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# Business Resilience and Business Innovation for Sustainability

The Double-Edged Role of Artificial  
Intelligence and Other Disruptive  
Technologies

# Studies in Systems, Decision and Control

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# Preface

Scholars, practitioners, and professionals consider business innovation as a necessity to minimize business risk. Through technological innovation, businesses can adapt to societal changes and reduce the impact of both internal and external threats and risks. Business resilience is the ability to deal with challenging conditions by ensuring the existence and prosperity of the organization. In today's rapidly evolving global landscape, businesses face unprecedented challenges and opportunities. The twin imperatives of building resilience against disruptions and driving innovation for sustainable growth have become paramount for long-term success. This book delves into the complex and often paradoxical role of artificial intelligence (AI) and other disruptive technologies in navigating this intricate terrain.

While AI and related technologies offer transformative potential for enhancing business resilience—from predictive analytics for risk mitigation to automated systems for operational continuity—they also present significant challenges. Ethical considerations, potential biases in algorithms, job displacement concerns, and the environmental impact of technology development all demand careful consideration. This double-edged sword requires a nuanced understanding to harness the benefits while mitigating the risks.

This book aims to provide a comprehensive exploration of this dynamic interplay between technology, resilience, and sustainability. It is targeted towards a diverse audience, including academics, students, researchers, business practitioners, policy-makers, and anyone interested in the intersection of technology, business strategy, and sustainable development.

We explore a range of critical topics, including but not limited to technological innovation and inclusivity, sustainable educational planning and integrating technology into educational development strategies, the impact of data analytics on business intelligence, financial technology and inventory management efficiency, augmented reality and digital marketing, and many more.

This work is intended to inspire critical thinking, foster collaboration, and contribute to a more informed and responsible approach to harnessing the power of technology for the benefit of both businesses and society.

Our hope is that this book will serve as a valuable resource for navigating the complex challenges and opportunities presented by AI and other disruptive technologies in the pursuit of sustainable business excellence.

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# The Moderating Role of Firm Size on the Relationship Between Intellectual Capital and Firm Performance Among Industrial Companies Listed on Palestine Exchange (PEX) and Amman Stock Exchange (ASE) for the Period 2016 to 2022



Ghassan Daas and Abeer Yahya

**Abstract** The literature assess the effect of “intellectual capital (IC)” on the performance of the firms and whether firm size can moderates the relationship between “intellectual capital” and “firm performance”. The study uses secondary data from annual reports of listed industrial firms on “PEX and ASE” to measure “human capital efficiency (HCE)”, “structural capital efficiency (SCE) and “Capital Employed Efficiency” (CEE)” as components of IC in the value-added intellectual coefficient model (VAICTM) and corporate performance indicators “(ROA, ROE, ATO, and EPS)”. The study sample includes 44 industrial companies on “PEX and ASE” for the period 2016 to 2022. Multiple regression analysis was used to analyze the data. The study finds with the moderation effect that for industrial companies listed on PEX, HCE has a positive impact on ROE, EPS and ROA. Negative impact of SCE on ROE, and positive impact of CEE on ATO. However, for industrial companies on the ASE, SCE has a negative impact on ROE, whereas CEE have positive impact. Other variables have no impact. The results show that for industrial firms listed on “PEX and ASE”, the firm size variable only moderates the relationships between IC and firm performance. The study recommends that the Industrial companies have to disclose in their annual reports all components of IC represented in “HCE, SCE, and CEE”.

**Keywords** Value-added intellectual coefficient model (VAICTM) · Intellectual capital (IC) · Human capital efficiency (HCE) · Structural capital efficiency (SCE) · Capital employed efficiency · Firm performance · ROA, ROE, ATO, EPS, firm size

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## 1 Introduction

The International Financial Reporting Standards (IFRS) dictate that financial statements should accurately reflect a company's current value. However, these standards tend to prioritize physical and monetary assets over intangible ones, such as "intellectual capital" (IC), even if they are significant and relevant to users. IC is a valuable asset for companies as it represents their knowledgeable base. Unfortunately, the exclusion of IC from financial statements means that they do not fully capture the company's true value [1]. To address this limitation, researchers have developed models that recognize, measure, and disclose IC, solving the recognition and measurement problem [2].

