACE_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (5)$$

Where $Q_\tau(ROE_{it};\ ROA_{it}, EPS_{it}, P/B_{it,} Tobin's\ Q_{it}|\alpha_i, \varepsilon_{\tau it, x_{it}})$ is the τ^{th} quantile regression function on financial performance of the firm; α_τ are a constant term in each equation at each quantile τ; ROE, return on equity, ROA, return on Assets, EPS, earnings per share, P/B, price to book value, Tobin's Q, are indicators measuring financial performance; β_τ represents the coefficient estimate related to each quantile τ. However, the values 0.1, 0.5, and 0.9 are assigned to the quantiles of τ. $VAHC_{it}$ is the value added human capital for the firm i for the year *t*. $VASC_{it}$ is the value added structural capital for the firm i for the year *t*. $VARC_{it}$ is the value added relational capital for the firm i for the year *t*. $VACE_{it}$ is the value added capital employed for the firm i for the year *t*. Size is the size$_{it}$ of the firm i for the year *t*, Age_{it} is the age of the firm i for the year *t*, Lev_{it} is the leverage of the firm i for the year *t*, and ε_{it} is the random error of the equation.

The second set of equations investigates the impact of overall IC coefficient (MVAIC) on each of the five indicators of firm financial performance, representing the fifth hypothesis as follows:

$$Q_\tau(ROE_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} MVAIC_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (6)$$

$$Q_\tau(ROA_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} MVAIC_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (7)$$

$$(EPS_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} MVAIC_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (8)$$

$$Q_\tau(P/B_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} MVAIC_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (9)$$

$$Q_\tau(Tobin's\ Q_{it}|\ \alpha_i, \varepsilon_{\tau it, x_{it}}) = \alpha_\tau + \beta_{1\tau} MVAIC_{it} + \beta_{2\tau} Size_{it} + \beta_{3\tau} Age_{it} + \beta_{4\tau} Lev_{it} + \varepsilon_{it} \quad (10)$$

Where $MVAIC_{it}$ is the modified value-added intellectual coefficient for the firm i for the year *t*.

3.3 Variables measurement

Guided by the existing literature, the research model consists of IC, financial performance, and control variables. IC measured by four components human capital, structural capital, relational capital, and capital employed. Financial performance is measured by five indicators, in addition to firm size, firm age, and financial leverage representing control variables.

Measuring a firm's IC presents challenges, as researchers and business experts have different approaches//models and definitions. Some critics argue that current measures of IC focus too much on intangible assets, but there are financial measures to evaluate it, such as e capital rental, profit margins, and market-based returns are commonly used, and selling and marketing expenses. Managerial concerns are also influential in how IC is measured, as executives use this information to inform their decision-making processes. Following the studies that added the relational component as an IC component besides human capital, structural capital and capital employed (Xu and Wang, 2018; Dalwai and Mohammadi, 2020), the research use MVAIC.

Financial performance is measured through three accounting-based indicators; the return on equity (ROE), the return on assets (ROA), and earning per share (EPS), and two market-based indicators; price-to-book ratio (P/B), and Tobin's Q ratio. Variables such as average employee age, training, and education are frequently used to assess IC. Studies often highlight the importance of recognizing the talents and organizational memory of older workers, as well as the value of recruiting younger employees with fresh expertise. It is suggested that hiring and retaining young employees can add value to organizations (Ahmed et al., 2020; Rehman et al., 2022; Chatterjee et al., 2022). Firm-specific characteristics such as firm size, firm age, and firm leverage had been used in some studies addressing the impact of IC on financial performance as control variables (Skhvediani et al., 2023; Ali et al., 2022; Rona and Almilia, 2013). Table (2) identifies, and presents the measurement of research variables.

4. Data analysis

To avoid the consequences of the presence of conditional heteroscedasticity and to make the estimation of the entire conditional distribution of response variables, nonlinear models are used to allow the error distribution to change with the change of the observed data. Quantile regression (QR) is one of the methods that estimates location changes of a dependent variable. The QR aims to estimate the conditional quantile functions of a dependent variable given a set of regressors while assuming no distributional configuration for unobserved errors. The QR accommodates both heteroscedasticity and the presence of heavy tails in the error distribution through Huber Sandwich Estimator of variance. Previous studies found that QR gives better results in terms of coefficient estimates and test statistics when the distribution is skewed, quantile regression can produce estimates that are much more effectively representative of the centroid (Korkmaz et al., 2022). Conditional heteroscedasticity can also decrease the efficiency of the Ordinary Least Square (OLS) and render the estimated standard errors and test statistics invalid. Studies show that even if the test

has a proper size, power may still be totally skewed if the true error distribution is heavy-tailed or has other non-normal distributions. Under these circumstances, the OLS method can generate misleading results and the related inferences may be unreliable. The key point is that the conditional distribution provides a robust effect prediction that reflects the population's underlying distribution using a quantile regression model (Pick et al.2022).

4.1 Descriptive analysis

Table (3) reflects descriptive analysis of all firm-year observations across all research variables. Number of firm-year observations varies from 210 to 200 observations across variables due to missing data in some firm-year observations. Regarding dependent variables represented by ROE, ROA, EPS, P/B, and Tobin's Q as indicators for firms' financial performance, the mean values of firm-year observations for these variables are 21.14, 11.94, 1.43, 2.32, and 0.0011 respectively. This indicates that on average, Egyptian firms within sample, have higher accounting- based financial performance indicators results across studied time period, than market-based indicators results. The minimum value for ROA is -11.250, while the maximum is 77.85. The difference between the maximum and minimum ROA (89.1) indicates that there is a variation across the firm-year observations represented by the standard deviation of 10.89. The values of the skewness and kurtosis for EPS, and P/B ratio are 5.945, 3.061 and 43.136, 14.427 respectively. Relevant to the independent variables, the values of the skewness and kurtosis for VAHC, and VARC are 5.131, -12.399 and 33.957, 169.571 respectively.

The values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George & Mallery, 2010). Hair et al. (2010) and Bryne (2010) argued that data is considered to be normal if skewness is between -2 to +2 and kurtosis is between -7 to +7, therefore, descriptive analysis of variables indicates that the data are not normally distributed. The mean values of the firm size, firm age, and leverage are 6.78, 34.83 and 0.1864 respectively, while standard deviation values are .51632, 17.083 .167786 respectively. This indicates that the skewness of firm age is greater than both firm size, and leverage.

