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IC Efficiency and Firm Performance Among Industrial Companies in Jordan: An Extended Vaic Approach

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Abstract

The purpose of this study is to investigate the impact of intellectual capital (IC), which include human, structural, relational, employed capital, and innovation, on the performance of industrial companies that are listed on the Amman Stock Exchange. In the present knowledge-driven era, the significance of IC has surpassed that of tangible assets and financial resources. IC has become a vital factor for economic progress, primarily due to the increasing value placed on intangible assets. Companies from industrial sector listed on the Amman Stock Exchange made up the study sample. Two hundred and thirty observations were sampled from panel data collected between 2014 and 2018 for this study. PLS was applied to analyse the collected data. The results of the regression analysis indicated a statistically significant link between human capital, capital employed, and company performance. However, no significant relationship was found between structural capital and firm performance.

Keywords: *Intellectual capital Efficiency; Firm Performance; VAIC Approach; Industrial Sector.*

INTRODUCTION

In recent years, knowledge-based economies have emerged due to the rapid technological development at the end of the 20th century, which has led to a change from the traditional idea of capital land, work, and physical capital (the traditional concept of capital) to a new concept of capital that takes into account the technical know-how of workers in companies and their intellectual creativity and intelligence, which is called intellectual capital (IC). This form of capital explains that knowledge and ideas are the basis for wealth creation (Slimani et al., 2016). Ability, knowledge, contacts, and equipment are all examples of items that can be transformed into something of value (Niwash, Cek, & Eyupoglu, 2022).

IC has gained increasing recognition as a critical factor in a company's ability to gain and sustain a competitive advantage and, in addition, achieve long-term success. This has sparked the interest of both professionals and researchers, who seek to uncover and measure the impact of IC on organisations' financial and market performance. Recent decades have seen a rise in the study of intangible assets like IC, contributing to the designation of an emerging category of strategic non-accounting resources that help firms succeed. (Xu & Liu, 2021).

IC becomes the centrepiece of knowledge-based growth. This shows that knowledge is a key enabler of sustainable economic growth and social development. It is part of the IC that is used as a competitive advantage for the industrial sector. Moreover, IC is the critical source of competitive advantage for organizations (Obeidat et al., 2021), leading to improved innovation capability and organizational performance. Therefore, companies

that rely on their employees to enhance the IC must learn to improve their innovation and business performance. (Sivalogathasan & Wu, 2015).

Current studies attempting to explain the relationship between IC and firm performance have yielded mixed results. For example, some studies (e.g., Tan et al., 2007; Clarke et al., 2011) find a significant positive relationship between IC and firm performance, while other studies (e.g., Firer & Williams, 2003; Chan, 2009) find no significant relationship. These mixed results are attributed to either the methodology used to measure IC (e.g., the use of the VAIC model) or the level of economic development of the countries studied (i.e., developed or developing).

In this study, the focus is on Jordan. This is because in emerging economies such as Jordan, many companies have started to recognize the importance of IC, which has also become part of their competitive strategies to enhance their overall performance. This led to the purpose of this study, which is to investigate the relationship between IC efficiency, measured through the extended VAIC model, and the performance of Jordan's industrial sector. This paper starts with an introduction in Section 1, a literature review in Section 2, data and methods in Section 3, results and discussion in Section 4, and a conclusion in Section 5.

LITERATURE REVIEW

Definition of IC

IC is a notion that emerged in the 1990s, while its origins can be traced back to the 1980s. In his book The New Industrial State IC, Galbraith (1969) introduced the idea of "IC" for the first time. Early in the 1980s, IC sprang to popularity as a concept as business executives and academic scholars around the world realised its significance to their success (Sullivan, 2000). Furthermore, Tom Stewart used the phrase IC in his 1991 Fortune Magazine article titled "Brainpower: How IC is becoming America's most valuable asset" (Chowdhury et al., 2019).

