“Intellectual capital components and industrial firm’s performance”

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ARTICLE INFO	Mohammad Fawzi Shubita (2022). Intellectual capital components and industrial firm’s performance. *Problems and Perspectives in Management*, *20*(1), 554-563. doi:10.21511/ppm.20(1).2022.44
DOI	http://dx.doi.org/10.21511/ppm.20(1).2022.44
RELEASED ON	Wednesday, 06 April 2022
RECEIVED ON	Sunday, 12 December 2021
ACCEPTED ON	Thursday, 31 March 2022

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
44	0	11

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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INTELLECTUAL CAPITAL COMPONENTS AND INDUSTRIAL FIRM'S PERFORMANCE

Abstract

The study aims to determine the connection between intellectual capital (IC) and financial performance of the Jordanian industrial listed companies. The methodology uses regression models, the IC will be measured using the VAIC model (value-added intellectual coefficient), on the other hand, company performance will be measured using return on equity (ROE). The main model includes financial leverage as a control variable to study the leverage role in the association between IC and return on equity. The study also investigates the incremental information content for intellectual capital components in explaining the change in firm performance. In addition, the size effect is studied to show if the company's size affects the link between ROE and IC. The sample for this study is 77 Jordanian industrial firms and 788 company-year observations during the period 2006–2020. The study results are as follows: Intellectual capital has an important influence on industrial firm performance; Intellectual capital components have a significant impact on industrial firm performance. In particular, human capital efficiency (HCE) and capital employed efficiency (CEE) have a positive influence on ROE, and structural Capital efficiency (SCE) has a negative impact on firm performance. Lastly, firm size has an effect on the relationship between IC and industrial company performance.

Keywords intellectual capital, return on equity, profitability, company's size, industry sector

JEL Classification M20, L21

Received on: 12th of December, 2021
Accepted on: 31st of March, 2022
Published on: 6th of April, 2022

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Intellectual capital (IC) contains skills and knowledge inside a firm, and it is a vital resource in the current economy, replacing physical and financial capital. There are several methods suggested to quantify the several aspects of IC (Mehralian et al., 2012).

The reason for selecting the industrial sector is that having unique characteristics like high level of risk, a highly regulatory environment, long development cycles, and high R&D expenses, there is a numerous discernment that Intellectual capital management is a vital economic growth (Lin, 2018; Abdollahi et al., 2020).

Firm performance is based on a firm's ability to manage resources and funds to add value to the firm (Tyeh et al., 2013; Cabral et al., 2018). In addition, performance is a vital input for the firm because it is the output from the entity assets consisting of the financial and the human resources of the firm. Management might be critical and creative to increase the performance of their firms (Galema et al., 2012; Robu & Ciora, 2010).

Financial leverage is a vital factor that affects a firm's financial performance and is used by investors in evaluating performance (Al Sharawi, 2021). This variable will be explored in this study as the firms with a

http://dx.doi.org/10.21511/ppm.20(1).2022.44

huge level of leverage should focus more on increasing the financial performance quality using intangible assets like intellectual capital (Amar et al., 2020). The research problem is that the association between IC and firms' performance needs to be studied in an emerging market like Jordan.

1. LITERATURE REVIEW

1.1. Intellectual capital (IC) measurement

The IC of any institution is the value that distinguishes it from similar institutions in the same sector, but also gives it a high competitive advantage. The criterion of competition today is information, knowledge and skills, and since we live in the era of technological progress and the age of knowledge, institutions are interested in developing these areas, which express intellectual capital components (Tamunomiebi et al., 2019).

The importance of IC is not just jurisprudence by researchers and specialists in accounting and management, but rather is a real result of the ability of intellectual capital to make a big difference between the institution market value and its book value, so the clear expression of its importance in being a basic weapon for institutions in the business world in today, and a competitive advantage, because intellectual assets represent the hidden force that ensures survival (Anghel et al., 2018).

Alvino et al. (2021) examine the role of IC for the innovative and sustainable development of entities by providing an overview of the literature review that in this vital topic, and discuss if intellectual capital can affect the entrepreneurial orientation into the development of sustainable models by all United Nations member.

Tarigan et al. (2019) examined the effect of intellectual capital on company performance, focusing on productivity and profitability. The findings presented that the intellectual capital did not have an important association with the market value of companies but had an important association with the financial performance.

Anghel et al. (2018) proved that on biotech firms during 2002–2014, this study measured intellectual capital by using market over book ratio and found that is positively associated with financial performance. Nawaz and Haniffa (2017) studied 64 Islamic financial firms in 18 countries for the period 2007–2011 by employing the Value Added Intellectual Capital method. Their results show a statistically positive association between ROA and IC. In addition, ROA has a significant relationship with HCE & CEE; however, there is no significant association with SCE.

