International Journal of Management and Sustainability
2022 Vol. 11, No. 4, pp. 258-272.
ISSN(e): 2306-0662
ISSN(p): 2306-9856
DOI: 10.18488/11.v11i4.3232

THE ROLE OF INTELLECTUAL CAPITAL IN FIRMS' PERFORMANCE AND MARKET VALUE: EVIDENCE FROM JORDAN

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Article History
Received: 5 October 2022
Revised: 8 November 2022
Accepted: 24 November 2022
Published: 13 December 2022

Keywords
Efficiency
Human capital
Intellectual capital
Jordan
Performance
Value-added.

ABSTRACT

The purpose of this study is to examine the association between intellectual capital efficiency and firms' financial performance and market value. The study employs the value-added intellectual coefficient (VAIC) model to measure intellectual capital efficiency. This model consists of three elements: human capital efficiency, structural capital efficiency, and capital employed efficiency. The study uses the return on assets (ROA) ratio to measure firms' financial performance and the market-to-book value (MBV) ratio as a measure of market value. Data for a sample of 113 manufacturing and service companies listed on the Amman Stock Exchange for 2014 to 2018 were analyzed using multiple regression analysis. The results indicate that VAIC has a significant positive relationship with a firm's financial performance, while it is unrelated to a firm's market value. Human and structural capital also have a positive influence on financial performance, but they have no relationship with market valuation. Capital employed is positively related to both financial performance and market value. The findings of this study would enable companies to better understand the role of intellectual capital in adding value for all stakeholders of the company. They may also bring standard setters' attention to the need for recognizing or disclosing intellectual capital either quantitatively or qualitatively within the accounting financial reports, which may have the potential to increase the credibility of financial reporting.

Contribution/ Originality: This study contributes to the existing literature by providing evidence on the association between intellectual capital efficiency and a firm's performance and market value from the Jordanian service and manufacturing companies. The study will help investors, firms' managers, policymakers, and researchers understand the importance of intellectual capital in a firm's performance and value creation.

1. INTRODUCTION

The resource-based theory suggests that companies can achieve high profits and gain competitive advantages through the efficient use of their resources (Caribano, Garcia-Ayuso, & Sanchez, 2000). In applying this theory, company resources are both tangible and intangible. As stated by Barney (1991), resources consist of assets, capabilities, knowledge, attributes, and organizational processes available within companies and allow them to develop and implement efficient and effective business strategies.

In today's knowledge-based economies, the wealth creation capacity has largely moved from physical to intangible resources. In an organizational context, intangible resources are referred to as intellectual capital (IC), which can be defined as having professional skills, applied experience, knowledge, organizational technology, and customer relationships that give a company competitive advantages (Edvinson & Malone, 1997). In this context, IC

represents a company's assets, which can differentiate organizations, give them competitive advantages, and contribute to their financial performance. In this regard, several empirical research provide evidence that IC is positively associated with some sort of performance (e.g., (Gogan, Artene, Sarca, & Draghici, 2016; Kamukama, Ahiauzu, & Ntayi, 2010; Soewarno & Tjahjadi, 2020; Tan, Plowman, & Hancock, 2007)).

Financial statements must provide relevant and faithfully represented information about a firm's resources to help users with their decision-making processes. However, despite IC's ability to add value and provide competitive advantages for a company, it is not recognized in financial statements because it cannot be controlled and thus does not meet the definition of assets (Goh, 2005). Because of this, financial statement users may find that traditional accounting systems have lost their relevance (Caribano et al., 2000).

The difference between a firm's market and book values is attributable to IC which is missing in the financial statements (Soler & Celestino, 2007). This difference can be as high as double or triple the company's book value. In this regard, Wallison and Litan (2000) state that the market-to-book ratio for S&P 500 firms increased from one-to-one to six-to-one from 1970 to 2000. They note that as the number of firms that earn their profits from intangible assets is increasing, the improper recognition of these assets could lead to distorted valuations and, possibly, a bubble.

Our objective in this research is to examine the relationship between IC and corporate performance in Jordan, particularly based on the quantitative measure of the value-added intellectual coefficient (VAIC) developed by Pulic (1998) and a sample of service and industrial companies listed on the Amman Stock Exchange. This study seeks to provide further evidence of the association between IC along with IC components and firm performance. The VAIC is based on the value created by a company for all stakeholders using its tangible and intangible resources. It includes three subsets, capital employed efficiency, structural capital efficiency, and human capital efficiency, the sum of which represents the VAIC.

Human capital is represented by the knowledge, skills, and experience possessed by employees of a company. These factors can largely contribute to value creation and gaining a competitive advantage. According to the human capital theory, companies' expenditures on training and educating employees will eventually lead to higher productivity (Becker, 1993). Employees' knowledge, skills, and experiences would be improved through education and training, and, as a result, their productivity would increase. Structural capital refers to business strategies, organizational infrastructure, information systems, production techniques, and databases available within a company. The main objective of structural capital is to collect and transmit information throughout the company, allowing for interaction with others. Finally, capital employed refers to the total funds deployed into a business in the form of physical assets owned by a firm. The value created for a company is largely influenced by the efficiency of these three types of capital (Pulic, 1998).

Prior research regarding the association between IC and firm performance shows mixed results. For example, Chen, Cheng, and Hwang (2005) and Alturiqi and Halioui (2020) find a positive relationship between VAIC and firms' market value and profitability, while Maditinos, Chatzoudes, Tsairidis, and Theriou (2011) argue that profitability and market value are not associated with IC. In addition, while Alturiqi and Halioui (2020) show that human capital positively influences firms' market value as measured by the Tobin's Q ratio, Bataineh, Abbadi, Alabood, and Alkurdi (2022) indicate that human capital is not related to firms' market value, and Chan (2009) suggest that human capital is negatively linked to market valuation.

Our study provides two contributions to the extant literature that examines the relationship between IC and firm performance. First, it provides further evidence on the association between IC and firm performance from the Jordanian service and manufacturing companies listed on Amman Stock Exchange. The outcomes of this research may enable companies to better understand the role of IC in value creation. This may encourage them to invest more in IC. Second, our findings may bring standard setters' attention to the need to recognize or disclose IC either quantitatively or qualitatively within a company's financial reports. This may have the potential to increase the

credibility of financial statements as users' decisions may be distorted by the omission of information regarding IC that is available within organizations.