Many academics and experts in the field of economics have written extensively on the topic of IC, discussing such topics as its definition, significance, measurement, efficiency, and the many ways in which it helps to boost the economy. A phenomenon needs to be precisely characterised before it can be managed or measured. When it comes to constructing a concrete definition, IC is a research issue with high conceptual clarity but high diversity and variation. First, the term "IC" needs to be defined precisely so that its effects on current and future performance can be fully captured. (Dzenopoljacet al,.2017).

IC is generally defined as knowledge related to intangible assets belonging to an organization (Kehelwalatenna & Premarantne, 2014). Within the context of accounting, intangible assets refer to those assets that are recognized by accounting standards as assets and mentioned in the balance sheet. In this case, IC represents intangible assets such as software, patents, infrastructure, and databases, which can be mentioned in traditional financial accounts (Ting & Lean, 2009). There is also a claim that the term IC was first used by economist John Kenneth, where IC is a sum up of human capital and structure capital representing packages of customers, processes, brands, and databases (Edvinsson & Malone, 1997).

IC consists of three primary elements: Firstly, there is tacit knowledge and innovation capabilities that reside within employees. Secondly, there is the infrastructure associated with human capital, which encompasses efficient work systems and processes that foster innovation. Lastly, there are the firm's external relationships, particularly its customer capital. These components serve as key drivers of firm performance and play a significant role in generating future wealth. Research conducted by Bontis et al. (2000) affirms the significance of IC in shaping the success and prosperity of organizations.

Considering the above, it is clear that IC is one of the most crucial resources for any business that relies on knowledge-based assets to increase productivity and competitiveness. It can help in companies' value creation, economic growth, competitive advantage, innovation, improved business performance in a long-term, sustainable business environment, and strong stakeholder relationships.

Methods used in measuring IC efficiency

In the phrase "you can manage what you can measure," companies need to locate the many IC elements across the organisation, quantify their impact, and report on their progress on a regular basis to ensure effective management. Companies need to utilise particular techniques to detect and quantify IC usage. But there is no universal system of measurement. Instead, various methods or models have been developed for quantifying IC, such as the Navigator (Edvinsson & Malone, 1997), the Intangible Assets Monitor (Sveiby, 1997), and the VAIC methodology (Kaplan & Norton, 2005).

IC and Financial Performance

The majority of research on IC has predominantly focused on advanced nations, whereas only a few percent has been done in less developed nations. Research into the link between IC efficiency and firm performance is especially limited in the Hashemite Kingdom of Jordan. An empirical investigation was conducted by Sardo and Serrasqueiro (2017) to test the hypothesis that IC improves financial performance and market value. They analysed data from 2,090 non-financial corporations listed in 14 countries between 2004 and 2015 and found that IC is a crucial factor in the value development of these companies. Human capital is found to be crucial to business performance in the study's final analysis. The findings also show that short-term financial performance is positively correlated with a company's capital-use efficiency. Moreover, structural capital has been found to have a long-term beneficial effect on financial performance.

Another study by Bataineh et al. (2022) collected data from listed service companies during 2014–2019. They examined whether there was a link between various forms of IC components and financial performance. The hypotheses were examined using SEM. The study's findings demonstrate that the effective use of IC is a driving force behind improved profitability and market value for businesses. The efficiency of IC has a significant and positive effect on the profitability of firms, as indicated by metrics such as ROA and EPS.

In the Malaysian context, Aljuboori et al. (2021) conducted a study to explore the relationship between IC and firm performance. The researchers employed SEM and the resource-based view (RBV) framework to collect and analyse the data. The study findings reveal a strong and positive correlation between human capital and business performance. However, the association between structural capital (SC) and relational capital (RC) with firm performance was found to be insignificant. Similarly, Shairi et al. (2021) conducted a study involving 40 technology companies listed on Bursa Malaysia between 2013 and 2019 to examine the impact of IC on financial performance. The results indicate that market value-added IC (MVAIC), human capital efficiency (HCE), and capital employed efficiency (CEE) have a significant and positive relationship with return on assets (ROA). On the other hand, structural capital efficiency (SCE) exhibits a negative association with ROA, while no significant relationship was found with relationship capital efficiency (RCE).