Pulic (2000) initiated the Value Added Intellectual Capital (VAIC) method in computing intellectual capital. This method is used in the current study because it is the most popularly used method (see for example, Firer & Williams, 2003; Yu et al., 2010; Maditinos et al., 2011; Latif et al., 2012).

1.2. Information content of intellectual capital components

Intellectual capital is one of the modern and developed concepts, and many models have been developed to measure IC to know its components, advantages and disadvantages, and thus the three main elements of IC become clear (Wang et al., 2014).

1) Human capital

Human capital represents the basic component of IC, because it is the main element in the performance of its tasks, and human capital is linked to many factors such as knowledge, capabilities and talents of workers, and their behavior combined with each other to achieve a basic goal for an institution, which is customer satisfaction, which is the source of profit for it (Xu et al., 2021).

2) Structural capital

Structural capital expresses the physical component of technology and the accompanying engineering competencies of software, databases, patents, and everything that workers use to support their business operations and activities, and that the core of IC is based on the knowledge embedded within the firm's patterns (Tahir et al., 2018).

3) Relational capital

Relational capital is the value of an institution's association with the clients it deals with, which is represented by the customer's satisfaction and loyalty, and the extent of customer retention by paying attention to his suggestions and addressing complaints submitted by him, meeting his desires and needs as quickly as possible, participating in its business and deals, and extending bridges of cooperation with him (Shubita, 2019).

Ali and Anwar (2021) looked into the effect of IC on the private hospitals efficiency using the sample of 92 patients. The study used a quantitative approach to evaluate the influence of IC components on competitive advantage in Iraq's Kurdistan private hospitals. The study found that that the effective association with the entity success was with human capital, while the least effective association was with ownership as intellectual capital element.

Shubita (2019) used the VAIC model to examine the intellectual capital impact on Jordanian industrial firms' market value during the period 2005–2017. 73 Jordanian firms represent the study sample. The findings showed no association between IC and the firm market value; human capital had a relationship with the market price, and CEE and SCE are not related to the market firm price.

Chen et al. (2005) found that IC and all components in Taiwan were associated with the companies' market performance for the period 1992–2002 using 4,254 company-year observations. On the other hand, Zéghal and Maaloul (2010) reached that UK firms with huge VA and innovation invest heavily in structural capital, human capital, and tangible capital, with an expectation of financial returns. Maditinos et al. (2011) found that IC was not significantly related to market performance and only human capital efficiency had a positive relationship with market performance on the Athens Stock Exchange using 96 listed firms.

1.3. Intellectual capital (IC) and firm performance

The basis for the success of the financial performance of any institution is the financial information that it obtains, because the accuracy of this information and the speed of obtaining it contributes to influencing the financial decisions taken by it, which in turn affects the value of its market shares, but the financial information alone is not enough, but rather it must be employing them within indicators capable of determining the financial performance of an institution.

Several studies investigated the important association between intellectual capital (IC) and company performance (e.g., Ali & Anwar, 2021; Ariff et al., 2016; Zeghal & Maaloul, 2010; Alqadi & Olimat, 2018; Eissawi & Eltahan, 2018; Ishak & Al-Ebel, 2018).

Lu et al. (2021) aimed to analyze the relationship between IC and firm performance and reached to that IC has no influence on sales growth and a negative effect on market value. The findings also indicated that IC had a positive influence on companies' corporate return, earnings, productivity, and income.

Bayraktarglu et al. (2019) modified and extended the VAIC model to investigate the association between IC and company performance for Turkish companies. Studies have examined how intellectual capital is linked to companies' financial performance. Riahi (2003) used 81 multinational companies and reached to a vital association between performance and IC. The results of Firer and Williams (2003) indicated a positive association between intellectual capital and the South African companies' performance. Pew et al. (2007) found out that IC improves companies' future and present performance in Singapore.

Phusavat et al. (2011) found a positive association between intellectual capital and profitability and between productivity and revenue growth in listed manufacturing industry firms in Thailand. The same findings were found in ASEAN countries by Nimtrakoon (2015). Sardo and Serrasqueiro (2017) revealed that the firms might take advantage of intellectual capital to improve a firm's market value and financial performance.

2. AIMS AND HYPOTHESES

The aim of the study is to investigate the association between IC as an intangible asset of a firm and the firm's performance; this will determine

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the Jordanian industrial firms' investments in intangible assets as an important resource for industrial firms, as well as tangible assets.