Table (3) Descriptive analysis

Variables	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Firm Size	210	5.74	8.18	6.7797	.51632	0.549	-0.29
Firm Age	210	9.00	95.00	34.8333	17.08397	1.552	3.229
Leverage	210	.000	1.080	.18643	.167786	1.48	4.311
ROE	205	-36.35	163.60	21.1492	20.21611	1.82	11.471
ROA	210	-11.25	77.85	11.9427	10.89354	1.977	7.307
EPS	200	.00	33.25	1.4282	3.59783	5.945	43.136
P/B	205	-4.59	20.74	2.3248	2.79819	3.061	14.427
Tobin's Q	205	.00	.01	.0011	.00108	1.889	4.169
VAHC	210	-281	12882	653	1417	5.131	33.957
VASC	210	.87	1.15	.9948	.01676	1.774	50.033
VARC	210	-.286	.024	.0020753	.0210547	-12.399	169.571
VACE	210	-10.98	77.87	12.2420	10.91204	1.915	7.064

Table (2) Variables measurement

Variables	Type	Measure (s)	Component/Main Equation		Sources
Firm Size	Control Variables	Log of Total Assets			Xu & Liu, 2020 Marzo & Bonnini, 2023
Leverage		Total Debts/Total Assets			
Firm Age		Number of years since firms' establishment			
Financial Performance	Dependent variable	Accounting-based ratios	ROE	Net Income After Tx/ Total Equity	Saputra, 2022
			ROA	Net Income After Tx/ Total Assets	Shahwan and Fathalla, 2020
			EPS	Net Income – Preferred dividends/outstanding number of common shares	Andamari et al., 2021
		Market-based ratios	Price-to-Book Ratio	Market share price/Book value of equity per share	
			Tobin's Q	Market Value/ Total Assets	Listiadi, 2023
Intellectual Capital	Independent variable	Value added human capital (VAHC)	Value added (VA) = Net Sales- total Expenses (except salaries & wages)	VAHC= VA/Salaries	Ali et al., 2022 Rona and Almilia, 2013 Liang & Reeneboog, 2017
		Value added structural capital (VASC)	Structural Capital (SC) = VA – Salaries & wages	VASC = SC / VA	
		Value added relational capital (VARC)	Relational Capital (RC) = Selling & Marketing Expenses +Donations*	VARC = RC / VA	
		Value added capital employed (VACE)	Capital Employed (CE)= Total Assets – Intangible Assets	VACE = VA / CE	
Modified Value Added Intellectual Coefficient (MVAIC) = VAHC +VASC +VARC+VACE					

4.2 Analytical analysis

Correlation matrix of research variables

Correlation matrix presented in table (4) indicates the relationship between research variables, and whether there is a correlation between independent variables. Correlation coefficients range from -0.775 to 0.887. Correlation results indicate that there is strong relationship between firm financial performance and both human capital and capital employed. Inverse high correlation exists between structural capital and relational capital. The quantile regression estimation method is thus employed since it yields robust estimates with heteroscedastic errors. The quantile regression estimates are robust to heteroscedasticity and autocorrelation (Zhu et al., 2021).

Table (4) Correlation between research variables

	Firm Size	Firm Age	Leverage	VAHC	VASC	VARC	VACE	FP
Firm Size	1							
Firm Age	-.266**	1						
Leverage	0.105	0.128	1					
VAHC	.216**	-0.001	-0.087	1				
VASC	0.01	-0.046	-0.093	0.1	1			
VARC	0.029	0.067	0.085	-0.012	-.755**	1		
VACE	-0.034	.212**	-.219**	.217**	-0.045	0.082	1	
FP	-0.092	.214**	-.214**	.249**	-0.025	0.072	.887**	1

** Correlation is significant at the 0.01 level (2-tailed).

FP: Financial performance.

Quantile regression analysis

The Quantile regression analysis will be used in order to examine the relationship between financial performance and the components of IC. Investors and stakeholders should utilize the findings of this research in their decision-making in order to have long-term relevance and sustainable growth in the investments. With the exception of the added value, other IC components that lead to positive abnormal returns must be properly disclosed and recognized by the capital market. Such an impact might attract foreign capital investment as foreign institutional investors, who are believed to be more demanding for performance and efficiency, will be concerned with the quality of financial information on the Egyptian market in their investment decisions (Houssein et al., 2021; Ibrahiem, 2020; Shahwan & Habib, 2020).

Three Quantiles are recognized in the research; $Q_{0.1}$ representing percentage of low-performing firms, $Q_{0.5}$ representing middle-performing firms, and $Q_{0.9}$ representing high-performing firms. As a variation of R^2 used with OLS applied on normally distributed data, Pseudo R^2 is used to indicate the fitness and predictability power of

each quantile model investigating the relationship among the research variables (Oyedapo et al., 2021). Tables (5,6,7,8) show the estimates of the regression coefficients, their standard errors and Pseudo R^2 for each selected quantile of the quantile regression. The regression coefficients are presented with their p-values to identify significant effects of predictors.

Tables (5), and (6) presents the estimated quantile models reflecting the relationship between IC components (VAHC, VASC, VARC, VACE) and financial performance addressed by equations (1, 2,3,4,5), while tables (7), and (8) presents the estimated quantile models reflecting the relationship between overall IC coefficient (MVAIC) and financial performance addressed by equations (6,7,8,9,10).

Table (5) provides the estimated quantile models related to IC components which influence accounting-based measures of financial performance, namely ROE, ROA, and EPS. Almost all models are significant at 1% level based on Likelihood Ratio Test. It is clear as shown in table (5), that with higher performance level, the predictability power of IC components to explain accounting-based financial measures increases. According to Pseudo R^2 value (0.2980), for **ROE**, the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of ROE. VASC (β=0.0084, S.E = 0.0036; α: 5%), VARC (β=0.0086, S.E = 0.0030; α: 1%), VACE (β=0.00008, S.E = 0.0000; α: 1%), have significant positive impact on ROE. These results are consistent with prior studies indicating the positive impact of IC components on firm performance (Chen et al., 2005; Xu & Liu, 2020). Size (β=-0.0014, S.E = 0.0002; α: 1%) have significant negative impact on ROE implying that small and medium-sized firms have better ROE level than large firms. This is consistent with prior literature which indicates that small and medium-sized firms have better ability to improve their human capital resources for better sustained performance (Neves et al., 2021; Khurshid et al., 2022; Liu et al., 2021). Both firm age and leverage have no impact on ROE.

For **ROA**, according to Pseudo R^2 value (0.1553), the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of ROA. All 4 IC components (VAHC (β=-0.0002, S.E =0.0001; α: 1%), VASC (β=14.6278, S.E = 8.8274; α: 10%), VARC (β=11.0533, S.E = 6.4336; α: 10%), VACE (β=0.1387, S.E = 0.0526; α: 1%)) significantly influence ROA. These results are consistent with studies that indicated the significant impact of structural and relational capital on financial performance (Aggarwal, 2020; Tarigan et al., 2021; Ferraris et al., 2020). Firm age and leverage have positive significant effect on ROA, while firm size has negative significant impact on ROA.

Q0.9 model relevant to **EPS**, and based on Pseudo R^2 value (0.3637) is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of EPS. VAHC (β=-0.0019, S.*E* =0.0003; α: 1%), VACE (β=-0.0370, S.*E* =0.0223; α: 10%), firm size (β= 3.4337, S.*E* =0.6702; α: 1%), and firm age (β=0.0605, S.*E* =0.0268; α: 5%) have significant positive impact on EPS.

Table (6) provides the estimated quantile models related to IC components which influence Market-based measures of financial performance, namely P/B ratio, and Tobin's Q. All models are significant at 1% level based on Likelihood Ratio Test. According to Pseudo R^2 value (0.9879), for **P/B** ratio, the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of P/B ratio. VAHC (β= 0.0000, S.*E* =0.0000; α: 1%), and VACE (β= 0.9983, S.*E* =0.0000; α: 1%) have high significant positive impact on P/B. Firm-specific characteristics have no impact on P/B ratio.