Previous studies, including those conducted by Inkinen (2015) and Singh et al. (2016), have explored the connection between IC and firm performance. Research findings have demonstrated that companies continue to face challenges due to the inefficient utilisation of IC. Nevertheless, it is worth noting that there is a scarcity of research that investigates the correlation between IC and firm performance, specifically in developing countries.

specifically using the quantitative measure of the extended value-added (E-VAIC) introduced by Bayraktaroglu et al. (2019) and Xu and Liu (2020).

Components of IC and Firm Performance

Human Capital Efficiency (HCE) and firm performance

The concept of human capital efficiency (HCE) can be traced back to human capital theory, which encompasses various factors such as abilities, expertise, values, education, training, innovation, and the work experiences of individuals, including their areas of specialisation (Dahiyat et al., 2023). Therefore, human capital is considered a vital component of a company's IC (Bontis et al., 2000).

The results show that Jordanian firms, both in the service and industrial sectors, need a higher HC that supports the production of high-quality products and services. The findings provide support for the alternative hypothesis, indicating a significant and notable impact of HC on firm performance. The findings provide support for the alternative hypothesis, indicating a significant and notable impact of HC on firm performance, which is notable. A large number of studies conducted by Sardo and Serrasqueiro (2017), Hamdan et al. (2017), Bayraktaroglu et al. (2019), Chowdhury et al. (2019), and Ramírez et al. (2020) consistently demonstrate that HC plays a significant role in influencing a company's performance. These findings stand in contrast to previous studies conducted by Maqableh et al. (2023), Soewarno and Tjahjadi (2020),and Mohammad and Bujang (2019). For this present study, the following hypothesis is proposed:

H1. The HCE of Jordanian-listed industrial companies has a significant positive impact on firm performance.

Structural Capital Efficiency (SCE) and firm performance

As previously mentioned, human capital stands out as the most critical component of IC for any company. The company places significant emphasis on the skills possessed by its workforce. However, skilled workers cannot perform unless they are provided with additional resources to make the greatest use of their knowledge. This section introduces the second most vital factor of IC, known as structural capital (SC). This is the company's investment in intangible assets other than the human factor (Khalique et al.,2015). A continuous firm needs SC as it offers the infrastructure and platform employees need to carry out their tasks efficiently (Nawaz & Haniffa, 2017).

Previous studies have demonstrated the positive effect of SC on firm performance (e.g., Hamdan et al., 2017; Haris et al., 2019). There are also findings that indicate the association between SC and firm performance is insignificant (e.g., Nimtrakoon, 2015; Buallay, 2017; Chowdhury et al., 2018; Xu and Wang, 2018; Mohammad and Bujang, 2019; Maqableh et al., 2023). In this study, the following hypothesis is proposed:

H2. The SCE of Jordanian-listed industrial companies has a significant positive impact on firm performance.

Relational Capital Efficiency (RCE) and firm performance

Relational capital, also known as customer capital (CC), encompasses the intellectual assets associated with managing and governing a company's external relationships. This includes the organisational relationships with suppliers, customers, stakeholders, and the knowledge that guides these connections (Bontis, 2001; Meles et al., 2016). Approximately 35% of the overall IC is allocated to relational capital, specifically focusing on the company's interactions and rapport with its customers (Ramanauskaitė & Rudžionienė, 2013).

Developing relational capital within IC is considered particularly challenging, as it exists partially outside the core operations of a company (Scafarto et al., 2016). Relational capital plays a crucial role in enhancing the interaction between human and structural capital with stakeholders, ultimately shaping their perception of the company (Meles et al., 2016; Bontis et al., 2015). Additionally, it is worth noting that relational capital holds utmost importance for any company, serving as the primary revenue source necessary for sustaining its operations (Sharabati et al., 2013).