Based on the literature review and to achieve the study goal, the study's hypotheses are as follows:

H_{01}: *IC has not a significant impact on industrial company performance.*

H_{02}: *IC components have not a significant impact on industrial company performance.*

H_{03}: *Firm size has not affected the association between IC and industrial company performance.*

3. METHODS

To test the study hypotheses, the following two models were used:

$$ROE = \alpha + \beta_1 IC + \beta_2 LEV + \varepsilon, \quad (1)$$

$$ROE = \alpha + \beta_1 HCE + \beta_2 CEE + \\ + \beta_3 SCE + \beta_4 LEV + \varepsilon, \quad (2)$$

where *ROE* – is a return on Equity, *IC* – intellectual capital, *HCE* – Human Capital Efficiency, *SCE* – Structural Capital Efficiency, *CEE* – Capital Employed Efficiency, *LEV* – Leverage Ratio (Total Debt ÷ Total Assets), ε – Error (Residual Value).

The first model investigates the intellectual capital impact as an independent variable on return on equity as the dependent variable; financial leverage will be used as a control variable. This model will be used for the first hypothesis. In the second model, the intellectual capital components will be used to study the incremental information content for intellectual capital components on explaining the return on equity performance variance over the intellectual capital. To test the third hypothesis, the first model will be used and the sample will be divided into two samples; small and big companies based on the total asset to study the firm size effect.

3.1. Study variables

Firm performance will be measured using ROE, which is equal to net income over average total equity. In this model, three components will be used to measure intellectual capital (Shubita, 2019).

$$VAIC = CEE + SCE + HCE.$$

CEE is Capital employed efficiency that will be computed by dividing the value-added into the total assets. The VA is measured using AlNajjar and Riahi-Belkaoui's (1999) equation:

$$VA = I + DE + T + R + M + D,$$

where *I* – interest; *DE* – dividends; *T* – taxes; *R* – retained earnings, *M* – non-controlling interest in the income statement, and *D* – depreciation.

On the other hand, $SCE = SC/VA$ and $HCE = VA/HC$ (Lin, 2018),

where *HC* is a firm's personal expenses; $SC = VA\text{-}HC$.

The control variable is the leverage ratio (total liabilities over total assets).

3.2. Study sample

The research sample includes 77 Jordanian shareholder manufacturing firms listed on the Amman Stock Exchange from 2006 to 2020. The sample includes 788 company-year observations.

4. RESULTS

Different kinds of statistical tests were performed where descriptive analysis, correlation, and OLS regression analysis were used. The descriptive test provided useful information about the dataset, and the correlation test helped in finding out the relationship between the variables used in regression models. OLS regression model was used to test the hypotheses.

4.1. Descriptive analysis

Descriptive statics are shown in Table 1 for the research variables after deleting odd observations; it contains the median, mean, STD, maximum and minimum. For the dependent variable, Jordanian industrial firms have a negative return on equity,

which means that the Jordanian firms on average generate losses during the study period because of the bad economic environment. The high variance comparing with the average can be explained by the huge differences between Jordanian industrial firms.

The VAIC mean is 2.173, which is less than the Mehralian et al. (2012), so for each one Jordanian Dinar paid to the employees, there is 2.173 Jordanian Dinar come from value-added. The average value for intellectual capital shows that Jordanian firms are efficient in utilizing their assets because any intellectual capital ratio above two is a good sign (Pulic, 2008). One can notice that the intellectual capital is higher than in Malaysia (1.8) and Pakistan (2.5) but is lower than the average intellectual capital of firms in Saudi Arabia (3.7), the United Kingdom (11), Turkey (3.9), Australia (3.7), and the UAE (7.95) (Tahir et al., 2018).

For intellectual capital components, human capital was the highest average (1.299). This means that human capital plays an important role in the value-added of Jordanian industrial firms rather than the two other components capital employed and structural capital. Jordanian firms finance 38.1% of their total resources from liabilities, which puts them in a good leverage situation.

4.2. Correlation coefficients

Table 2 shows the correlation matrix, Spearman and Pearson correlation coefficients between intellectual capital and return on equity are positive and significant. For the intellectual capital components, the three elements have a significant relationship with ROE, the HCE has the highest correlation coefficient (67.2%). One can also notice a negative and significant relationship between the leverage ratio and profitability, which means that the firms that rely more on debt to finance their asset generate losses.

4.3. Regression analysis

4.3.1. OLS analysis

The independent variable is important and the adj-R^2 is 22.3%, which leads to rejecting the first null hypothesis, so IC has an important effect on industrial firm performance. This finding suggests a firms' efficiency importance in using structural, human, and physical capital efficiently and effectively to encourage higher firm performance. This result is in line with those of Tarigan et al. (2019) and Chan (2009). The table also indicates that the leverage is negative and significant, which means that the firms that depend more on an external source of funds will suffer from a loss.