The remainder of this paper is structured in five sections. The next section reviews prior studies related to this research and presents the research hypotheses. In section 3, we describe the sample, data collection, and statistical methods to be used. The main results are shown in section 4. Finally, in section 5, we provide some conclusions, research limitations, and recommendations.

2. LITERATURE REVIEW AND RESEARCH HYPOTHESIS

2.1. Intellectual Capital Overview

According to Steward (2000), IC refers to the intellectual material that arises from information, knowledge, experience, and intellectual property that would create value for a company. The main point highlighted by Steward in his definition is wealth creation. This concept is also emphasized by Sullivan (1999) in his definition of IC, which stipulates that IC is the knowledge that can be used by a company to generate income.

IC includes several subsets. For example, according to Edvinsson (1997), IC is comprised of two subsets: human and structural capital. In Jardon and Martinez-Cobas (2021), IC is divided into human, structural, and relational capital. Steward (2000) and Bollen, Vergauwen, and Schnieders (2005) divide IC into human, structural, and customer capital, while Leliaert, Candries, and Tilmans (2003) divide IC into human, structural, customer, and strategic alliance capital. Chang (2007) classifies IC into five elements: human, structural, social capital, intellectual property, and R&D expenditure. Finally, according to Sullivan (1999), IC is made up of human capital, structural capital, and intellectual assets.

The Skandia value scheme developed by Edvinsson (1997) is among the early development conjectures on the IC framework. According to this scheme, IC is made up of two subsets: human and structural capital. The latter includes both customer and organizational capital, which also includes processes and innovations. Innovations, in turn, consist of intangible assets and intellectual property. Figure 1 summarizes the framework outlined by the Skandia Value Scheme.

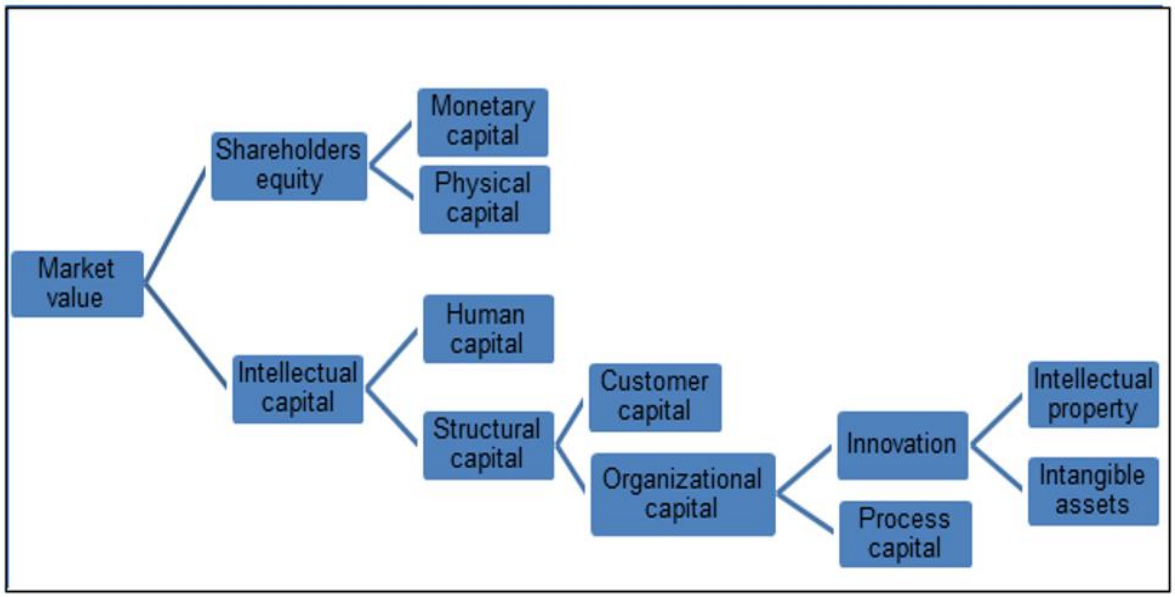

Figure 1. Skandia value scheme.

Source: Edvinsson (1997).

According to this scheme, the combination of IC and shareholders' equity determine the overall market value of a firm. Therefore, the exclusion of any of these elements would result in an increase in the difference between book and market value. Shareholders' equity, which represents monetary and physical capital, is properly captured and

presented by a company's financial statements. However, the recognition of IC in financial statements is not allowed by any standard in place to date.

2.2. Intellectual Capital and Firm Performance

Several global studies have examined the link between IC and firm performance, employing a variety of measures.

While most prior research has employed the Pulic (1998) VAIC model to proxy for IC, some researchers have modified this model by adding other components of IC. For example, Bayraktaroglu, Calisir, and Baskak (2019) incorporate customer capital efficiency and innovation capital efficiency. Shairi, Mohammad, and Tuyon (2021); Ulum (2015), and Ulum and Jati (2016) use the modified value-added intellectual coefficient (MVAIC), which is a modified version of VAIC that includes the relational capital efficiency representing the efficiency of investments in a relational aspect and is proxied for by marketing costs. In addition, Nadeem, Dumay, and Massaro (2019) presented the adjusted - value-added intellectual coefficient (A-VAIC). This version of VAIC introduced R&D costs rather than structural capital to represent a firm's ability to innovate.

IC and the performance of firms were examined by Chen et al. (2005) for Taiwanese listed companies from 1992 to 2000 using the VAIC model comprising human capital, structural capital, and capital employed. The findings indicate that VAIC has a positive relationship with market performance, measured by the MBV ratio, and with all financial performance measures (ROA, ROE, growth in revenues (GR), and employee productivity (EP)). Among all these measures of financial performance, IC explains variations in ROA more than other measures. The results also indicate that the current year's IC is positively related to the next two years' performance. Therefore, investing in IC in the current year enables companies to achieve high ROA, ROE, GR, and EP in three consecutive years.

Tan et al. (2007) examine whether IC affects the performance of companies listed on the Singapore Exchange. IC was found to be positively related to current and future performance (measured by ROE, EPS, and annual stock return). However, this study indicates that IC contribution to a firm's performance differs by industry, where a higher contribution is most evidenced in the service, property, manufacturing, and trading sectors. Chan (2009) also analyzes data for companies listed on the Hong Kong Stock Exchange to examine the link between IC and a firm's performance. IC in this study was found not to be capable of influencing the productivity of employees and a firm's MBV ratio. However, IC was found to be positively related to a firm's ROA and ROE.