Previous studies have demonstrated that RCE positively influences firm performance. The results are connected to the work of Sardo et al. (2018), Xu and Wang (2019), and Sardo and Serrasqueiro (2017). On the other hand, the results also conflict with other studies such as Aybars and Mehtap (2022), and Mohammad and Bujang (2019), For the purpose of this study, the following hypothesis is proposed:

H3. The RCE of Jordanian-listed industrial companies has a significant positive impact on firm performance.

Capital Employed Efficiency (CEE) and firm performance

According to Tefera (2018), the concept of capital employed (CE) refers to the total capital employed in a company's present and fixed assets, which reflects the company's potential. Additionally, CE is defined in relation to value drivers, specifically in terms of brand equity and customer loyalty. It is important to note that CE is a widely used term, but its description can vary depending on the context in which it is used. In essence, all interpretations of CE emphasise the significance of capital investments necessary for a business's operations.

The present study reveals a strong association between capital employed efficiency (CEE) and the firm performance of industrial companies. This finding is consistent with several previous studies, including Haris et al. (2019), Al-Musali and Ismail (2016), Nawaz and Haniffa (2017), Bontis et al. (2015), Poh et al. (2018), and Maqableh et al. (2023), which have also demonstrated a positive relationship between CEE and firm performance. However, there are contrasting results from other studies, such as Joshi et al. (2013) and Firer and Williams (2003), which did not find a significant impact of CEE on firm performance. For this present study, the following hypothesis is used:

H4. The CEE of Jordanian-listed industrial companies has a significant positive impact on firm performance.

Innovation Capital Efficiency (RDE) and firm performance

As stated by Xu and Liu (2020), innovation capital refers to the capacity to leverage existing knowledge and create new knowledge, whereas protective capital relates to legally safeguarded rights associated with intellectual assets, including patents, copyrights, trademarks, and trade secrets. The ability of a company to generate innovative ideas and transform them into new products or services that enhance its performance is commonly known as innovation capability. Investing in human capital can greatly impact a company's innovation capability by enhancing its creative potential through the development of new skills and ideas that align with market demands (Han & Li, 2015).

The findings of past studies indicate a substantial correlation between innovation capital and firm performance, leading to the acceptance of the hypothesis. This outcome aligns with previous research conducted by Nadeem , Massaro (2019) and Amin and Aslam (2017). On the contrary, the result contradicts the findings of Bayraktaroglu et al. (2019) and Xu and Wang (2018). However, for this study, the following hypothesis is proposed:

H5. The RDE of Jordanian-listed industrial companies has a significant positive impact on firm performance.

DATA AND METHODOLOGY

The target population for this study consists of the companies that are publicly listed on the Amman Stock Exchange (ASE), focusing specifically on industrial sector companies. The researchers utilized secondary data sourced from the Jordanian Capital Market Directory, an annual report published by the ASE, to gather information on the listed companies. The main aim of this study is to explore the association between IC efficiency and firm performance. The sample for the study comprises 46 companies from the industrial sectors that are listed on the Amman Stock Exchange, covering the time span from 2014 to 2018.

IC efficiency includes the items that represent the efficiency of human capital, structural capital, and relational capital, as well as capital employed and innovation capital. This study applies the modified and extended VAIC method: VA = operating profit + depreciation + amortisation + employee salaries and wages + marketing and advertising expenses + R&D expenses (Xu and Wang, 2019).

In this study, four measurement models were utilised to assess firm performance. Specifically, the researchers employed indicators such as return on assets (ROA), return on equity (ROE), earnings per share (EPS), and Tobin's Q market value index (Almshabbak and Chouaibi, 2023).