As a result of moving from a production economy into a knowledge economy as a basic resource of value creation in modern economics, knowledge plays a more vital contributor resource than "physical and financial assets" in generating sustainable competitive advantages and superior performance [3]. According to the resources-based theory, the competitive advantages of the company depend on the capabilities and resources the organization possesses, and those resources contain both "tangible and intangible" assets [4]. IC is recognized as the knowledge that may be converted into value for driving sustainable competitive advantages and long-term superior performance [2]. It contains three basic components which are "human capital efficiency (*HCE*)" relying on employees' skills, experiences, knowledge, and innovation, "structural capital efficiency (*SCE*)" which depends on databases, software, computers, and patents, and "capital employed efficiency (*CEE*)" which refers to the relationships between the company and the customers. The "value-added intellectual coefficient model (*VAICTM*)" is a model created by Anti Public. It is considered the best way to measure the "efficiency of intellectual capital's" contribution to a company's value creation.

The (*VAICTM*) model measures three components: "physical capital, structural capital", and "human capital" that form the value of the company [5]. In addition, firm performance expresses the health of the company during a given period [6]. Various financial ratios can be used to measure "firm performance (*FP*)" such as "return on assets (*ROA*)", and "return on equity (*ROE*)" represent profitability. While "assets turnover (*ATO*)" measures productivity, and earning per share to evaluate the performance of companies [3]. Whereas firm size is used as a fundamental characteristic of a company which refers to the size of companies at a given period [7]. Most researchers have studied the direct impact of IC on *FP* such as [1–3, 8–11]. This study is based on investigating the moderating role of firm size on the relationships between IC and *FP*.

## 2 Problem Statement

IC as a form of intangible asset has a salient role in a firm's performance. Most prior research investigated the direct relationships between IC and FP by using qualitative measures of IC such as HCE, SCE, CEE, and financial ratios as a measure of FP represented in ROA, ROE, ATO, and EPS. Such as [1–3, 8–11]. However, the investigation of the moderating role of firm size on the relationships between “intellectual capital” and firm performance has not been discussed yet in “PEX and ASE”. The main question of this study is “What is the moderating role of firm size on the relationship between IC and FP for industrial companies listed on “PEX and ASE”? And the next sub-question addressed:

- (1) What is the effect of “human capital efficiency (HCE)”, on the FP among industrial listed companies listed on “PEX and ASE”?
- (2) “What is the effect of structural capital efficiency (SCE)” on the FP among industrial companies listed on “PEX and ASE”?
- (3) “What is the effect of “Capital Employed Efficiency” (CEE)” on the FP among industrial companies listed on “PEX and ASE”?
- (4) What is the “moderating role of firm size on the effect of HCE, SCE, and CEE” on the FP among industrial companies listed on “PEX and ASE”?

## 3 Research Importance

The importance of research emerges from the gap related to exploring the moderating role of firm size on the relationships between IC and FP”. The result of this study will be useful for the industrial companies sector seeking to evaluate the importance of IC on an FP and how firm size moderates the impact of IC on FP [3]. Moreover, stakeholders can identify the factors that can affect FP. This study tries to ensure the disclosure of IC by managers is fruitful [1].

## 4 The Research Objectives

Based on the study problem, the study tries to achieve the following objectives:

- (1) Exploring the nature and existence of IC components in industrial companies.
- (2) Investigating the effect of “IC components” and the FP in industrial companies.
- (3) Understanding how firm size moderates the effect of IC components on FP.

## 5 Theoretical Framework and Hypothesis Development

**Resources-based view (RBV):** Penrose (1959) first developed the resource-based perspective which has become the dominant theory in strategic management [4]. This theory is utilized to decipher and examine a company's resources, to attain long-lasting competitive advantages and excellent performance. RBV suggests that a company's competitive advantages stem from its abilities and resources, which consist of both "tangible and intangible" assets, which the human resources capital (IC) is included. RBV proposes that the firm competitive advantage depends on the capabilities and resources that the organization possesses, and those resources contain both "tangible and intangible" assets [1]. RBV stipulates the connection between intangible assets represented in IC and capabilities, resources, profitability, and competitive advantages and investigates the effect of these connections on achieving sustainable competitive advantages and superior performance [12].