Table 1. Descriptive analysis

Variable	Observations	Average	Med.	Standard Variation	Min	Max
HCE	788	1.558	1.299	4.733	–53.84	48.61
SCE	788	0.975	0.706	7.04	–125.5	84.1
CEE	788	–0.360	0.078	11.04	–309.37	9.27
VAIC	788	2.173	2.18	14.111	–314.55	84.09
LEV	787	0.381	0.327	0.286	0.004	2.275
ROE	788	–0.107	0.0067	0.125	–1.059	0.549

Table 2. Pearson (Spearman) correlation matrix

	SCE	CEE	VAIC	LEV	ROE
HCE	–0.029	0.072*	0.377**	–0.302**	0.672**
	(–0.294)**	(0.754)**	(0.844)**	(–0.361)**	(0.875)**
SCE		–0.002	0.488**	0.027	–0.066
		(–0.367)**	(0.137)**	(0.094)**	(–0.381)**
CEE			0.805**	–0.081*	0.130**
			(0.614)**	(–0.082)*	(0.798)**
VAIC				–0.151**	0.294**
				(–0.306)**	(0.703)**
LEV					–0.412**
					(–0.416)**

Note: * 0.05, ** 0.01.

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The coefficients on intellectual capital are positive, referring that companies with greater intellectual performance have better profitability. In this second model, the intellectual capital components are the independent variables, this breakdown increases the model explanatory power from 22.3% in model 1 to 50.3% in the model 2 as shown in Table 4. This will lead to the rejection of the second null hypothesis, so IC components have a significant impact on industrial firm performance.

The higher structural capital efficiency influences a firm's performance. This explained by the manufacturing firms' nature, where intangible assets may be more dominant, as the entity operations depend on machines. In addition, investors focus on the value of the capital employed and structural capital (SCE) of firms.

This result indicates that the three elements of intellectual capital are better than the aggregate intellectual capital measure in interrupting firm performance.

To test the third hypothesis, Table 5 and Table 6 are used that relate to the small and large firms' findings, which state that the Adj-R^2 for model 1 is higher for large firms than for small firms. This analysis leads to rejecting the third hypothesis, so the firm size has affected the relationship between intellectual capital and industrial firm performance.

Table 3. Model 1

Variable	Factors	Error	*t*-statistics	Sig
Constant	0.047	0.007	7.043	0
VAIC	0.002	0.00	7.47	0
LEV	–0.164	0.014	–11.810	0.00
R^2	0.225	Adj R^2		0.223
F-Statistics	113.496	Sig.		0.00
VIF	1.023	DW		0.983

Table 4. Model 2

Variable	Factors	Error	*t*-statistics	Sig
Constant	0.003	0.006	0.529	0.597
HCE	0.016	0.00	22.616	0.00
SCE	–. 001	0.00	–1.694	0.091
CEE	0.001	0.00	2.750	0.006
LEV	–0.098	0.012	–8.894	0.00
R^2	0.505	Adj R^2		0.503
F-Statistics	199.767	Sig.		0.00
VIF	1.105	DW		0.950

Table 5. The first model (Big companies)

Variable	Factors	Error	*t*-statistics	Sig
Constant	0.073	0.008	8.812	0.00
VAIC	0.004	0.001	6.780	0.00
LEV	–0.178	0.015	–11.646	0.00
R^2	0.405	Adj R^2		0.402
F-Statistics	132.804	Sig.		0.00
VIF	1.13	DW		0.911

Table 6. The first model (Small companies)

Variable	Factors	Error	*t*-statistics	Sig
Constant	0.013	0.010	1.274	0.203
VAIC	0.002	0.00	4.386	0.00
LEV	-0.150	0.021	-7.008	0.00
R^2	0.164	Adj R^2		0.160
F-Statistics	38.401	Sig		0.00
VIF	1.015	Durbin Watson		0.994

4.4. Balanced data analysis

4.4.1. Pooled OLS

Table 7 refers to the pooled OLS findings for the models.