Table 1: Study Variables

Variables	Labels	Measurement	Source
Dependent Variable			
Market based performance	TOBINS Q	total market value of firm/total assets value	Ciftci et al. (2019); Kyere; and Ausloos (2021).
	EPS	The ratio of net income to total shareholders' equity	Ge and Xu (2021); Bataineh et al. (2022).
accounting based performance	ROA	Calculated by dividing net income by the average number of outstanding shares	Buallay et al. (2020) ; Bataineh et al. (2022).
	ROE	net income / shareholder's equity	Bayraktaroglu et al. (2019); Xu, and Wang (2019).
Independent Variable			
Human capital efficiency	HCE	It is calculated by the ratio between value added and total salary and wages of employees	Bayraktaroglu et al ., (2019) ; Xu & Liu (2020).
Structural capital efficiency	SCE	It is calculated by the ratio between SCE and VA of the firm	Bayraktaroglu et al ., (2019) ; Xu & Liu (2020).
Relational Capital Efficiency	RCE	It is calculated by marketing and advertising expenses and VA	Bayraktaroglu et al ., (2019) ; Xu & Liu (2020).
Capital employed efficiency	CEE	It is calculated by the ratio between VA and CEE of the company	Bayraktaroglu et al ., (2019) ; Xu & Liu (2020).
Innovation Capital efficiency	RDE	It is equal to total R&D expenditure, and VA is value added	Bayraktaroglu et al ., (2019) ; Xu & Liu (2020).

RESULTS AND DISCUSSION

To examine the hypotheses, structural equation modelling (SEM) using the partial least squares (PLS) approach was employed. Before conducting the main model analysis, preliminary tests, including descriptive statistics, Descriptive statistics is necessary to give a brief overview of the data from all 230 observations. The study's descriptive statistics are provided in Table 2. The maximum and minimum values of the observations

are highlighted, allowing identification of any outliers in the data. Most variables exhibit maximum and minimum values close to the mean, indicating a relatively even distribution and minimal data dispersion. The standard deviation (std. dev.) provides information about the degree of dispersion or deviation from the mean for each variable. In this study, the standard deviation values are relatively small for all variables, indicating a limited level of variability within the data set.

The provided data descriptions have verified that the data possess sufficient characteristics to proceed with the analysis. Table 2 displays the descriptive statistics for the variables examined in the study. The analysis revealed that human capital ranged from a minimum of -60.66 to a maximum of 62.98, with a mean value of 3.15. Structural capital, on the other hand, had a mean value of 0.51. Relational capital had a mean value of 0.01, while capital employed had a mean value of 0.26. Lastly, innovation capital had a mean value of -0.01.

Table 2: Descriptive Findings

Variable	**Mean**	**Standard deviation**	**Min**	**Max**
ROE	5.21	26.3	-245.32	248.05
ROA	2.88	7.9	-31.44	38.67
EPS	0.14	0.41	-0.56	4.02
TOBINS Q	1.20	0.97	0.09	11.55
HCE	3.15	9.83	-60.66	62.98
SCE	0.51	3.46	-41.55	17.49
RCE	0.01	0.53	-5.91	2.49
CEE	0.26	0.68	-7.76	3.43
RDE	-0.01	0.16	-1.95	0.12

Assessment of Measurement Model

The measurement model assessment in this study consists of two key aspects: validity and reliability. To assess validity, construct validity is established, and both convergent and discriminant validity are evaluated. The reliability of the study variables is also examined through measures of internal consistency and reliability indicators. The works of Hair et al. (2020) and Ramayah et al. (2018) provide guidance in this regard.

Next, the structural model was examined to assess the strength of the proposed relationships between the latent constructs. The findings, displayed in Table 3, include the composite reliability (CR) components and the evaluation of convergent validity. Loading values equal to or greater than 0.50 were considered to ensure the reliability of the measurement model, while an average variance extracted (AVE) of 0.50 or higher was deemed suitable. Moreover, the composite reliability (CR) value should be at least 0.70, as recommended by Hair et al. (2020).

Table 3 presents the results indicating that the indicator loadings surpass the threshold of 0.50, confirming the presence of convergent validity at the indicator level. Additionally, the average variance extracted (AVE) values for all variables exceed 0.50, demonstrating construct-level convergent validity. Furthermore, all composite reliability values are above 0.70, meeting the recommended criteria for data convergence validity established by Hair et al. (2020).