### **Knowledge-Based View (KBV)**

As suggested by the resources-based view, it focuses on resources and capabilities inside of the companies including "tangible and intangible" assets. So, the "Knowledge-Based View" is considered as the recent extension for RBV of a company which relates to knowledge within the organization that cannot be easily imitated by rivals [13]. The KBV of a firm analyzes and interprets four attributes of skills represented in (1) skills and knowledge of employees, (2) database and management system, (3) control process, and (4) construction of knowledge [12]. Sustained competitive advantages and superior performance highly rely on Knowledge resources which are considered primary components of IC. It can simplify the success of a firm [4].

**Firm performance (FP):** Firm performance (FP) is considered a dependent variable. This refers to the ability of the company to exploit its available resources efficiently and effectively to achieve its desired goals, with consideration of their relevance to the current and potential users [6]. The "resource-based view" focuses on both "tangible and intangible" assets to measure benefits and competitive advantages for a company. Whereas measures of financial performance are considered as a dominant model in determining business performance. Many measures have been used to measure profitability, productivity, and market evaluation. "ROA and ROE" represent profitability. While ATO measures productivity. And EPS to evaluate the performance of companies. ROA is an indicator that relates to the company's ability to create profits from the resources invested in it, and show the firm's competency in utilizing its assets [10]. ROE is an indicator that refers to the efficiency of the company in bringing income from stakeholders' money that has been invested [2]. Whereas ATO is a financial indicator that measures the efficiency of the company in using its resources to bring revenues. ATO is computable as total revenue divided by total assets [10, 14]. EPS is a financial indicator that is used by financial analysts to evaluate the performance of companies. It refers to the monetary amount of profits per outstanding common shares during the accounting period [4].

**“Intellectual capital”:** International Accounting Standard 38 (IAS38) define “intangible assets” as non-monetary resources that lack physical substance. These resources can be identified if they are separable or arise from legal or contractual rights, such as computer software, trademarks, databases, and patents. The standard requires that intangible assets be clearly defined and only recognized if there is a potential future economic benefit and their cost can be reliably measured. Despite ongoing debates, there is still no consensus on a universal interpretation of IC [9]. It is defined as the differences between market value and book value known as IC [10], while [2] view “intellectual capital” as knowledge that can generate value and fuel sustainable competitive advantages and long-term success. The fundamental components of “intellectual capital” include “HCE, SCE, and CEE”.

**Human capital Efficiency (HCE):** Human capital is a crucial element of intellectual wealth and creativity. It refers to a business’s capacity to reap advantages from its employee’s skills, experiences, knowledge, and innovation [8]. It depends on the personal characteristics of employees such as education, entrepreneurship, leadership, and experiences [15]. Most previous studies found a positive effect of HCE on FP. such as, [10] found a positive impact of IC on firms’ productivity measured by ATO, [3] indicated a positive effect of HCE and FP represented in ROA and ROE. [4] Found a positive impact of HCE on FP measured by ROA and EPS. Depending on these earlier studies, the first hypothesis is:

**Hypothesis 1** There is a positive effect of HCE on FP of industrial companies listed on “PEX and ASE”.

**Structural capital (SC):** Structural capital also known as organizational capital [10] "Organizational or company value refers to the assets owned by a firm that persist even after employees leave, such as the company’s systems, intellectual properties, operations, structure, and other intangible resources. Knowledge management systems play a crucial role in supporting employees’ performance within a business by facilitating the creation, sharing, and transfer of knowledge" [16]. There are two main components to SC: infrastructural resources used in organizational activities, and knowledge innovation, such as patents, copyrights, and databases [14]. According to the resource-based view, SC cannot be substitutable easily so it is an important source of sustainable competitive advantages [1].

Most studies have suggested a positive impact of SCE on FP such as [10] revealed a positive impact of SCE on productivity measured by ATO, whereas [1] found a significant positive effect of SCE on ROA and an insignificant positive effect of SCE on ROE

Al Momani et al. [4] found that ROA and ROE were significantly affected by SCE. However, [3] indicated there is no association between SCE and profitability measured by ROA and ROE. Depend on these earlier studies, the second hypothesis is:

**Hypothesis 2** There is a positive effect of SCE on FP of the industrial companies listed on “PEX and ASE”.

**“Capital Employed Efficiency”:** Capital employed is a key component of “intellectual capital” (IC). It refers to the intellectual resources that are used to manage and regulate a company’s relationships with its stakeholders, such as government, society, clients, suppliers, and marketing channels. These stakeholders create the environment of the firm, and maintaining and expanding relational capital is crucial for obtaining new resources and achieving long-term superior performance for a company [11, 17].