Concerning **Tobin's Q**, Pseudo R^2 value (0.5703), the Middle-performing firms Q0.5 model is better than Q0.1 and Q0.9 models in terms of its factors' power in predicting the level of Tobin's Q. VACE (β=1.5370, S.*E* = 0.0781; α: 1%)), and firm size (β=2.8492, S.*E* = 1.2006; α: 5%) have significant positive impact on Tobin's Q. These results are consistent with prior studies which indicated the firm market value, measured by market to book ratio and Tobin's Q, can be explained by financial measures as well as the IC components (Sukesti et al., 2021; Jihadi et al., 2021; Sari and Sedana, 2020). Quantile regression results shown in tables (5) and (6), indicate that there is statistically significant relationship between IC components (VAHC, VASC, VARC, VACE) and financial performance, thus the first four hypotheses are rejected.

Table (5) The relationship between IC components (VAHC, VASC, VARC, VACE) and accounting-based financial performance

	Relationship Between each IC Component and ROE			**Relationship Between each IC Component and ROA**			**Relationship Between each IC Component and EPS**		
	Q 0.1	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**
Constant	-0.0001	0.0049	0.0027	3.5245	3.0866	1.4306	-2.6784	-3.3022	-20.7381
(VAHC)	0.0000	0.0000	0.0000	-0.0001	-0.0001	-0.0002***	-0.0001	0.0001***	0.0019***
Std. Error	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0003
(VASC)	0.0009	-0.0020	0.0084**	-1.7111	2.2066	14.6278*	0.0223	-2.3281	-2.8782
Std. Error	0.0103	0.0033	0.0036	4.5845	6.0868	8.8274	6.3891	4.8894	15.2218
(VARC)	-0.0009	-0.0015	0.0086***	-4.5677	-0.0374	11.0533*	-0.5178	-2.2971	-40.6774
Std. Error	0.0056	0.0023	0.0030	3.1380	4.4696	6.4336	3.3767	2.9218	90.3549
(VACE)	0.0002***	0.0005***	0.00008***	0.0198**	0.056***	0.1387***	0.0071	0.0409***	0.0370*
Std. Error	0.0001	0.00001	0.0000	0.0084	0.0180	0.0526	0.0115	0.0076	0.0223
Size	-0.00008	-0.0003***	-0.0014***	-0.1466	-0.577***	-2.3089***	0.3831***	0.8079***	3.4337***
Std. Error	0.00007	0.00009	0.0002	0.1814	0.1915	0.5733	0.1314	0.1717	0.6702
Age	0.0000	-0.0000**	-0.0000	-0.0004	-0.0044	0.0589*	0.0071**	0.0104**	0.0605**
Std. Error	0.0000	0.0000	0.0000	0.0043	0.0066	0.0359	0.0029	0.0055	0.0268
Leverage	-0.0004*	-0.0007**	0.0002	2.233***	-1.4156*	6.1034***	-0.6718***	-0.6608**	1.4579
Std. Error	0.0003	0.0004	0.0004	0.7593	0.8283	2.2534	0.2371	0.3176	2.1477
Pseudo R-squared	0.1307	0.2228	0.2980	0.1126	0.1188	0.1553	0.0351	0.1502	0.3637
Prob (Quasi-LR stat)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0320	0.0000	0.0000
Observations	205	205	205	210	210	210	200	200	200

*Note: *, **, and***indicate statistical significance at the 10%, 5%, and 1% levels, respectively.*

Table (6) The relationship between IC components (VAHC, VASC, VARC, VACE) and market-based financial performance

	Relationship Between each IC Component and Price to Book Value			**Relationship Between each IC Component and Tobin's Q**		
	Q 0.1	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**
Constant	(34.3383)	(9.2893)	(1.2380)	7.3676	(31.1796)	(97.9668)
(VAHC)	0.0001***	0.0000	0.0000***	0.0012*	0.0021	0.0024
Std. Error	0.00003	0.0000	0.0000	0.0007	0.0015	0.0015
(VASC)	34.4814*	9.3236*	1.2299	9.3457	12.1821	72.0313**
Std. Error	0.1058	4.9908	0.94124	63.1901	29.0380	28.3501
(VARC)	15.5130	5.0080*	0.3380	221.6244	11.7170	59.6308***
Std. Error	11.37978	2.67627	3.94265	436.4543	21.8970	22.0569
(VACE)	0.9920***	0.9973***	0.9983***	1.3181***	1.5370***	1.6499***
Std. Error	0.00726	0.0008	0.00046	0.0665	0.0781	0.1735
Size	(0.0991)	(0.0073)	0.0004	(3.0884)	2.8492**	4.2451*
Std. Error	0.12150	0.01476	0.00941	3.8336	1.2006	2.4526
Age	0.0079	0.0005	(0.0000)	0.0366	0.0145	0.1500
Std. Error	0.00699	0.00035	0.00027	0.0536	0.0339	0.1729
Leverage	(2.5784) ***	(0.0879)	0.0051	(16.1281)	(2.2168)	3.2293
Std. Error	0.6893	0.05570	0.04327	11.1392	6.0292	14.8781
Pseudo R-squared	0.9086	0.9645	0.9879	0.5381	0.5703	0.5571
Prob (Quasi-LR stat)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	205	205	205	205	205	205

*Note: *, **, and***indicate statistical significance at the 10%, 5%, and 1% levels, respectively.*

Table (7) provides the estimated quantile models related to overall IC coefficient (MVAIC) which influence accounting-based measures of financial performance, namely ROE, ROA, and EPS. All models are significant at 1% level based on Likelihood Ratio Test except Q0.1 model related to relationship between MVAIC and EPS, it is significant at 10%. It is clear as shown in table (6), that with higher performance level, the predictability power of MVAIC to explain accounting-based financial measures increases. According to Pseudo R^2 value (0.15311) for **ROE**, the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of ROE. Size (β=-0.00139, S.*E* = 0.00024; α: 1%), and leverage (β=-0.00116, S.*E* = 0.00036; α: 1%) have negative significant impact on ROE. MVAIC has no significant effect on ROE.

For **ROA**, according to Pseudo R^2 value (0.11912), the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of ROA. Size (β= -2.62655, S.*E* = 0.45525; α: 1%) has negative significant impact on ROE, while firm age (β= 0.10939, S.*E* = 0.04681; α: 5%) has positive significant impact on ROA. MVAIC has no significant effect on ROA.

Q0.9 model relevant to **EPS**, and based on Pseudo R^2 value (0.33834) is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of EPS. MVAIC (β= 0.00200, S.*E* =0.00028; α: 1%), firm size (β= 3.28758, S.*E* =0.57675; α: 1%), and firm age (β= 0.06893, S.*E* =0.01956; α: 1%), have significant positive impact on EPS.