By employing Pulic's VAIC model, Calisir, Gumussoy, Bayraktaroğlu, and Deniz (2010) also explore the association between IC and a firm's market value, profitability (ROA and ROE), and productivity over fourteen information technology companies in Turkey from 2005 to 2007. Although the study focuses on knowledge-based firms, the only significant influence found is between IC and ROA. Apart from this result, no association is found between IC and the other measures of performance. In addition, Clarke, Seng, and Whiting (2011) analyze data for firms listed on the Australian Stock Exchange from 2003 to 2008. Using ROA, ROE, EP, and GR as measures of performance, they indicate a positive relationship between IC and each measure, except for revenue growth. IC in this study also has a positive influence on future performance. Furthermore, using data from ninety-six Greek companies, Maditinos et al. (2011) found no significant relationship between firms' performance (MBV, ROE, ROA, and GR) and IC. They suggest that companies in emerging and developing countries rely on tangible assets, neglecting intangible assets, in deriving their income.

Ahangar (2011) applied the VAIC model to a large Iranian company for a period covering thirty years from 1980 to 2009 to investigate whether IC plays any role in its financial performance measured by a growth in sales, EP, and profitability. The outcomes indicate that productivity and profitability are the only measures significantly associated with IC. Gogan et al. (2016) analyzed data collected using a questionnaire from four Romanian companies working in drinking water distribution from 2010 to 2014. The findings show the association between IC and organizational performance is significant and positive.

Smriti and Das (2018) used a sample of service and manufacturing companies listed on the Indian stock market from 2001 to 2016. They investigated the effect of IC, measured using VAIC, on financial performance (Sales Growth, Tobin's Q, ROA, and Asset Turnover Ratio). The findings indicate that Indian companies are utilizing their IC well. Similarly, Alturiqi and Halioui (2020) applied the VAIC model in Saudi Arabia. They examined the effect of IC on firms' market performances (Tobin's Q) and financial performances (ROA and ROE). The results support a positive relationship between IC components (CEE, SCE, and HCE) as well as the overall IC efficiency with a firm's financial performance. In addition, a positive association is shown between market performance and both HCE and SCE. Bataineh et al. (2022) examine the link between VAIC components and P/BV, P/E, EPS, and ROA as a firm's performance. Data for forty-six Jordanian service firms listed on the Amman Stock Exchange (ASE) from 2014 to 2019 was analyzed. The findings provide strong evidence of the role that IC plays in a firm's performance; IC is associated with a higher market value as well as a higher financial performance.

Shairi et al. (2021) analyzed data for technology firms listed on Bursa Malaysia from 2013 to 2019. They employed the MVAIC model in their study and measured performance by ROA. They found that ROA is positively and significantly related to MVAIC. However, mixed results regarding MVAIC components were documented; ROA is positively associated with HCE and CEE and negatively associated with SCE, while it has no significant relationship with RCE. Finally, employing the A-VAIC model, Dalwai and Salehi (2021) investigate the impact of IC and business strategies on Omani firms' bankruptcy and performance by analyzing 380 firm-year observations for non-financial sector companies listed on the Muscat Securities Market. Using ROE and ROA as measures for firms' performance, the findings show no effect of A-VAIC on any measure of a firm's performance, while SCE has a positive association with ROA.

2.2.1. Human Capital, ROA, and MBV

The relationships between human capital and a firm's market value and profitability have been explored by several studies. For example, these relationships have been examined for Taiwanese listed companies by Chen et al. (2005), for Malaysian technology sector companies by Gan and Saleh (2008), and for a sample of twenty-five firms listed on the Saudi Stock Exchange by Alturiqi and Halioui (2020). All these studies provide evidence that human capital is positively related to both firms' profitability and market value.

Other studies indicate that human capital positively affects profitability, but it is not associated with market value. Bataineh et al. (2022) indicate that Jordanian service sector firms' profitability, measured by return on assets, is positively and significantly affected by human capital efficiency. The same findings were found among ICT companies in Turkey, where HCE is the only sub-dimension of IC that positively affects ROA (Calisir et al., 2010). Chowdhury, Rana, and Azim (2019) also show that human capital affects ROA in Bangladesh pharmaceutical sector companies but does not affect MBV.

Ahangar (2011) shows a positive association between HCE and ROA in an Iranian company, which turned out to be the most dynamic sub-dimension of IC in creating value when compared with CEE and SCE. In addition, among the listed companies on the Australian Stock Exchange, human capital efficiency leads to an increase in firms' performance in terms of ROA (Clarke et al., 2011). Other studies that document a positive relationship between HCE and ROA include Sardo and Serrasqueiro (2017) and Shairi et al. (2021). Conversely, Dalwai and Salehi (2021), Soewarno and Tjahjadi (2020), and Smriti and Das (2018) find that HCE is not associated with ROA.

Although HCE is not associated with ROA, it is the only variable that is significantly related to the MBV of Greek companies in a positive direction (Maditinos et al., 2011). Conversely, while HCE does not affect a firm's ROA, it is negatively linked to MBV in Hong Kong (Chan, 2009). This means that investors in Hong Kong view expenditures incurred to develop employee skills, knowledge, and capabilities as expenses that would reduce the market value of the company. Finally, Wang and Chang (2005) and F-Jardon and Martos (2009) found no direct

association between performance and human capital. However, they show that human capital can increase the performance of firms through their structural and relational capital.

2.2.2. Structural Capital, ROA, and MBV

Several studies provide evidence that structural capital is positively associated with ROA (e.g., (Alturiqi & Halioui, 2020; Chen et al., 2005; Dalwai & Salehi, 2021; F-Jardon & Martos, 2009)). In addition, structural capital was found to be positively related to ROA in Malaysian service and non-service industries (Bontis, Kew, & Richardson, 2000), in all publicly listed companies in South Africa (Firer & Williams, 2003), and in microfinance institutions in Uganda (Kamukama et al., 2010). Findings for companies listed on the Hang Seng Index also exhibited a positive correlation between ROA and SCE found by Chan (2009). The same result was found in China for the automobile industry by Ji-Jian, Nai-ping, and Yu-Sheng (2006). However, contrary to the above worldwide evidence, Shairi et al. (2021) report a negative association between ROA and SCE. Regarding MBV, Chen et al. (2005) and Bataineh et al. (2022) provide evidence that structural capital is positively linked with an MBV ratio.