There is a difference in the findings of the studies about the effect of CEE on the FP. Agomor [1] stated that CEE enhances the firm’s profitability measured by ROA and ROE. Whereas, Al Momani [4] didn’t find any association between CEE and ROA and ROE. Xu and Liu [3] revealed the productivity of the firm is positively affected by CEE and the profitability of the firm is negatively impacted by CEE. Depending on these earlier studies the third hypothesis is:

**Hypothesis 3** There is a positive effect of CEE on the FP of the industrial companies listed on “PEX and ASE”.

**Firm size:** Firm size is considered a moderating variable in the current study. It is a fundamental characteristic of a company and measures the natural logarithm of a company’s total assets at a given period [7]. Most previous studies used firm size as a control variable and they indicate a positive impact of firm size on FP that means when a company gets bigger in size of total assets will increase the ability to develop FP by optimal usage of available resources [1–3, 10]. According to our knowledge, this study is the first study to investigate the moderating role of firm size on the relationship between IC and FP. Then, the expected fourth hypotheses is:

**Hypothesis 4** There is a moderating role of firm size on the effect of IC on FP of industrial companies listed on “PEX and ASE”.

## 6 Method and Procedures

### 6.1 Population and Sample

This study employs the quantitative approach, which encompasses all numerical data—primary or secondary—in its methodology. The annual reports of all industrial firms on the “PEX and ASE” during 2016–2022 and the websites of the companies serve as the secondary data source for the current study. The study’s sample was chosen using the following standards: Throughout the research period, the company needs to be operational and listed on “PEX and ASE”, the business is required to include all components of VAICTM in its published annual reports (Table 1).

**Table 1** The study population

Subsector	Population	No. of companies listed in PEX	No. of companies listed in ASE	Percentage
1	Pharmaceutical and medical industries	3	3	13.6
2	Chemical industries	0	5	11.4
3	Food and beverages	3	7	22.7
4	Tobacco and cigarettes	1	1	4.5
5	Mining and extraction industries	2	7	20.5
6	Engineering and construction	2	7	20.5
7	Electrical industries	0	2	4.5
8	Textiles, leathers and clothing	0	1	2.3
Total		11	33	100

## 6.2 Variables

1. **Independent variable:** the “value-added intellectual coefficient model (VAICTM)” is regarded as the most effective means of gauging the effectiveness of “intellectual capital” in generating value for the organization. There are various reasons for using the VAICTM model in the current study: first: quantitative method that depends on real and historical data from financial statements; second: reliability and objectivity of data that are obtained from audited financial statements; third: easily to understand by management and stakeholders [18]. The (VAICTM) model measures three components “human capital, physical capital, and structural capital” that comprise the company’s worth [5]. There are five steps to measure “intellectual capital” (Table 2).

### 2. Dependent, moderating and control variables

The “Firm performance” is a dependent variable. Which is measured by “ROA, ROE, ATO, and EPS”. Firm size is a moderating variable. While control variables are represented in leverage and firm age (Table 3).

## 7 Results

The following two regression models were constructed using the annual reports of industrial firms listed on the “PEX and ASE” to test the effect of IC on FP as well as the moderating effect of firm size on the relationship between variables.

**Table 2** Calculation of VAICTM

First step:	“Calculation of value added (VA)” [4]. “VA = OP + HC + D + I + DI + T” Where: “OP = Operating profit of company, HC = Employee cost, D = Depreciation, I = Interest, DI = Dividend, T = Tax”
Second step	Estimation of “Human Capital Efficiency (HCE)” [2], $HCE = VA / HC$
Third step	Estimation of “Structural capital Efficiency (SCE)” [10] $SCE = SC / VA$ “SC = VA – HC” Where: “SC = “Structural capital”
Fourth step	Estimation of “Capital Employed Efficiency” (CEE) [3] “CEE = VA / CE” “CE = Capital employed = Total assets – Total liabilities”
Fifth step:	Estimation of VAICTM [1] $VAICTM = HCE + SCE + CEE$

$$\text{Model 1a—FP} = \alpha_0 + \beta_1 HCE + \beta_2 SCE + \beta_3 CEE + \varepsilon.$$

$$\text{Model 1b—FP} = \alpha_0 + \beta_1 HCE + \beta_2 SCE + \beta_3 CEE + \beta_4 FLEV + \beta_5 FAGE + \varepsilon.$$

$$\text{Model 2—FP} = \alpha_0 + \beta_1 HCE_1 + \beta_2 SCE_1 + \beta_3 CEE_1 + \varepsilon.$$

Where

$\alpha_0$ : represent Intercept;  $\beta_1$ – $\beta_6$ : represent regression coefficients; FP: Firm performance; HCE: Human Capital Efficiency; SCE: Structural Capital Efficiency; CEE: “Capital Employed Efficiency”; FLEV: Financial leverage; FAGE: Firm age; FSIZ: Firm size;  $\varepsilon$ : error term.