Table 3: Measurement Model Output

constructs	**indicators**	**Loading**	**CR**	**AVE**
IC	IC	0.675	0.716	0.518
Firm performance	Firm performance	0.521	0.825	0.526

Discriminant validity examines the extent to which a construct differs from other constructs within the model, representing a unique phenomenon (Hair, Anderson, Babin, & Black, 2010). In this study, discriminant validity is evaluated using the heterotrait- monotrait ratio of correlations (HTMT) based on the multitrait-multimethod matrix proposed by Henseler et al. (2015). Henseler et al. (2015) suggest that values below 0.85 and 0.90 can be considered as initial benchmarks for assessing discriminant validity. It is crucial to note that the confidence interval of the HTMT should not encompass a value of
1.The findings presented in Table 4 demonstrate that all the values meet the criteria of HTMT.90 (Gold, Malhotra, and Segars, 2001) and HTMT.85 (Kline, 2011), indicating the establishment of discriminant validity. Furthermore, the HTMT inference results reveal that the confidence intervals for all constructs do not include the value of 1, further confirming the presence of discriminant validity (Henseler et al., 2015).

Table 4: Discriminant Validity Output

	IC	Firm performance
IC		
Firm performance	.25	

Assessment of Structural Model

After conducting the analysis of the PLS-SEM model, path coefficients (β) were obtained, representing the strength of the proposed relationships among the latent constructs. These path coefficients are standardized, ranging from -1 to +1. The results presented in Table 5 demonstrate that the path coefficients have standardized values ranging from 0.01 to 0.57, which fall within the acceptable range of -1 to +1. According to Hair et al. (2017), path coefficients closer to +1 indicate strong positive relationships, while coefficients closer to 0 indicate weaker relationships.

Prior to assessing the structural model, it is essential to address the issue of lateral collinearity within the model (Ramayah et al., 2016). Kock and Lynn (2012) state that while discriminant validity ensures vertical collinearity is satisfied, the presence of lateral collinearity (collinearity between predictors and criteria) can potentially lead to misleading outcomes. Lateral collinearity arises when two variables that are intended to measure distinct constructs actually capture the same underlying construct (Ramayah et al., 2016).

The outcomes of the lateral collinearity test are presented in Table 4. The inner variance inflation factors (VIF) for the predictor variables of each construct, which need to be examined for lateral collinearity, are all below 3.3, as recommended by Diamantopoulos and Siguaw (2006). These results indicate that there is no issue of lateral multicollinearity in the study (Hair et al., 2017).

Subsequently, the significance of each path coefficient is assessed through bootstrapping and re-sampling. In this study, 5000 re-samplings are conducted to evaluate the significance of the path coefficients. The t-test is employed, and relationships with t- values greater than or equal to 1.64 are considered significant at the 0.05 level of significance. The significant relationships at this level include HCE and firm performance (β=0.23, t-value =2.28), RCE and firm performance (β=0.19, t-value =1.71), ICE and firm performance (β=0.24, t-value =1.67), and CEE and firm performance (β=0.44, t- value =2.11). Moreover, relationships with t-values greater than or equal to 2.33 are considered significant at the 0.10 level of significance, such as IC and firm performance (β=0.57, t-value =2.52).

The significance of each path coefficient is determined using bootstrapping and re- sampling techniques. For this study, 5000 re-sampling iterations were conducted to assess the significance of the path coefficients. The t-test was employed, considering relationships to be significant at a significance level of 0.05 if their t-values were equal to or greater than 1.64. Based on this criterion, the following relationships were found to be

significant: HCE and firm performance (β=0.23, t-value =2.28), RCE and firm performance (β=0.19, t-value =1.71), RDE and firm performance (β=0.24, t-value =1.67), and CEE and firm performance (β=0.44, t-value =2.11). Additionally, the relationship between IC and firm performance (β=0.57, t-value =2.52) was considered significant at a level of 0.10, as its t-value exceeded 2.33. However, the relationship with SCE (β=0.01, t- value=1.17) was found to have no significant effect on firm performance. A summary of these findings is provided in Table 5. Subsequently, the R-squared (R2) value is used to evaluate the predictive capability of the research model, while the path coefficients measure the strength of the proposed relationships. The R2 value, ranging from 0 to 1, indicates the degree of predictive precision, with a higher value indicating greater accuracy (Hair et al., 2017). The SmartPLS algorithm is utilised to calculate the R2 value. In this study, the criteria proposed by J. Cohen (1992) are followed, where an R2 value of