No relationship was found between SCE and ROA in Greece (Maditinos et al., 2011), Turkey (Calisir et al., 2010), Hong Kong (Chan, 2009), Malaysia (Gan & Saleh, 2008), Australia (Clarke et al., 2011), Iran (Ahangar, 2011), Bangladesh (Chowdhury et al., 2019), Jordan (Bataineh et al., 2022), India (Maji & Goswami, 2016), or Taiwan (Shiu, 2006). Meanwhile, MBV was found not to be related to SCE in studies in Greece (Maditinos et al., 2011), Hong Kong (Chan, 2009), Malaysia (Gan & Saleh, 2008), Turkey (Calisir et al., 2010), Bangladesh (Chowdhury et al., 2019), Sri Lanka (Dharmakeerthi & Ranjani, 2022), and by Firer and Williams (2003) in South Africa.

2.2.3. Capital Employed, ROA, and MBV

Among listed companies in Taiwan from 1992 to 2002, Chen et al. (2005) indicate a positive relationship between the CEE and both ROE and MBV. Similar results were found by Chan (2009) in Hong Kong. CEE in these two studies was the most influential sub-dimension of VAIC for ROA and MBV when compared with HCE and SCE. Gan and Saleh (2008) also found that CEE is positively associated with MBV and ROA for technological companies in Malaysia.

Meanwhile, Chang (2007); Maji and Goswami (2016); Alturiqi and Halioui (2020), Ji-Jian et al. (2006); Clarke et al. (2011); Dalwai and Salehi (2021) and Shairi et al. (2021) indicate that CEE is positively linked with ROA. Conversely, studies like Firer and Williams (2003); Calisir et al. (2010); Ahangar (2011); Maditinos et al. (2011); Chowdhury et al. (2019); Dalwai and Salehi (2021); and Bataineh et al. (2022) do not find any relationship between ROA and CEE.

Although Firer and Williams (2003) and Bataineh et al. (2022) show no relationship between ROA and CEE, they indicate that CEE is positively related to MBV. Finally, Calisir et al. (2010), Maditinos et al. (2011), and Chowdhury et al. (2019) show that CEE is not related to MBV. This indicates that the companies examined are not relying on CEE when deriving their market value.

2.2.4. Research hypotheses

To address the research objective of this study, the following hypotheses have been developed:

H1a: VAIC is positively associated with firms' financial performance.

H1b: VAIC is positively associated with firms' market performance.

H2a: HCE is positively associated with firms' financial performance.

H2b: HCE is positively associated with firms' market performance.

H3a: SCE is positively associated with firms' financial performance.

H3b: SCE is positively associated with firms' market performance.

H4a: CEE is positively associated with firms' financial performance.

H4b: CEE is positively associated with firms' market performance.

3. RESEARCH METHOD

3.1. Sample and data collection

The sample for this study includes manufacturing and service firms listed on the Amman Stock Exchange from 2014 to 2018. Financial companies were excluded from the analysis because of their different capital structure. The data related to the variables of interest for the sample firms were collected from their annual reports for the financial years 2014 to 2018 and from the ASE and Jordanian Securities Depository Center websites. Companies without all the required data about the independent and dependent variables have been excluded. The final sample for the study consists of 113 companies with 565 firm-year observations.

3.2. Variable Definition and Measurement

3.2.1. Dependent Variables

The analysis includes two dependent variables: firms' financial performance and market performance. Financial performance is measured by the return on assets ratio (ROA), while market performance is measured by the market-to-book ratio (MBV). We calculate the ROA ratio by dividing earnings before interest and tax (EBIT) on total assets and the MBV ratio by dividing the market value per share by the book value per share. ROA was used as a measure of financial performance by Clarke et al. (2011); Chen et al. (2005); Chang (2007); Firer and Williams (2003); Chan (2009), and Calisir et al. (2010). Conversely, MBV was used as a measure of market performance by Chang (2007) and Chan (2009).

3.2.2. Independent Variables

The independent variables include *VAIC* and its three components, which are determined using Pulic's (1998) model. This model has been widely used in the accounting literature (e.g., (Al-Musali & Ismail, 2014; Shahveisi, Khairollahi, & Alipour, 2017)). It accounts for value creation efficiency using basic accounting figures. The computation process is summarized in Pulic (2000) and involves the following two steps:

Step 1: Calculate value-added

The value-added, according to Pulic (1998), represents the difference between outputs and inputs:

$$VA = outputs - inputs$$

Where *VA* represents the value created to all stakeholders of a company during a financial year. Outputs represents a company's operating revenue for that year, while inputs represent a company's operating expenses excluding employee salaries and allowances, which are considered to be value creating and not expenditures (Puntillo, 2009; Tan, Plowman, & Hancock, 2008). However, *VA* can be determined by adding back non-cash expense items to EBIT:

$$VA = EBIT + W + D + A$$

Where EBIT is a company's operating profit before interest and tax, W is wages and salaries during the period, and D and A are depreciation and amortization expense during the period, respectively. The right-hand side of this equation represents portions of earnings attributed to all stakeholders of the company. For example, EBIT is earnings attributed to the shareholders of the company (net income), creditors (interests), and government (taxes).

Step 2: Calculate capital efficiency ratios

3.2.2.1. Human Capital Efficiency (HCE)

Human capital (HC) includes skills, experiences, and knowledge possessed by the employees of a company. According to the VAIC model, HC refers to the salaries and wages during the year. High wages suggest greater skills and experience, and thus greater productivity:

$$HC = total\ expense\ of\ employees$$

HCE refers to the ratio of value-added to human capital (i.e., $HCE = VA / HC$). HCE shows the value added by each unit of currency spent on employees. The higher the ratio, the more efficiently a firm is utilizing its human capital.

3.2.2.2. Structural Capital Efficiency (SCE)

Structural capital (SC) includes information systems, databases, and other organizational infrastructure. According to Pulic (1998), SC is the difference between value-added and human capital:

$$SC = VA - HU$$

SC is negatively related to HC. Therefore, to mitigate any inconsistency between the efficiency of HC and SC, Pulic (1998) calculates SCE as SC/VA. SCE, therefore, indicates the value-added to the stakeholders of a company by each unit of currency spent on structural capital.

3.2.2.3. Capital Employed Efficiency (CEE)

CE is the book value of a company's physical assets, calculated as:

$$CE = total\ assets - intangible\ assets$$

CEE is the ratio of value-added to capital employed (i.e., $CEE = VA/ CE$). CEE shows the value-added by each unit of currency spent on physical capital. High CEE indicates that a company is efficiently utilizing its capital employed.