HCE1 = moderating the independent variable by firms size (HCE \* size)

SCE1 = moderating the independent variable by firms size (SCE \* size)

CEE1 = moderating the independent variable by firms size (CEE \* size)

## 7.1 The Impact of IC Components on ROA

According to Table 4, the “coefficient of determination (R<sup>2</sup>)” for the industrial companies on PEX was 4.3%. This indicates that only 4.3% of the variation in ROA is accounted for the independent variables “HCE, SCE, and CEE”. In contrast, for the industrial companies on ASE, the coefficient of determination (R<sup>2</sup>) reached 10.3%, which is higher compared to Palestinian industrial companies. To determine whether there is a multicollinearity between independent variables in the regression model, we used VIF. Table 4 shows that there is no internal correlation between independent variables as the VIF is less than 5, indicating no multicollinearity. Based on the findings, we can conclude that there is no significant effect of each of “HCE, SCE, and CEE” on the ROA of the industrial companies on PEX. On the other hand, for the industrial companies on ASE, there is no significant effect for both “HCE and SCE on ROA”, but there is a significant effect of CEE on ROA.

**Table 3** Measurement of the variables

Type of variable	Variable	Definition	Measurement	References
Independent variable	Intellectual capital	The variations between book value and market value	VAICTM = HCE + SCE + CEE	[4]
Dependent variables	“Return on assets (ROA)”	The capacity of a business to turn a profit from the invested assets. It is a profitability indicators represented by “Return on Assets (ROA) or Return on Investment (ROI)”,	Net income as a percentage of total assets	[19]
	“Return on equity (ROE)”	The efficiency of the company in generating income from stockholders’ money that have been invested	Net income as a percentage of total equity	[20]
	“Assets turnover ratio (ATO)”	The efficiency of company in using its resources to create revenue	Total revenues as a percentage of total assets	[21]
	Earnings per share (EPS)	The monetary amount of profits per outstanding common shares during accounting period	Net income as a proportion of all outstanding common shares	[11]
Moderating variable	Firm size	Size of industrial companies at a given period	Natural logarithm of the company’s total assets	[2]
Control variables	Financial leverage(FLEV)	Financial ratio that measures the ability of the company to pay its obligation	Ratio of total debts divided by total assets	[22]
	Firm age(FAGE)	The duration of the company’s operations, counting from the year of founding to the present	Natural logarithm of the current year of the company minus the formation year	[4]

**Table 4** The impact of IC on ROA

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F-sig	DV
1a	0.208	0.043	0.355	ROA	1	0.321	0.103	0.000	ROA
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		– 0.009	0.860		(Constant)		0.036	0.000	VIF
HCE		– 0.001	0.821	2.699	HCE		3.629E–05	0.786	1.004
SCE		0.114	0.226	2.578	SCE		0.004	0.328	1.002
CEE		0.050	0.499	1.084	CEE		0.000	0.000	1.003

**Table 5** The impact of IC on ROE

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1a	0.233	0.0540		ROE	2	0.221a	0.049	0.010	ROE
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		0.066	0.352		(Constant)		0.057	0.000	VIF
HCE		0.008	0.183	2.699	HCE		0.00003	0.906	1.004
SCE		– 0.015	0.904	2.578	SCE		0.002	0.835	1.002
CEE		0.080	0.413	1.084	CEE		0.000	0.001	1.003

## 7.2 The Impact of IC Components on ROE

According to Table 5, the industrial companies on PEX have a coefficient of determination of 5.40%. This means that 5.40% of the variation in ROE is accounted for by the independent variables represented in “HCE, SCE, and CEE”. On the other hand, the industrial companies on ASE have an R2 of 4.9%, which is lower than that of the PEX companies. The VIF is less than 5. The results indicate that there is no effect of “HCE, SCE, and CEE” on the ROE of the industrial companies on PEX. For the industrial companies on ASE, there is no effect of HCE and SCE on ROE, but there is an effect of CEE on ROE.