0.67 represents significant predictive power, 0.333 indicates average predictive power, and 0.19 suggests weak predictive power. Based on the findings presented in Table 4.6, the variables ICE, HCE, SCE, RCE, RDE, and CEE collectively account for 40.0% of the variability in firm performance, indicating a moderate level of predictive accuracy.

In addition, the study examines the effect sizes (f2) to evaluate the relative influence of predictor constructs on endogenous constructs. The f2 metric provides a measure of effect size, capturing both substantive significance and statistical significance, as recommended by Sullivan and Feinn (2012). To assess the effect size, Cohen's guideline (1988) is utilised. Cohen (1988) suggests that effect sizes of 0.02, 0.15, and 0.35 correspond to small, medium, and large effects, respectively (refer to Table 5).

Table 5: Structural Model Assessment

Hypothesis		**Path Coefficient,** β	**t-value**	**p-value**	**Decision**	**R^2**	**f^2**	**Effect Size**	**VIF**
H1	HCE-> Firm Performance	0.23	2.28*	0.01	**Supported**	0.40	0.38	Large	1.00
H2	SCE-> Firm Performance	0.01	1.17	0.24	**Not Supported**		0.03	Small	1.00
H3	RCE-> Firm Performance	0.19	1.71*	0.02	**Supported**		0.13	Small	1.29
H4	CEE-> Firm Performance	0.44	2.11**	0.04	**Supported**		0.39	Large	1.14
H5	RDE-> Firm Performance	0.24	1.67*	0.04	**Supported**		0.05	Small	1.20

Note:

HCE = Human Capital Efficiency; SCE = Structural Capital Efficiency; RCE=Relational Capital Efficiency; CEE=Capital Employed Efficiency; and RDE=Innovation Capital Efficiency.
Critical t-values for a one-tailed test: 1% = 2.33, 5% =1.645, 10% = 1.28; *p < .05, **p < .10, ***p < .01

F2 values = 0.02 (Small), 0.15 (moderate), and 0.35 (Large).

CONCLUSION

This study made a distinct contribution to the existing literature by investigating the influence of IC efficiency, including Human capital, structural capital, relational capital, capital employed, and Innovation capital, on the performance of publicly listed companies in the ASE region from 2014 to 2018. The findings revealed significant and positive effects of IC efficiency on firm performance within the industrial companies of Jordan. Specifically, the study found that Human capital efficiency (HCE) and Capital

employed efficiency (CEE) had a substantial impact on firm performance. On the other hand, it has been demonstrated that a statistically significant link between innovation capital and firm performance. However, the results did not provide sufficient statistical evidence to support a significant influence of Structural Capital (SC) on firm performance.

Despite its contribution, this study has certain limitations. Firstly, it focused solely on the industrial sector within ASE and did not consider other sectors. Consequently, the findings may not be applicable to other industries. Additionally, the study exclusively concentrated on industrial companies in Jordan, limiting the generalizability of the results to industrial firms in other countries.

The second limitation of this study pertained to its reliance solely on existing data and quantitative research methods. Due to limitations in terms of time and resources, no surveys or questionnaires were administered to collect primary data. Moreover, the research was constrained by the availability of data. Despite comprehensive searches, information for the majority of companies could only be obtained for a maximum of 5 years. Furthermore, certain listed industrial companies that were either inactive or delisted during the study period were unable to provide data.

Given these limitations, it is suggested that future research should consider examining the influence of moderators or mediators on the studied phenomena. Additionally, an alternative approach to measuring IC could be explored, combining both monetary and non-monetary methods. Lastly, investors are advised to carefully consider the different components of IC to make informed predictions about firm performance and identify promising investment opportunities.

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