Table (8) provides the estimated quantile models related to MVAIC and its impact on Market-based measures of financial performance, namely P/B ratio, and Tobin's Q. All models are significant at 1% level based on Likelihood Ratio Test. According to Pseudo R^2 value (0.1767), for **P/B** ratio, the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of P/B ratio. MVAIC (β= 0.0049, S.*E* =0.0013; α: 1%) have high significant positive impact on P/B. Leverage (β= -24.438, S.*E* =6.3254; α: 1%) has a significant negative relationship with P/B, while firm size and firm age has no impact on P/B. Concerning **Tobin's Q**, Pseudo R^2 value (0.2210), the high-performing firms Q0.9 model is better than Q0.1 and Q0.5 models in terms of its factors' power in predicting the level of Tobin's Q. MVAIC (β= 0.0119, S.*E* =0.0018; α: 1%), and firm age (β= 0.6059, S.*E* =0.2319; α: 1%), have significant positive impact on Tobin's Q, while leverage (β= -49.0486, S.*E* =12.5493; α: 1%) have significant negative impact on Tobin's Q. Quantile regression results shown in tables (7) and (8), indicate that there is statistically significant relationship between overall IC coefficient (MVAIC) and financial performance, thus the fifth hypotheses is rejected.

Table (7) The relationship between overall IC coefficient (MVAIC) and accounting-based financial performance

	Relationship Between IC and ROE			**Relationship Between IC and ROA**			**Relationship Between IC and EPS**		
	Q 0.1	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**
Constant	0.00106	0.00401	0.01154	2.51000	6.61097	18.94962	-1.32374	-6.96176	-22.58274
MVAIC	0.0000***	0.00000	0.00000	-0.00010	-0.00010	-0.00009	0.00001	0.00010**	0.00200***
Std. Error	0.00000	0.00000	0.00000	0.00011	0.00012	0.00007	0.00005	0.00004	0.00028
Size	-0.00012*	-0.0004***	-0.00139***	-0.24184	-0.70947***	-2.62655***	0.18935*	1.01585***	3.28758***
Std. Error	0.00007	0.00014	0.00024	0.18507	0.22686	0.45525	0.11655	0.23457	0.57675
Age	0.00000	-0.00001	0.00001	0.00330	0.00695	0.10939**	0.00429	0.02243***	0.06893***
Std. Error	0.00000	0.00000	0.00003	0.00390	0.00942	0.04681	0.00317	0.00579	0.01956
Leverage	-0.0006**	-0.00042	-0.00116***	-2.40408***	-2.42585***	1.71030	-0.30987	-0.56612	0.85104
Std. Error	0.00030	0.00036	0.00036	0.79440	0.84271	1.95166	0.24015	0.63969	1.41164
Pseudo R-squared	0.0707	0.07291	0.15311	0.08539	0.05506	0.11912	0.02284	0.09260	0.33834
Prob (Quasi-LR stat)	0.00170	0.00013	0.00000	0.00010	0.00030	0.00000	0.06641	0.00000	0.00000
Observations	205	205	205	210	210	210	200	200	200

*Note: *, **, and*** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.*

Table (8) The relationship between overall IC coefficient (MVAIC) and market-based financial performance

	Relationship Between IC and Price to Book Value			**Relationship Between IC and Tobin's Q**		
	Q 0.1	**Q 0.5**	**Q 0.9**	**Q 0.1**	**Q 0.5**	**Q 0.9**
Constant	-6.6991	19.2007	21.9975	-40.5939	31.1242	35.0861
(MVAIC)	0.0010***	0.0006*	0.0049***	0.0019***	0.0012*	0.0119***
Std. Error	0.0002	0.0004	0.0013	0.0005	0.0007	0.0018
Size	0.8630	-1.8215	-0.4575	5.7851*	-1.8478	-1.5917
Std. Error	0.9910	1.4301	3.3276	3.3952	2.7280	3.7878
Age	0.0958***	0.0798**	0.2825	0.2555***	0.1508*	0.6059***
Std. Error	0.0235	0.0403	0.4402	0.0717	0.0892	0.2319
Leverage	-0.8004	-4.2979	-24.4381***	-30.799**	-40.350***	-49.049***
Std. Error	2.8882	4.1705	6.3254	15.6523	12.8268	12.5493
Pseudo R-squared	0.1007	0.0421	0.1767	0.1010	0.0761	0.2210
Prob (Quasi-LR stat)	0.0000	0.0081	0.0000	0.0002	0.0001	0.0000
Observations	205	205	205	205	205	205

*Note: *, **, and***indicate statistical significance at the 10%, 5%, and 1% levels, respectively.*

Summary of hypotheses testing

Hypotheses	Status
H_{01}: Value added human capital VAHC as a component of IC has no significant influence on firms' financial performance.	Rejected
H_{02}: Value added structural capital VASC a component of IC has no significant influence on firms' financial performance.	Rejected
H_{03}: Value added relational capital VARC as a component of IC has no significant influence on firms' financial performance	Rejected
H_{04}: Value added capital employed VACE has no significant influence on firms' financial performance.	Rejected
H_{05}: MVAIC has no significant influence on firms' financial performance.	Rejected

5. Conclusion

The basic purpose of this research is to evaluate the influence of overall IC coefficient and components, human capital; structural capital; relational capital, on the financial performance of the Egyptian firms. In light of the increasing importance of intangible resources such as IC in creating firm value and sustaining the competitiveness of newly developed academic models, the research used secondary data from Thomson Reuters DataStream to investigate and measure the relationship between each component of IC and firm performance. The research sample include 30 Egyptian listed on Egyptian Stocks Exchange EGX 100 and focuses on the contributing role of IC to financial performance in a period spanning from 2017 to 2023. Few studies measure more than one of the components of IC. Therefore, the research aims to contribute to literature through measuring the total and individual influence of the four components of IC on a firm's financial performance.

Findings revealed the significant impact of IC components especially VAHC, and VACE on firms' financial performance, to a lower significant level VASC and VARC had an impact on financial performance. MVAIC has a significant influence on EPS, P/B ratio, and Tobin's Q, however, it had no impact on ROE, and ROA. Firm size is negatively and significantly related to accounting-based measures, firm age has a positive impact on accounting-based measures while leverage have negative relationship with most financial performance measures. This finding is consistent with studies that positively relate IC to financial performance (Alvino et al., 2021; Prasetyo and Kistanti, 2020; Aggarwal, 2020; Tarigan et al., 2021; Ferraris et al., 2020)

There is a shortage of empirical research for the efficiency of financial performance of IC in emerging economies like Egypt (Mousa, 2015; Jarrar and Abu Zaid, 2016), the current research fills this gap. In addition, the research employs QR, which has not been employed by prior studies, to investigate the relationship between IC and financial performance in an emerging economy as Egypt. Future research can link firms' usage of strategic management accounting techniques with IC. In addition,

the research can be extended to include results from different countries or regions for comparative analysis purposes.

References

Abeysekera, I. (2021). Intellectual capital and knowledge management research towards value creation. From the past to the future. Journal of Risk and Financial Management.

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.

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.

Al-Delawi, A. S., Raewf, M., & Jameel, A. (2023). The Impact of Human Capital on a Company's Value: A Cross-Cultural Study. Journal of Intercultural Communication, 23(1), 24-32.

Alabdullah, T. T. Y. (2022). Management accounting insight via a new perspective on risk management-companies' profitability relationship. International Journal of Intelligent Enterprise, 9(2), 244-257.