## 7.3 The Impact of IC Components on ATO

Table 6 examines the relationship between the components of IC and assets turnover (ATO). The results show that the coefficient of determination (R2) for PEX companies is 34.3%, while for ASE companies, it is 100%, indicating that the independent variables in the model account for all the variation in ATO for ASE companies, the result seems strange, but this is the fact. Previous studies concentrate of ROA and EPS [4], without having the ATO into consideration, so the result can't be verified for the Jordanian firms. The VIF is less than 5, indicating no multicollinearity between the independent variables. The impact of HCE, SCE, and CEE on ATO is significant for PEX companies. However, for ASE companies, only HCE and CEE affect ATO, while SCE has no significant impact.

## 7.4 The Impact of IC Components on EPS

According to Table 7, the coefficient of determination (R2) for industrial companies on PEX is 29.3%. This indicates that 29.3% of the variation in EPS can be explained

**Table 6** The impact of IC on ATO

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1a	0.585	0.343		ATO	3	1.000a	1.000	0.000	ATO
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		0.255	0.142		(Constant)		0.486	0.000	VIF
HCE		- 0.062	0.000	2.699	HCE		- 0.037	0.000	1.004
SCE		0.623	0.041	2.578	SCE		- 0.015	0.640	1.002
CEE		0.566	0.020	1.084	CEE		0.812	0.000	1.003

**Table 7** The impact of IC on EPS

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1a	0.542	0.293	0.00	EPS	4	0.552a	0.305	0.296	EPS
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		- 37.181	0.001		(Constant)		0.204	0.001	VIF
HCE		- 0.139	0.877	2.699	HCE		4.437E-6	0.998	1.004
SCE		33.212	0.081	2.578	SCE		0.026	0.633	1.002
CEE		70.840	0.000	1.084	CEE		0.009	0.000	1.003

by the independent variables represented in HCE, SCE, and CEE. On the other hand, the coefficient of determination (R<sup>2</sup>) is 30.5% for industrial companies on ASE. The independent variables do not exhibit multicollinearity. There is a positive effect of CEE on EPS for the industrial companies on both “PEX and ASE”, and there is no impact of HCE and SCE on EPS for both companies listed in “PEX and ASE”.

### 7.5 *The Impact of IC Components on ROA in the Presence of Control Variables*

Table 8 displays the influence of IC elements on the ROA in the presence of control variables. The results observed that the coefficient of determination (R<sup>2</sup>) for industrial companies on PEX is 15.8%. This percentage is higher than the coefficient of determination in Table 4. It means that control variables have a significant impact on increasing R<sup>2</sup>. The coefficient of determination (R<sup>2</sup>) for industrial companies on ASE is 22.6%. This percentage is also higher than the coefficient of determination in Table 4. It indicates that R<sup>2</sup> is significantly influenced by control variables.

With the presence of the control variables the IC elements have no significant impact on ROA for Palestinian companies, but CEE impact the ROA for the Jordanian firms. The result was consistent with that of Table 4.

**Table 8** The impact of IC on ROA in the presence of control variables

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1b	0.398a	0.158	0.029	ROA	5	0.476	0.226	0.000	ROA
IV	B	Sig	VIF	IV	B	Sig			
(Constant)	0.118	0.293		(Constant)	0.043	0.051	VIF		
HCE	0.007	0.175	3.667	HCE	3.81E−05	0.760	1.006		
SCE	− 0.033	0.746	3.304	SCE	0.004	0.257	1.005		
CEE	0.079	0.271	1.118	CEE	0.000	0.000	1.013		
AGE	4.868E−05	0.998	1.103	AGE	0.007	0.252	1.040		
LEV	− 0.214	0.003	1.408	LEV	− 0.088	0.000	1.030		

### 7.6 The Impact of IC Components on ROE in the Presence of Control Variables

According to Table 9 in the presence of control variables, the findings indicate that the coefficient of determination (R<sup>2</sup>) for industrial companies on PEX is 11.8%, which is higher than the coefficient of determination in Table 5. This suggests that control variables may have an important role in raising R<sup>2</sup>. On the other hand, the coefficient of determination (R<sup>2</sup>) for industrial companies on ASE is 5.03%, which is also significantly affected by control variables, as evident in Table 5.