3.2.2.4. Value-added Intellectual Coefficient (VAIC)

The *VAIC* is calculated by summing the above three elements:

$$VAIC = HCE + SCE + CEE$$

VAIC is an indirect measure of the value created by the company's tangible and intangible assets. A higher *VAIC* means that the company is efficiently utilizing its human, structural, and physical capitals.

3.2.3. Control Variables

We control for the effect of two variables that have been evidenced to affect a firm's performance: firm size and leverage (e.g., (Chowdhury et al., 2019; Dalwai & Salehi, 2021; Firer & Williams, 2003)). Firm size is represented by the natural log of total assets. Controlling for firm size ensures the results are not related to the wealth, economies of scale, or bargaining power of large firms. Leverage, on the other hand, is measured as the ratio of total debt to total equity. A higher proportion of debt compared to equity is expected to inversely affect a company's performance.

3.3. Regression Model

To examine the association between a firm's performance and its IC, the following regression models have been developed:

$$\text{Model 1: } ROA_{i,t} = \beta_0 + \beta_1 VAIC_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon$$

$$\text{Model 2: } MBV_{i,t} = \beta_0 + \beta_1 VAIC_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon$$

Model 3: $$ROA_{i,t} = \beta_0 + \beta_1 HCE_{i,t} + \beta_2 SCE_{i,t} + \beta_3 CEE_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \varepsilon$$

Model 4: $$MBV_{i,t} = \beta_0 + \beta_1 HCE_{i,t} + \beta_2 SCE_{i,t} + \beta_3 CEE_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \varepsilon$$

Where:

$ROA_{i,t}$ Return on assets ratio for firm $_i$ in year $_t$

$MBV_{i,t}$ Market to book value for firm $_i$ in year $_t$

$VAIC_{i,t}$ Value-added intellectual coefficient for firm $_i$ in year $_t$

$HCE_{i,t}$ Human capital efficiency for firm $_i$ in year $_t$

$SCE_{i,t}$ Structural capital efficiency for firm $_i$ in year $_t$

$CEE_{i,t}$ Capital employed efficiency for firm $_i$ in year $_t$

$SIZE_{i,t}$ Size of firm $_i$ in year $_t$

$LEV_{i,t}$ Leverage ratio for firm $_i$ in year $_t$

ε Error term

Models 1 and 2 examine the relationships between *VAIC* as a measure of capital efficiency and a firm's financial and market performance, respectively, while models 3 and 4 are concerned with the relationship between the components of *VAIC* for both financial and market performance.

4. DATA ANALYSIS

4.1. Descriptive Statistics

Table 1 presents some statistics for the dependent, independent, and control variables included in the study. Regarding the dependent variable financial performance, measured by *ROA*, the average annual return earned by manufacturing and service firms in Jordan during the period of study was 5.47% of their total assets with a standard deviation of 7.53%. This is higher than the ratio indicated by Bataineh et al. (2022) for service firms (*ROA* = 3.32) from 2014 to 2019. The lowest return on assets earned by individual companies was 0 and the highest return was 41.78% of total assets. Regarding the other dependent variable, *MBV*, the average market-to-book ratio for the sample firms was 1.417. It ranged from 0 to 11.728 with a standard deviation of 1.656. This is close to the value of 1.10 found by Bataineh et al. (2022).

Table 1. Descriptive statistics.

Variable	Mean	S. Dev	Min	Max
ROA	0.0547	0.0753	0	0.4178
MBV	1.417	1.656	0	11.728
VAIC	4.077	4.072	0	24.733
HCE	2.989	3.098	0	16.379
SCE	1.057	2.108	0	17.378
CEE	0.142	0.168	0	1.091
SIZE	7.395	0.694	5.706	9.083
LEV	0.408	0.348	0.0049	3.660

The statistics for the independent variable were as follows: the mean for *VAIC* was 4.077 with a standard deviation of 4.072. The minimum value was 0 and the maximum value was 24.733. The mean for *HCE* is 2.989 with a standard deviation of 3.098. The minimum value was 0 and the maximum value was 16.379. The mean for *SCE* was 1.057 and the standard deviation was 210.8 %, with values ranging from 0 to 17.378. The *CEE* had a mean of 0.142 and a standard deviation of 0.168, with values ranging between 0 and 1.091. As can be noted HCE is the most effective *VAIC* component in terms of creating value for the company compared to *SCE* and *CEE*.

Regarding the control variables, the descriptive statistics indicate that company size, in terms of the natural logarithm of total assets, is an average of 7.395. In addition, the sample firms have a leverage ratio of 40.8 % with a standard deviation of 34.8 %.

4.2. Correlation Analysis

The Pearson correlation coefficients have been calculated among all the variables included in the study. Table 2 presents the results.

As the table shows, *SCE* is negatively correlated with both *HCE* and *CEE*, while *HCE* has a positive correlation with *CEE*. In addition, there is a relatively high positive correlation between *CEE* and *ROA*. However, the results indicate that multicollinearity does not exist among the independent variables that may affect the analysis. All the correlation coefficients between the independent variables are less than 0.70 indicating that no multicollinearity problem exists. This is also confirmed by the variance inflation factor (VIF) in the second column of Table 3, where all VIFs are less than ten. A VIF below ten indicates that no multicollinearity problem exists (Gujarati, 2003).

Table 2. Pearson correlation matrix.

Variable	VAIC	HCE	SCE	CEE	SIZE	LEV	ROA	MBV
VAIC	1							
HCE	N/A	1.000						
SCE	N/A	-0.114	1.000					
CEE	N/A	0.268	-0.175	1.000				
SIZE	0.241	0.381	-0.122	0.045	1.000			
LEV	-0.200	-0.253	0.074	-0.235	0.231	1.000		
ROA	0.388	0.506	-0.114	0.761	0.117	-0.241	1	
MBV	-0.046	-0.046	-0.011	0.076	-0.059	0.109	N/A	1

As the table shows, *SCE* is negatively correlated with both *HCE* and *CEE*, while *HCE* has a positive correlation with *CEE*. In addition, there is a relatively high positive correlation between *CEE* and *ROA*. However, the results indicate that multicollinearity does not exist among the independent variables that may affect the analysis. All the correlation coefficients between the independent variables are less than 0.70 indicating that no multicollinearity problem exists. This is also confirmed by the variance inflation factor (VIF) in the second column of Table 3, where all VIFs are less than ten. A VIF below ten indicates that no multicollinearity problem exists (Gujarati, 2003).