Albertini, E., Berger-Remy, F., Lefrancq, S., Morgana, L., Petković, M., & Walliser, É. (2021). Voluntary disclosure and intellectual capital: how CEOs mobilise discretionary accounting narratives to account for value creation stemming from intellectual capital. Journal of applied accounting research, 22(4), 687-705.

Ali, BJ, & Anwar, G. (2021). Intellectual capital: A modern model to measure the value creation in a business. International journal of Engineering, Business and Management, 5(2), 31-43.

Ali, M. A., Hussin, N., Haddad, H., Al-Araj, R., & Abed, I. A. (2021). A multidimensional view of intellectual capital: The impact on innovation performance. Journal of Open Innovation: Technology, Market, and Complexity, 7(4), 216. sciencedirect.com

Ali, S., Murtaza, G., Hedvicakova, M., Jiang, J., & Naeem, M. (2022). Intellectual capital and financial performance: A comparative study. Frontiers in Psychology, 13, 967820.

Aljuboori, Z. M., Singh, H., Haddad, H., Al-Ramahi, N. M., & Ali, M. A. (2021). Intellectual capital and firm performance correlation: the mediation role of innovation capability in Malaysian manufacturing SMEs perspective. Sustainability, 14(1), 154.

Alshwayat, D., MacVaugh, J. A., & Akbar, H. (2021). A multi-level perspective on trust, collaboration and knowledge sharing cultures in a highly formalized organization. Journal of Knowledge Management, 25(9), 2220-2244.

Alvarez, T., Sensini, L., Bello, C., & Vazquez, M. (2021). Management accounting practices and performance of SMEs in the Hotel industry: Evidence from an emerging economy. International Journal of Business and Social Science, 12(2), 24-35.

Alvino, F., Di Vaio, A., Hassan, R., & Palladino, R. (2021). Intellectual capital and sustainable development: A systematic literature review. Journal of Intellectual Capital, 22(1), 76-94.

Amjad, F., Abbas, W., Zia-Ur-Rehman, M., Baig, S. A., Hashim, M., Khan, A., & Rehman, H. U. (2021). Effect of green human resource management practices on organizational sustainability: the mediating role of environmental and employee performance. Environmental Science and Pollution Research, 28, 28191-28206.

Andamari, R. J. B. I., Rahayu, C. W. E., & Yulita, I. K. (2021). The Influence of Earning Per Share, Price Earnings Ratio, and Price to Book Value toward Price of Stok of Coal Mining Companies Listed in the Indonesia Stock Exchange During 2014-2018'. Journal of Management and Business Environment (JMBE), 3(1), 32-52.

Andreassen, R. I. (2020). Digital technology and changing roles: a management accountant's dream or nightmare?. Journal of management control.

Arroyo-Barrigüete, J. L., Escudero-Guirado, C., & Minguela-Rata, B. (2023). Factors influencing the social perception of entrepreneurs in Spain: A quantitative analysis from secondary data. Plos one, 18(12), e0296095.

Asiaei, K., Bontis, N., Alizadeh, R., & Yaghoubi, M. (2022). Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance. Business Strategy and the Environment, 31(1), 76-93.

Ausat, A. M. A., Al Bana, T., & Gadzali, S. S. (2023). Basic capital of creative economy: The role of intellectual, social, cultural, and institutional capital. Apollo: Journal of Tourism and Business, 1(2), 42-54.

Baker, William E. & Mukherjee, Debmalya & Gattermann Perin, Marcelo. (2022). Learning orientation and competitive advantage: A critical synthesis and future directions,"Journal of Business Research, Elsevier, vol. 144(C), pages 863-873.

Barker, R., Lennard, A., Penman, S., & Teixeira, A. (2022). Accounting for intangible assets: suggested solutions. Accounting and Business Research, 52(6), 601-630.

Batubara, S. M., Sahari, S., & Jais, S. M. (2021). Evaluation-value added intellectual coefficient (Ev-VAIC) model expansion: The new measurement model for intellectual capital. International Journal of Academic Research in Business and Social Science, 10(4), 59-72.

Becker, G.S. (1964) Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. University of Chicago Press, Chicago.

Bellucci, M., Marzi, G., Orlando, B., & Ciampi, F. (2021). Journal of Intellectual Capital: a review of emerging themes and future trends. Journal of Intellectual Capital, 22(4), 744-767.

Beltramino, N. S., García-Perez-de-Lema, D., & Valdez-Juárez, L. E. (2020). The structural capital, the innovation and the performance of the industrial SMES. Journal of Intellectual Capital, 21(6), 913-945.

Benková, E., Gallo, P., Balogová, B., & Nemec, J. (2020). Factors affecting the use of balanced scorecard in measuring company performance. Sustainability.

Billah, M., Amar, A. B., & Balli, F. (2023). The extreme return connectedness between Sukuk and green bonds and their determinants and consequences for investors. Pacific-Basin Finance Journal.

Byrne, B. M. (2010). Structural equation modeling with AMOS: Basic concepts, applications, and programming. New York: Routledge.

Cartaxo, A., Koller, M., Mayer, H., Kolland, F., & Nagl-Cupal, M. (2023). Risk factors with the greatest impact on caregiver burden in informal homecare settings in Austria: a quantitative secondary data analysis. Health & Social Care in the Community, 2023.

Chatterjee, S., Chaudhuri, R., Thrassou, A., & Sakka, G. (2022). Impact of firm's intellectual capital on firm performance: a study of Indian firms and the moderating effects of age and gender. Journal of Intellectual Capital, 23(1), 103-126.

Chen, M. C.; Cheng, S. J.; Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms market value and financial performance. Journal of Intellectual Capital, v. 6, n. 2, p. 159-76.

Chen, T. C. & Wu, Y. J. (2020). The influence of R&D intensity on financial performance: The mediating role of human capital in the semiconductor industry in Taiwan. Sustainability.

Cooper, C., Pereira, V., Vrontis, D., & Liu, Y. (2023). Extending the resource and knowledge-based view: Insights from new contexts of analysis. Journal of Business Research.

Crouzet, N., Eberly, J. C., Eisfeldt, A. L., & Papanikolaou, D. (2022). The economics of intangible capital. Journal of Economic Perspectives, 36(3), 29-52.

Dalwai, T., and Mohammadi, S. S. (2020). Intellectual capital and corporate governance: an evaluation of Oman's financial sector companies. J. Intellect. Cap. 21, 1125–1152.

De Villiers, C. & Sharma, U. (2020). A critical reflection on the future of financial, intellectual capital, sustainability and integrated reporting. Critical Perspectives on Accounting.

Delfanti, A. & Frey, B. (2021) Humanly Extended Automation or the Future of Work Seen through Amazon Patents. Science, Technology, & Human Values, 46(3): 655–682.

Desoky, AM and Mousa, GA (2020). The impact of intellectual capital on firm's financial performance: evidence from Bahrain, Investment Management and Financial Innovations, 17(4), 189-201.