Table 7. Model 1 (OLS results)

Variable	Coeff.	Std. Error	*t*-statistics	Prob.
VAIC	33.23585	3.851690	8.628903	0.0000
Constant	2.527955	0.483107	5.232701	0.0000
R^2	0.086634	(F-statistic) Prob.		0.000000
Adjusted R^2	0.085470	D-W stat		2.014985
F	74.45796	–		

Table 8. Model 2 (Coefficients)

Variable	Coeff.	Std. Error	*t*-statistics	Prob.
Human	0.017540	0.000695	25.23408	0.0000
Capital	0.000937	0.000298	3.146090	0.0017
Structure	–0.000830	0.000466	–1.781038	0.0753
Constant	–0.036861	0.003490	–10.56200	0.0000
R^2	0.4599704	(F-statistic) Prob.		0.000000
Adjusted R^2	0.457903	D-W stat		0.869472
F	222.5903	–		

4.5. Hausman test

Hausman test helps determine which method is better, fixed effect model or random effect model (Ahmed et al., 2021).

Table 9. Hausman test results

Equation	Chi-Sq. Statistic	Chi Sq. d.f.	Prob.	Result
Model (1)	13.851	1	0.0002	Fixed
Model (2)	5.96	3	0.1135	Random

Based on Hausman test results for the study equations, the random effect is suitable for model 2 (Gujarati, 2021).

Table 10. Fixed effect models

Model 1				
Variable	**Coeff.**	**Std. Error**	***t*-statistic**	**Prob.**
LEV	–0.231776	0.018226	–12.71695	0.0000
VAIC	0.001362	0.000237	5.734997	0.0000
Constant	0.074560	0.007680	9.708920	0.0000
Effects Specification				
Cross-section fixed				
R^2	0.568575	(F-statistic) Prob.		0.000000
Adjusted R^2	0.521045	D-W stat		1.570378
F	11.96248	–		

Table 11. Random effect models

Model 2				
Variable	**Coeff.**	**Std. Error**	***t*-statistic**	**Prob.**
Human	–0.000947	0.000378	–2.503634	0.0125
Capital	0.014500	0.000696	20.82396	0.0000
Structure	0.000778	0.000240	3.250339	0.0012
LEV	–0.145536	0.013448	–10.82228	0.0000
Constant	0.021558	0.008582	2.511986	0.0122
Weighted Statistics				
R^2	0.485916	(F-statistic) Prob.		0.000000
Adjusted R^2	0.483286	D-W stat		1.367196
F	184.7880	–		

5. DISCUSSION

First, the results of model 1 indicate that IC has a positive influence on return on equity, stating that IC can positively enhance companies' financial performance and generate wealth in Jordan, an emerging market. Regarding intellectual capital components, model 2 indicates that HCE and CEE have a positive effect on ROE, supporting the second hypothesis. In addition, the positive CEE coefficients also refer that tangible resources are the vital driving force behind company performance in Jordanian companies, several studies reached the same findings.

The analysis in model 2 also describes that SCE has a negative impact on a firm's performance. Jordanian firms tend to rely on management mechanisms and lack management competencies, which leads to deficiencies in performance. However, firms that are efficiently able to use SCE will own a vital advantage due to its rarity (Pattiruhu & Paais, 2020). In model 2, the negative association between SCE and financial performance indicator confirms that SCE cost does not help translate Jordanian firms' income in the short run. Amin and Aslam (2017), however, confirmed on the London Stock Exchange a positive association between firm performance and innovation of pharmaceutical listed companies. Additionally, SCE has a statistically important influence and the negative association, different than Andreeva and Garanina (2016), who found out that intellectual capital might be important for being an element in Russian firms. Findings from model 1 and model 2 indicate that intellectual capital positively influences firms' performance. This provides evidence for the first two hypotheses; agrees with the results of Smriti and Das (2018) and Chen et al. (2005) who found that intellectual capital has a direct effect on earnings growth.

The definition of future prospects helps future studies include other variables such as working capital, inventory turnover, and balance scorecard, and it is suggested to study this important issue in other sectors like insurance, banking and service sectors.

CONCLUSION

The study aims to examine the important association between the investment in intangible assets in emerging markets. The total assets of any firm include current assets, long-term assets, and intangible assets. Intangible assets are like the non-current, they generate future benefits for firms but without having physical substance.

http://dx.doi.org/10.21511/ppm.20(1).2022.44

Industrial firms generally have a huge proportion of fixed asset investments and depend on them in their operations. This study explored the modeling firm's value based on IC and on manufacturing firms. The results indicate that the intellectual capital components would significantly influence financial performance.

The study results also indicate that CEE, SCE, and HCE have a significant effect on firms' profits. Human capital and physical capital make the same contributions to firms' performance. Considering the impact of intellectual capital on firm performance, model 2 shows that firms' performance is positively correlated only with HCE and CEE, whereas SCE has a significant negative influence on company performance. From this it is concluded that investment in intellectual capital brings competitive advantages to Jordanian manufacturing firms. Thus, HCE, CEE, and SCE are found to make vital contributions to VA for listed Jordanian firms.

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