4.3. Regression Analysis

Table 3 presents a summary of the results for the four regression models developed in this study. The F-statistics in all models are statistically significant at the 5% level ($p < 0.05$) which confirm the validity of these models for the analysis. However, the explanatory power, as indicated by the R^2, is low in models 2 and 4 (0.019 and 0.033, respectively) suggesting that other variables not included may affect the relationship between *VAIC* and *MBV*. The R^2 in models 1 and 3 indicate that the variables included in these models explain 18.4% and 68.2%, respectively, of the variation in *ROA*.

Panel A of Table 3 shows the results regarding the relationship between the value-added intellectual coefficient, as well as the control variables size and leverage, with firms' financial and market performance (*ROA* and *M*BV). The coefficient on VAIC is positive and statistically significant at the 1% level in model 1, but insignificant in model 2. This result supports hypothesis H1a but induces us to reject hypothesis H1b. Thus, there is a positive association between VAIC and firm financial performance measured by ROA, while there is no relationship between VAIC and MBV as a measure of market performance. The result regarding *ROA* is consistent with Maji and Goswami (2016) and Tan et al. (2007) supporting that *VAIC* positively affects firm financial performance but contradicts the result in Dalwai and Salehi (2021) who found no association between *VAIC* and *ROA*.

Regarding the control variables, the results indicate that there is a positive relationship between *SIZE* and *ROA* which is statistically significant at the 5% level, suggesting that a firm's profitability increases as a firm grows. However, although significant, the coefficient on *SIZE* in model 2 is negative, which suggest that a firm's market valuation lowers as it grows. Regarding leverage, the results indicate there is a statistically significant relationship between *LEV* and a firm's performance at the 1% level; the coefficient on *LEV* is negative when the performance is measured by *ROA* and positive when measured by *MBV*.

Table 3. Regression results.

Panel A: Regression results for models 1 and 2							
		Model 1			**Model 2**		
Variable	**VIF**	**coeff**	**t-stat**	**Sig.**	**coeff**	**t-stat**	**Sig.**
VAIC	1.146	0.006	8.074*	0.000	0.001	0.034	0.973
SIZE	1.162	0.009	1.993**	0.047	-0.214	-1.992**	0.047
LEV	1.140	-0.042	-4.775*	0.000	0.618	2.909*	0.004
		Dependent variable: ROA			**Dependent variable:** MBV		
		F = 42.270 P-value = 0.000 R^2 = 0.184 Adjusted R^2= 0.180			F = 3.699 P-value = 0.012 R^2 = 0.019 Adjusted R^2= 0.014		
Panel B: Regression results for models 3 and 4.							
		Model 3			**Model 4**		
Variable	**VIF**	**coeff**	**t-stat**	**Sig.**	**coeff**	**t-stat**	**Sig.**
HCE	1.424	0.009	12.366*	0.000	0.001	0.041	0.967
SCE	1.053	0.002	2.046**	0.041	-0.012	-0.353	0.724
CEE	1.135	0.304	26.807*	0.000	1.131	2.600*	0.010
SIZE	1.363	-0.005	-1.633	0.103	-0.250	-2.153**	0.032
LEV	1.273	0.003	0.549*	0.000	0.769	3.447*	0.001
		Dependent variable: ROA			Dependent variable: MBV		
		F = 239.878 P-value = 0.000 R^2 = 0.682 Adjusted R^2= 0.679			F = 3.768 P-value = 0.002 R^2 = 0.033 Adjusted R^2= 0.024		

Note: *Correlation is significant at 0.01 level, ** Correlation is significant at 0.05 level.

Panel B of Table 3 presents the results regarding the relationship between *VAIC* components (*HCE*, *SCE*, and *CEE*), and the control variables *SIZE* and *LEV*, with a firm's performance measured by *ROA* and *MBV*. **The** coefficient on *HCE* is positive and statistically significant at the 1% level when a firm's performance is measured by *ROA*. Thus, hypothesis H2a, which posits that a firm's financial is positively associated with *HCE* is supported. This result is consistent with the result of Bataineh et al. (2022) and Sardo and Serrasqueiro (2017), while it is inconsistent with Dalwai and Salehi (2021); Soewarno and Tjahjadi (2020) and Smriti and Das (2018) who find that *HCE* is not related to *ROA*. Our results suggest that as expenditure on employees increases, the financial performance of a company improves. This can be attributed to employees improved skills through education and training, or increased job satisfaction, which would lead to increased productivity and, consequently, increase profitability.

The coefficient on *HCE* is not statistically significant when performance is measured by *MBV*, and therefore, hypothesis H2b is rejected. Thus, there is no relationship between *HCE* and market performance. This can be explained by investors not paying attention to expenditures on employees when making investment decisions. This result, however, is consistent with Bataineh et al. (2022) but is inconsistent with Soewarno and Tjahjadi (2020) and Firer and Williams (2003) who find a positive relationship between *HCE* and *MBV*.

The coefficient on *SCE* is positive and statistically significant at the 5% level when a firms' performance measured by *ROA*, which supports hypothesis H3a. This result is consistent with the results of Dalwai and Salehi (2021); Soewarno and Tjahjadi (2020) and Firer and Williams (2003). The result indicates that good organizational infrastructure, business processes and strategies, databases, networks, information systems, and other capabilities

support and improve employees productivity and, therefore, enhance profitability. This supports organizational and innovation theories, which suggest that valuable, rare, inimitable, and non-substitutable structural capital generate higher profitability (Soewarno & Tjahjadi, 2020). However, our result regarding *SCE* and *ROA* is inconsistent with the results of Bataineh et al. (2022); Bayraktaroglu et al. (2019), and Chowdhury et al. (2019) who indicate that *SCE* and *ROA* are unrelated. If a firm's performance is measured by *MBV* but the coefficient on *SCE* is not statistically significant, this leads us to reject hypothesis H3b and suggests there is no relationship between *SCE* and market performance. This is inconsistent with Bataineh et al. (2022) who finds a positive relationship between *SCE* and *MBV*.

Regarding *CEE*, panel B of Table 3 shows that the coefficient on *CEE* is positive and statistically significant at the 1% level when a firm's performance is measured by both *ROA* and *MBV*. Therefore, both H4a and H4b hypotheses are supported. This indicates that *CEE* is positively associated with both measures of firm performance, which is in line with the financial theory that suggests that the efficient use of a firm's capital would improve their profitability and enhance stock prices. Regarding the *ROA*, the result is consistent with Soewarno and Tjahjadi (2020); Smriti and Das (2018), and Chen et al. (2005) but inconsistent with Bataineh et al. (2022) and Dalwai and Salehi (2021) who find that *CEE* has no effect on *ROA*. As for the *MBV*, our result is consistent with Bataineh et al. (2022); Soewarno and Tjahjadi (2020), and Firer and Williams (2003) who also find that a higher *CEE* is associated with a higher market value. This result also supports Firer and Williams' argument (2003) who suggest that a firm's physical and financial capital plays a significant role in value creation in emerging and developing markets.