Dumay, J., Guthrie, J., & Rooney, J. (2020). Being critical about intellectual capital accounting in 2020: An overview. Critical Perspectives on Accounting.
Duodu, B. & Rowlinson, S. (2021). Intellectual capital, innovation, and performance in construction contracting firms. Journal of Management in Engineering.
Ferraris, A., Vrontis, D., Belyaeva, Z., De Bernardi, P., & Ozek, H. (2020). Innovation within the food companies: how creative partnerships may conduct to better performances? British Food Journal, 123(1), 143-158.
Flores, E., Xu, X., & Lu, Y. (2020). Human Capital 4.0: a workforce competence typology for Industry 4.0. Journal of Manufacturing Technology Management, 31(4), 687-703.
for organizational knowledge assets. Business Process Management Journal, 10(5), 551-569.
George, D. & Mallery, M. (2010). SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 update (10a ed.) Boston: Pearson.
Gerhart, B. & Feng, J. (2021). The resource-based view of the firm, human resources, and human capital: Progress and prospects. Journal of management.
Goldin, C. (2024). Human capital. Handbook of cliometrics. harvard.edu
Grant, R. & Phene, A. (2022). The knowledge-based view and global strategy: Past impact and future potential. Global Strategy Journal. Volume 12, Issue 1 p. 3-30.
Hadid, W., & Al-Sayed, M. (2021). Management account- ants and strategic management accounting: The role of organizational culture and information systems. Manage- ment Accounting Research, 50, 100725.
Hair, J., Black, W. C., Babin, B. J. & Anderson, R. E. (2010). Multivariate data analysis (7th ed.). Upper Saddle River, New Jersey: Pearson Educational International.
Hephzibah A. O., Olusola A., Nathanael B. A., Odunayo J. A. (2021). Quantile regression methods for determination of factors associated with nutritional status of women of reproductive age in Nigeria, Scientific African, Volume 14.
Hoang, H. T., Nguyen, H. T. H., Vu, N. H., Le, A. H., & Quach, H. H. (2020). Intellectual capital and firm performance in Vietnam 2012-2016. International Journal of Learning and Intellectual Capital, 17(1), 27-46.
Houssein, E. H., Dirar, M., Hussain, K., & Mohamed, W. M. (2021). Assess deep learning models for Egyptian exchange prediction using nonlinear artificial neural networks. Neural Computing and Applications, 33(11), 5965-5987.
Hsu, C. C., Chau, K. Y., & Chien, F. S. (2023). Natural resource volatility and financial development during Covid-19: implications for economic recovery. Resources Policy.
Huang, H., Leone, D., Caporuscio, A., & Kraus, S. (2021). Managing intellectual capital in healthcare organizations. A conceptual proposal to promote innovation. Journal of Intellectual Capital, 22(2), 290-310.
Huang, M. C., Kang, M. P., & Chiang, J. K. (2020). Can a supplier benefit from investing in transaction-specific investments? A multilevel model of the value co-creation ecosystem perspective. Supply Chain Management: An International Journal, 25(6), 773-787.
Hussain, T., Edgeman, R., & Eskildsen, J. K. (2020). Knowledge-based intellectual structure of research in business excellence (1995–2015). Total Quality Management & Business Excellence, 31(11-12), 1171-1194.
Hutahayan, B. (2020), "The mediating role of human capital and management accounting information system in the relationship between innovation strategy and internal process performance and the impact on corporate financial performance", Benchmarking: An International Journal, Vol. 27 No. 4, pp. 1289-1318.
Ibrahiem, D. M. (2020). Do technological innovations and financial development improve environmental quality in Egypt? Environmental Science and Pollution Research.

Jafari-Sadeghi, V., Kimiagari, S., & Biancone, P. P. (2020). Level of education and knowledge, foresight competency and international entrepreneurship: A study of human capital determinants in the European countries. European Business Review, 32(1), 46-68.
Jardon, C. M., & Martinez-Cobas, X. (2021). Measuring intellectual capital with financial data. PloS one, 16(5), e0249989.
Jarrar, A. & Abu-Zaid, M. (2016). The influence of intellectual capital on corporate social responsibility and financial performance. Journal of Intellectual Capital, 17(1), 162–182.
Jihadi, M., Vilantika, E., Hashemi, S. M., Arifin, Z., Bachtiar, Y., & Sholichah, F. (2021). The effect of liquidity, leverage, and profitability on firm value: Empirical evidence from Indonesia. The Journal of Asian Finance, Economics and Business, 8(3), 423-431.
Jordão, R. V. D., Novas, J., & Gupta, V. (2020). The role of knowledge-based networks in the intellectual capital and organizational performance of small and medium-sized enterprises. Kybernetes.
Kadim, A., Sunardi, N., & Husain, T. (2020). The modeling firm's value based on financial ratios, intellectual capital and dividend policy. Accounting.
Khalifa, N., Abd Elghany, M., & Abd Elghany, M. (2021). Exploratory research on digitalization transformation practices within supply chain management context in developing countries specifically Egypt in the MENA region. Cogent Business & Management, 8(1), 1965459.
Khalique, Muhammad & Bontis, Nick & Shaari, Jamal & Yaacob, Mohd & Rohana, Ngah. (2018). Intellectual capital and organisational performance in Malaysian knowledge-intensive SMEs. International Journal of Learning and Intellectual Capital. 15 (1):20.
Khurshid, A., Rauf, A., Calin, A. C., Qayyum, S., Mian, A. H., Qayyum, S., & Fatima, T. (2022). Technological innovations for environmental protection: role of intellectual property rights in the carbon mitigation efforts. Evidence from western and southern Europe. International Journal of Environmental Science and Technology, 19(5), 3919-3934.
Kianto, A., Ritala, P., Vanhala, M., & Hussinki, H. (2020). Reflections on the criteria for the sound measurement of intellectual capital: A knowledge-based perspective. Critical Perspectives on Accounting, 70, 102046.
Kiraz, A. & Açikgöz, N. (2021). A fuzzy-logic-based approach to the EFQM model for performance enhancement. Sādhanā, 46(1), 1-15.
Korkmaz, M. C., Chesneau, C., & Korkmaz, Z. S. (2022). The unit folded normal distribution: A new unit probability distribution with the estimation procedures, quantile regression modeling and educational attainment applications. Journal of Reliability and Statistical Studies, 261-298.
Kroon, N., do Céu Alves, M., & Martins, I. (2021). The impacts of emerging technologies on accountants' role and skills: Connecting to open innovation—a systematic literature review. Journal of Open Innovation: Technology, Market, and Complexity, 7(3), 163.
Liang, Hao and Renneboog, Luc. (2017). Corporate donations and shareholder value. Oxford Review of Economic Policy. 33, (2), 278-316.
Lise, J. & Postel-Vinay, F. (2020). Multidimensional skills, sorting, and human capital accumulation. American Economic Review.
Listiadi, A. (2023). The Effect of Financial Performance on The Tobin's Q Value of Company Investment. Valley International Journal Digital Library.
Liu, S., Yu, Q., Zhang, L., Xu, J., & Jin, Z. (2021). Does intellectual capital investment improve financial competitiveness and green innovation performance? Evidence from renewable energy companies in China. Mathematical Problems in Engineering, 2021(1), 9929202.
MacDonald, R. (2023) Adam Smith and the neo-liberal paradigm: on the essential nature of trust, and rebalancing capital, National Institute Economic Review, 1–39.
Mahmood, Tarique & Mubarik, Muhammad Shujaat, 2020. "Balancing innovation and exploitation in the fourth industrial revolution: Role of intellectual capital and technology absorptive capacity," Technological Forecasting and Social Change, Elsevier, vol. 160(C).