Finally, the coefficient on *SIZE* is not statistically significant when a firm's performance is measured by *ROA*, but it is negative and statistically significant at the 5% level when a firm's performance is measured by *MBV*. The coefficient on *LEV* is positive and statistically significant at the 1% level when a firm's performance is measured by both *ROA* and *MBV*.

5. CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

This research examined the relationship between the value-added intellectual coefficient and its components with firms' performance measured by *ROA* and *MBV* ratios for all manufacturing and service companies listed on ASE for 2014 to 2018. The empirical findings show that *VAIC* is statistically and positively related to firms' financial performance as measured by *ROA*, while it is unrelated to firms' market performance as measured by *MBV*. The results also indicate that *HCE* and *SCE* have a significant positive influence on firms' profitability, but no significant relationship with firms' market valuation. In addition, *CEE* is positively and significantly related to both the profitability and market value of a firm.

A positive relationship between both *HCE* and *SCE* with a firm's profitability suggests that if a firm's expenditure on employees, organizational infrastructure, and information systems is efficiently used and managed it would increase its profitability. These expenditures would improve employee knowledge, skills, capabilities, or job satisfaction which would increase their productivity and, ultimately, lead to higher profitability. Conversely, the results related to market performance analysis indicate that investors in Jordan appreciate investment in physical and financial assets more than investment in employees and organizational infrastructure. This is evidenced by the positive coefficient on the *CEE* variable, which is the only significant variable among all the components of *VAIC* examined.

Our findings may have implications for policymakers. The results particularly indicate that IC is associated with profitability. This highlights the need for recognizing or disclosing IC information, either quantitatively or qualitatively, within financial reports. This may have the potential to increase the credibility of financial statements as users' decisions may be distorted by the omission of information regarding IC available within a company.

Two limitations associated with this study are identified. First, the analysis is based on a pooled sample that includes companies listed with the industrial and service sectors of the Amman Stock Exchange; therefore, the results may differ if these two sectors are examined separately or if other sectors are included. Second, the analysis is based

on the *VAIC* model, which includes three subsets: human capital, structural capital, and capital employed. However, this model does not cover all aspects of IC.

Based on the results obtained, this study recommends that firms should invest more in human capital to permit innovation through developing new products, processes, and services which would ultimately be reflected in better financial performances. Investment in and the efficient management of structural capital would also support employee productivity and enhance firm profitability. In addition, due to their positive association with firm profitability, we recommend that investors should take all IC aspects into consideration when making investment decisions. However, we recommend that future research in Jordan be carried out by adding other components of IC, like social and relational capital.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study.

REFERENCES

Ahangar, R. G. (2011). The relationship between intellectual capital and financial performance: An empirical investigation in an Iranian company. *African Journal of Business Management*, *5*(1), 88-95.

Al-Musali, M. A. K., & Ismail, K. N. I. K. (2014). Intellectual capital and its effect on financial performance of banks: Evidence from Saudi Arabia. *Procedia-Social and Behavioral Sciences*, *164*, 201-207.Available at: https://doi.org/10.1016/j.sbspro.2014.11.068.

Alturiqi, A., & Halioui, K. (2020). The impact of intellectual capital on firms' performance: Evidence from Saudi Arabia. *Accounting and Finance Research*, *9*(4), 1-26.Available at: https://doi.org/10.5430/afr.v9n4p44.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120.Available at: https://doi.org/10.1177/014920639101700108.

Bataineh, H., Abbadi, S. S., Alabood, E., & Alkurdi, A. (2022). The effect of intellectual capital on firm performance: The mediating role of family management. *Journal of Islamic Accounting and Business Research 13* (5), 845-863.Available at: https://ezproxy.yu.edu.jo:2087/10.1108/JIABR-02-2022-0032.

Bayraktaroglu, A. E., Calisir, F., & Baskak, M. (2019). Intellectual capital and firm performance: An extended VAIC model. *Journal of Intellectual Capital*, *20*(3), 406-425.Available at: https://doi.org/10.1108/jic-12-2017-0184.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education* (3rd ed.). Chicago: University of Chicago Press.

Bollen, L., Vergauwen, P., & Schnieders, S. (2005). Linking intellectual capital and intellectual property to company performance. *Management Decision*, *43*(9), 1161-1185.Available at: https://doi.org/10.1108/00251740510626254.

Bontis, N., Kew, W. C., & Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital*, *1*(1), 85-100.

Calisir, F., Gumussoy, C. A., Bayraktaroğlu, A. E., & Deniz, E. (2010). Intellectual capital in the quoted Turkish ITC sector. *Journal of Intellectual Capital*, *11*(4), 537-553.Available at: https://doi.org/10.1108/14691931011085678.

Caribano, L., Garcia-Ayuso, M., & Sanchez, P. (2000). Accounting for intangibles: A literature review. *Journal of Accounting Literature*, *19*, 102-130.

Chan, K. H. (2009). Impact of intellectual capital on organisational performance. An empirical study of companies in the Hang Seng Index (Part1). *The Learning Organization*, *16*(1), 4-21.

Chang, S. L. (2007). *Valuing intellectual capital and firms' performance: Modifying value added intellectual coefficient (VAICTM) in Taiwan IT industry*. Unpublished Doctoral dissertation, Golden Gate University, San Francisco.

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*, *6*(2), 159-174.Available at: https://doi.org/10.1108/14691930510592771.

Chowdhury, L. A. M., Rana, T., & Azim, M. I. (2019). Intellectual capital efficiency and organizational performance. *Journal of Intellectual Capital*, *20*(6), 784–806.

Clarke, M., Seng, D., & Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital*, *12*(4), 505–530.

Dalwai, T., & Salehi, M. (2021). Business strategy, intellectual capital, firm performance, and bankruptcy risk: evidence from Oman's non-financial sector companies. *Asian Review of Accounting*, *29*(3), 474-504.Available at: https://doi.org/10.1108/ara-01-2021-0008.

Dharmakeerthi, M. M. K. S., & Ranjani, R. P. C. (2022). The impact of intellectual capital on firm value: A comparative study of consumer services companies and capital goods companies listed in CSE. *Journal of Accountancy and Finance*, *9*(1), 109-123.

Edvinson, L., & Malone, M. S. (1997). *Intellectual capital: Realizing your company's true value by finding its hidden brainpower*. New York: Harper Business.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long Range Planning*, *30*(3), 366-373.Available at: https://doi.org/10.1016/s0024-6301(97)00016-2.

F-Jardon, C. M., & Martos, M. S. (2009). Intellectual capital and performance in wood industries of Argentina. *Journal of Intellectual Capital*, *10*(4), 600-616.

Firer, S., & Williams, S. M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital*, *4*(3), 348-360.Available at: https://doi.org/10.1108/14691930310487806.

Gan, K., & Saleh, Z. (2008). Intellectual capital and corporate performance of technology-intensive companies: Malaysia evidence. *Asian Journal of Business and Accounting*, *1*(1), 113-130.

Gogan, L. M., Artene, A., Sarca, I., & Draghici, A. (2016). The impact of intellectual capital on organizational performance. *Procedia - Social and Behavioral Sciences*, *221*, 194–202.

Goh, P. C. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of Intellectual Capital*, *6*(3), 385-396.Available at: https://doi.org/10.1108/14691930510611120.

Gujarati, D. (2003). *Basic econometrics*. New York: McGraw- Hill.

Jardon, C. M., & Martinez-Cobas, X. (2021). Measuring intellectual capital with financial data. *Plos One*, *16*(10), e0249989.Available at: https://doi.org/10.1371/journal.pone.0259568.

Ji-Jian, Z., Nai-ping, Z., & Yu-Sheng, K. (2006). Study on intellectual capital and enterprise's performance- empirical evidence from the Chinese Securities Market. *Journal of Modern Accounting and Auditing*, *2*(10), 35-39.

Kamukama, N., Ahiauzu, A., & Ntayi, J. M. (2010). Intellectual capital and performance: Testing interaction effects. *Journal of Intellectual Capital*, *11*(4), 554-574.

Leliaert, P. J., Candries, W., & Tilmans, R. (2003). Identifying and managing IC: A new classification. *Journal of Intellectual Capital*, *4*(2), 202-214.Available at: https://doi.org/10.1108/14691930310472820.

Maditinos, D., Chatzoudes, D., Tsairidis, C., & Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital*, *12*(1), 132-151.Available at: https://doi.org/10.1108/14691931111097944.

Maji, S. G., & Goswami, M. (2016). Intellectual capital and firm performance in emerging economies: The case of India. *Review of International Business and Strategy*, *26*(3), 410–430.Available at: https://doi.org/10.1108/ribs-03-2015-0019.

Nadeem, M., Dumay, J., & Massaro, M. (2019). If you can measure it, you can manage it: A case of intellectual capital. *Australian Accounting Review*, *29*(2), 395-407.Available at: https://doi.org/10.1111/auar.12227.

Pulic, A. (1998). *Measuring the performance of Intellectual Potential (IP) in knowledge economy. In C. Tiffany, & S. Jennifer (Eds.)*. Paper presented at the 19th Annual National Business Conference. DeGroote School of Business.

Pulic, A. (2000). VAIC™–an accounting tool for IC management. *International Journal of Technology Management*, *20*(5-8), 702-714.Available at: https://doi.org/10.1504/ijtm.2000.002891.

Puntillo, P. (2009). Intellectual capital and business performance. Evidence from Italian banking industry. *Electronic Journal of Corporate Finance*, *4*(12), 97-115.

Sardo, F., & Serrasqueiro, Z. (2017). A European empirical study of the relationship between firms' intellectual capital, financial performance and market value. *Journal of Intellectual Capital*, *18*(4), 771-788.Available at: https://doi.org/10.1108/jic-10-2016-0105.

Shahveisi, F., Khairollahi, F., & Alipour, M. (2017). Does ownership structure matter for corporate intellectual capital performance? An empirical test in the Iranian context. *Eurasian Business Review*, *7*(1), 67-91.Available at: https://doi.org/10.1007/s40821-016-0050-8.

Shairi, S. A. B., Mohammad, H. S., & Tuyon, J. (2021). Intellectual capital and firm performance: Evidence from technology sector in Malaysia. *International Journal of Academic Research in Economics and Management and Sciences*, *10*(1), 244–258.

Shiu, H.-J. (2006). The application of the value added intellectual coefficient to measure corporate performance: Evidence from technological firms. *International Journal of Management*, *23*(2), 356-365.

Smriti, N., & Das, N. (2018). The impact of intellectual capital on firm performance: A study of Indian firms listed in COSPI. *Journal of Intellectual Capital*, *19*(5), 935-964.Available at: https://doi.org/10.1108/jic-11-2017-0156.

Soewarno, N., & Tjahjadi, B. (2020). Measures that matter: An empirical investigation of intellectual capital and financial performance of banking firms in Indonesia. *Journal of Intellectual Capital*, *21*(6), 1085-1106.Available at: https://doi.org/10.1108/jic-09-2019-0225.

Soler, L. E., & Celestino, D. J. (2007). Evaluating the scope of IC in firm's value. *Journal of Intellectual Capital*, *8*(3), 470-493.

Steward, T. A. (2000). Intellectual capital: The new wealth of organisation. *Journal of Intellectual Capital*, *21*(1), 60-70.

Sullivan, P. H. (1999). Profiting from intellectual capital. *Journal of Knowledge Management*, *3*(2), 132-142.

Tan, H. P., Plowman, D., & Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital*, *8*(1), 76-95.

Tan, H. P., Plowman, D., & Hancock, P. (2008). The evolving research on intellectual capital. *Journal of Intellectual Capital*, *9*(4), 585-608.Available at: https://doi.org/10.1108/14691930810913177.

Ulum, I. (2015). *Intellectual capital: Measurement models, disclosure frameworks, and organizational performance*. Malang: UMM Press.

Ulum, I., & Jati, A. W. (2016). Intellectual capital performance: A comparative study between financial and non-financial industry of Indonesian biggest companies. *International Journal of Economics and Financial Issues*, *6*(4), 1436-1439.

Wallison, P. J., & Litan, R. E. (2000). Corporate disclosure in the internet age. *Available at SSRN 235274*.

Wang, W.-Y., & Chang, C. (2005). Intellectual capital and performance in causal models. Evidence from the information technology industry in Taiwan. *Journal of Intellectual Capital*, *6*(2), 222-236.