Marr, B., Schiuma, G. and Neely, A. (2004), "Intellectual capital – defining key performance indicators for organizational knowledge assets", Business Process Management Journal, Vol. 10 No. 5, pp. 551-569.

Metawa, N., Elhoseny, M., & Mutawea, M. (2022). The role of information systems for digital transformation in the private sector: a review of Egyptian SMEs. African Journal of Economic and Management Studies, 13(3), 468-479.

Meyer, J. P. (2023). Social capital as the main driver of organizationally valuable innovation. European Journal of Innovation Management.

Moro-Visconti, R. (2024). The valuation of intangible assets: an introduction. In Artificial Intelligence Valuation: The Impact on Automation, BioTech, ChatBots, FinTech, B2B2C, and Other Industries (pp. 41-129). Cham: Springer Nature Switzerland.

Mouritsen, J., Thorsgaard Larsen, H., & Bukh, P. N. (2005). Dealing with the knowledge economy: intellectual capital versus balanced scorecard. Journal of Intellectual Capital, 6(1), 8–27.

Mousa, G. A. (2015). An Examination of Intellectual Capital and Corporate Financial Performance: Canonical Correlation Analysis. Egyptian Accounting Review, 5(1), 1-24.

Neves, P. C., Afonso, O., Silva, D., & Sochirca, E. (2021). The link between intellectual property rights, innovation, and growth: A meta-analysis. Economic Modelling.

Nguyen, A. H., & Doan, D. T. (2020). The impact of intellectual capital on firm value: Empirical evidence from Vietnam. International Journal of Financial Research, 11(4), 74-85.

Nicholls, J. A. (2020). Integrating financial, social and environmental accounting. Sustainability Accounting, Management and Policy Journal, 11(4), 745-769.

Nikki Rona, D., & Spica Almilia, L. (2013). The effect of intellectual capital on financial performance of manufacturing companies listed in Indonesia Stock Exchange period 2007-2011. The Indonesian Accounting Review, 3(2), 193–202.

O'Connor, N., Lowry, P. B., & Treiblmaier, H. (2020). Interorganizational cooperation and supplier performance in high-technology supply chains.

Obeidat, U., Obeidat, B., Alrowwad, A., Alshurideh, M., Masadeh, R., & Abuhashesh, M. (2021). The effect of intellectual capital on competitive advantage: The mediating role of innovation. Management Science Letters, 11(4), 1331-1344.

Oliveira, M., Curado, C., Balle, A. R., & Kianto, A. (2020). Knowledge sharing, intellectual capital and organizational results in SMES: are they related? Journal of Intellectual Capital, 21(6), 893-911.

Ousama, A. A., Hammami, H., & 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, 13(1), 75-93.

Ozgun, A. H., Tarim, M., Delen, D., & Zaim, S. (2022). Social capital and organizational performance: The mediating role of innovation activities and intellectual capital. Healthcare Analytics.

Padgett, D., Hopkins, C. D., & Williams, Z. (2020). Buyer dependence in B2B relationships: The role of supplier investments, commitment form, and trust. Journal of Business Research.

Paoloni, M., Coluccia, D., Fontana, S., & Solimene, S. (2020). Knowledge management, intellectual capital and entrepreneurship: a structured literature review. Journal of Knowledge Management, 24(8), 1797-1818.

Pereira, V. & Bamel, U. (2021). Extending the resource and knowledge based view: A critical analysis into its theoretical evolution and future research directions. Journal of Business Research.

Petković, M., & Obradović, A. (2022). Adoption of IFRS or US GAAP on intangible assets and the potential effect on the final result. A theoretical overview. Tax Avoidance, Accounting and Financial Reporting, 18.

Pezeshkan, A., Smith, A., Fainshmidt, S., & Nair, A. (2020). A neo-configurational institutional analysis of international venture capital attractiveness and performance: insights for Asia-Pacific. Asia Pacific Journal of Management, 1-29.

Pick, J. L., Lemon, H. E., Thomson, C. E., & Hadfield, J. D. (2022). Decomposing phenotypic skew and its effects on the predicted response to strong selection. Nature Ecology & Evolution, 6(6), 774-785.

Pigola, A., De Santi, P. V., da Costa, P. R., & Storopoli, J. (2022). Intellectual capital on performance: a meta-analysis study enhancing a new perspective of the components. Journal of Intellectual capital, 23(6), 1379-1403.

Pradana, M., Pérez-Luño, A., & Fuentes-Blasco, M. (2020). Innovation as the key to gain performance from absorptive capacity and human capital. Technology Analysis & Strategic Management, 32(7), 822-834.

Prasetyo, P. E., & Kistanti, N. R. (2020). Human capital, institutional economics and entrepreneurship as a driver for quality & sustainable economic growth. Entrepreneurship and Sustainability Issues, 7(4), 2575.

Rehman, S. U., Bresciani, S., Ashfaq, K., & Alam, G. M. (2022). Intellectual capital, knowledge management and competitive advantage: a resource orchestration perspective. Journal of Knowledge Management, 26(7), 1705-1731.

Rehman, W. U., Nadeem, M., Saltik, O., Degirmen, S., & Jalil, F. (2024). Investing in knowledge assets: a novel approach for measuring national intellectual capital index in emerging economies. Journal of Intellectual Capital.

Ritala, P., Baiyere, A., Hughes, M., & Kraus, S. (2021). Digital strategy implementation: The role of individual entrepreneurial orientation and relational capital. Technological Forecasting and Social Change, 171, 120961.

Roeck, D., Sternberg, H., & Hofmann, E. (2020). Distributed ledger technology in supply chains: A transaction cost perspective. International Journal of Production Research, 58(7), 2124-2141.

Salehi, M., Fahimi, M. A., Zimon, G., & Homayoun, S. (2022). The effect of knowledge management on intellectual capital, social capital, and firm innovation. Journal of Facilities Management, 20(5), 732-748.

Salvi, A., Vitolla, F., Giakoumelou, A., Raimo, N., & Rubino, M. (2020). Intellectual capital disclosure in integrated reports: The effect on firm value. Technological Forecasting and Social Change, 160, 120228.

Saputra, F. (2022). Analysis Effect Return on Assets (ROA), Return on Equity (ROE) and Price Earning Ratio (PER) on Stock Prices of Coal Companies in the Indonesia Stock Exchange (IDX) Period 2018-2021. Dinasti International Journal of Economics, Finance & Accounting, 3(1), 82-94.

Sari, I. A. G. D. M., & Sedana, I. B. P. (2020). Profitability and liquidity on firm value and capital structure as intervening variable. International research journal of management, IT and Social Sciences, 7(1), 116-127.

Sarwenda, B. (2020). Intellectual capital, business performance, and competitive advantage: An empirical study for the pharmaceutical companies. QUALI TY Access to Success.

Serenko, A. & Bontis, N. (2022). Global ranking of knowledge management and intellectual capital academic journals: a 2021 update. Journal of Knowledge Management.

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.

Shahwan, T. M., & Fathalla, M. M. (2020). The mediating role of intellectual capital in corporate governance and the corporate performance relationship. International Journal of Ethics and Systems, 36(4), 531-561.

Sharp, E. A. & Munly, K. (2022). Reopening a can of words: Qualitative secondary data analysis. Journal of Family Theory & Review.

Shehata, G. M. & Montash, M. A. (2020). Driving the internet and e-business technologies to generate a competitive advantage in emerging markets: Evidence from Egypt. Information Technology & People.

Singla, H. K. (2020). Does VAIC affect the profitability and value of real estate and infrastructure firms in India? A panel data investigation. Journal of Intellectual Capital.

Skhvediani, Angi, Anastasia Koklina, Tatiana Kudryavtseva, and Diana Maksimenko. (2023). The Impact of Intellectual Capital on the Firm Performance of Russian Manufacturing Companies. Risks 11: 76.

Sukesti, F., Ghozali, I., Fuad, F., Kharis Almasyhari, A., & Nurcahyono, N. (2021). Factors affecting the stock price: The role of firm performance. The Journal of Asian Finance, Economics and Business, 8(2), 165-173.

Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of internal integration, supply chain partnership, supply chain agility, and supply chain resilience on sustainable advantage. Sustainability.

Van Criekingen, K., Bloch, C., & Eklund, C. (2022). Measuring intangible assets—A review of the state of the art. Journal of Economic Surveys, 36(5), 1539-1558.

Vikas A. Aggarwal. (2020). Resource congestion in alliance networks: How a firm's partners' partners influence the benefits of collaboration. Strategic Management Journal, Wiley Blackwell, vol. 41(4), pages 627-655.

Wachter, T. V. (2020). The persistent effects of initial labor market conditions for young adults and their sources. Journal of Economic Perspectives.

Wang, C. H. & Juo, W. J. (2021). An environmental policy of green intellectual capital: Green innovation strategy for performance sustainability. Business Strategy and the Environment.

Wang, Z., Cai, S., Liang, H., Wang, N., & Xiang, E. (2021). Intellectual capital and firm performance: the mediating role of innovation speed and quality. The International Journal of Human Resource Management, 32(6), 1222-1250.

Widiatmoko, J., Indarti, M. G. K., & Pamungkas, I. D. (2020). Corporate governance on intellectual capital disclosure and market capitalization. Cogent Business & Management, 7(1), 1750332.

Xiong, F., Xie, M., Zhao, L., Li, C., & Fan, X. (2022). Recognition and evaluation of data as intangible assets. Sage Open.

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.

Xu, Jian, and Binghan Wang. 2018. Intellectual capital, financial performance and companies' sustainable growth: Evidence from the Korean manufacturing industry. Sustainability 10: 4651.

Yousaf, M. (2021). Intellectual capital and firm performance: evidence from certified firms from the EFQM excellence model. Total Quality Management & Business Excellence, 33(13–14), 1472–1488.

Yusliza, M. Y., Yong, J. Y., Tanveer, M. I., Ramayah, T., Faezah, J. N., & Muhammad, Z. (2020). A structural model of the impact of green intellectual capital on sustainable performance. Journal of Cleaner Production, 249, 119334.

Zaytsev, A., Rodionov, D., Dmitriev, N., & Kichigin, O. (2020). Comparative analysis of results of using assessment methods for intellectual capital. In IOP Conference Series: Materials Science and Engineering, Vol. 940, No. 1, p. 012025.

Zhang, H., Gupta, S., Sun, W., & Zou, Y. (2020). How social-media-enabled co-creation between customers and the firm drives business value? The perspective of organizational learning and social Capital. Information & Management.

Zhang, M., Zeng, W., Tse, Y. K., Wang, Y., & Smart, P. (2021). Examining the antecedents and consequences of green product innovation. Industrial Marketing Management, 93, 413-427.

Zhao, J., Wang, Z., Wang, C., Han, L., Ruan, Y., Huangfu, Z., ... & Zhou, L. (2022). Research on the status of intangible cultural heritage bearers in the human capital perspective. Frontiers in psychology, 13, 850780.

Zhu, Q., Li, G., & Xiao, Z. (2021). Quantile Estimation Of Regression Models With Garch-X Errors. Statistica Sinica, 31(3), 1261–1284.

The Influence of Intellectual Capital on Financial Performance: Quantile Analysis Approach

تأثير رأس المال االفكري على الأداء المالي لمنشآت الأعمال مدخل التحليل الكُميمي

ملخص البحث

يهدف البحث إلى دراسة تأثير مكونات رأس المال الفكري IC على الأداء المالي للشركات المصرية المدرجة في EGX100. للتحقق من العلاقة بين IC والأداء المالي للشركات، تم جمع بيانات ثانوية من خلال قاعدة البيانات Thomson Reuters DataStream لعينة من ٣٠ شركة مدرجة في EGX 100، خلال الفترة من 2017 إلى 2023 مما أدى إلى توافر ٢١٠ مشاهدة على مستوى الشركات. تم استخدام تحليل الانحدار الكميمي Quantile Regression لفحص العلاقة بين كل مكون من مكونات رأس المال الفكري والأداء المالي للشركات. كشفت نماذج الانحدار الكميمي أنه ليس لكل النماذج الكميمية نفس القيمة الاحتمالية - المعنوية المحسوبة (P-value)، فيما يتعلق بالعلاقة بين مكونات رأس المال الفكري (القيمة المضافة لرأس المال البشري VAHC، القيمة المضافة لرأس المال الهيكلي VASC، القيمة المضافة رأس مال العلاقات VARC، القيمة المضافة لرأس المال الملموس VACE) ومقاييس الأداء المالي المتمثلة في العائد على حقوق الملكية ROE، والعائد على الأصول ROA، وعائد السهم EPS، والقيمة السوقية مقاسة بسعر السهم إلى القيمة الدفترية P/B، ومؤشرTobin's Q.

المعامل المعدل للقيمة الفكرية المضافة (MVAIC) له أيضًا تأثير إيجابي معنوي على EPS وP/B وTobin's Q. كما أظهرت النتائج ارتباط حجم الشركة عكسيا ومعنويا بالمقاييس المحاسبية، ويؤثر عمر الشركة تأثير إيجابي على المقاييس المحاسبية بينما يوثر معدل الرافعة المالية عكسيا ومعنويا على معظم مقاييس الأداء المالي. يمثل حجم العينة واستبعاد المؤسسات المالية من العينة قيود البحث الرئيسية. يضيف البحث الي الكتابات المحاسبية من خلال تناول التأثير الكلي والفردي للمكونات الأربعة لـ IC على الأداء المالي للشركات باستخدام تحليل الانحدار الكميمي الذي لم يتم استخدامه من قبل لفحص العلاقة بين IC والأداء المالي للشركات المدرجة بالبورصة المصرية.

الكلمات الدالة: تحليل الانحدار الكميمي؛ رأس المال الفكري؛ رأس المال البشري؛ رأس المال الهيكلي؛ رأس مال العلاقات؛ رأس المال الملموس؛ الأداء المالي، EGX100.