With the presence of the control variables the IC elements ( SCE, CEE) have no significant impact on ROE, where, HCE has for Palestinian companies, but CEE only has an impact on ROE for the Jordanian firms. The result was consistent with that of Table 5 for the Jordanian firms, but inconsistent for the Palestinian firms.

**Table 9** The impact of IC on ROE in the presence of control variables

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1b	0.344	0.118	0.105	ROE	6	0.230	0.053	0.031	ROE
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		0.233	0.128		(Constant)		0.029	0.512	VIF
HCE		0.015	0.025	3.667	HCE		3.629E−05	0.883	1.006
SCE		− 0.158	0.248	3.304	SCE		0.001	0.858	1.005
CEE		0.105	0.284	1.118	CEE		0.000	0.001	1.013
AGE		− 0.011	0.731	1.103	AGE		0.010	0.411	1.040
LEV		− 0.215	0.026	1.408	LEV		− 0.012	0.710	1.030

**Table 10** The impact of IC on ATO in the presence of the control variables

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1b	0.660a	0.435		ATO	7	1.000	1.000	0.000	ATO
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		− 0.086	0.808		(Constant)		0.586	0.002	VIF
HCE		− 0.089	0.000	3.667	HCE		− 0.037	0.000	1.006
SCE		1.127	0.001	3.304	SCE		− 0.013	0.678	1.005
CEE		0.457	0.048	1.118	CEE		0.812	0.000	1.013
AGE		− 0.025	0.728	1.103	AGE		− 0.002	0.967	1.040
LEV		0.723	0.002	1.408	LEV		− 0.267	0.043	1.030

### 7.7 *The Impact of IC Components on ATO in the Presence of Control Variables*

Table 10 analyzes findings show that the coefficient of determination (R<sup>2</sup>) for industrial companies on PEX is 43.5%, which is higher than the R<sup>2</sup> in Table 6. This indicates that the control variables have a significant impact on increasing R<sup>2</sup>. On the other hand, the R<sup>2</sup> for industrial companies on ASE is 100%, which is a strange results, but this the fact.

With the presence of the control variables the all IC elements have significant impact on ATO, for Palestinian companies, but HCS and CEE only has an impact on ATO for the Jordanian firms. The result was consistent with that of Table 6 for the Jordanian and Palestinian firms.

### 7.8 *The Impact of IC Components on EPS in the Presence of Control Variables*

Table 11 findings show that the coefficient of determination (R<sup>2</sup>) for industrial companies on PEX is 30.1%, which is higher than the coefficient of determination in Table 7. This indicates that control variables play a significant role in increasing R<sup>2</sup>. The coefficient of determination (R<sup>2</sup>) is 33% for the industrial companies on ASE, revealing that control variables also play a significant role in these companies.

With the presence of the control variables the IC elements only (CEE) have significant impact on EPS for both firms in “PEX and ASE”. The result was consistent with that of Table 7 for the Jordanian firms, and Palestinian firms.

**Table 11** The impact of IC on EPS in the presence of control variables

Palestine					Jordan				
“Model”	R	R Square	F-sig	DV	“Model”	R	R Square	F sig	DV
1b	0.548	0.301		EPS	8	0.574	0.330	0.000	EPS
IV		B	Sig	VIF	IV		B	Sig	
(Constant)		– 19.003	0.428		(Constant)		– 0.472	0.135	VIF
HCE		0.002	0.999	3.667	HCE		0.000	0.923	1.006
SCE		29.071	0.179	3.304	SCE		0.021	0.701	1.005
CEE		70.284	0.000	1.118	CEE		0.009	0.000	1.013
AGE		– 3.677	0.449	1.103	AGE		0.219	0.010	1.040
LEV		– 7.914	0.597	1.408	LEV		– 0.192	0.395	1.030

### ***7.9 The Impact of Firm Size on the Relationship Between IC Components and ROA, ROE, ATO, and EPS.***

The moderating effect was solarized in Table 12. The results investigate the significant impact before and after the moderating effect through P-Value (Sig). For the Palestinian companies, the moderating effect of the firm size on ROA was for HCE1, ROE for HCE1 and SCE1, ATO for CEE1, and EPS for HCE. While for the Jordanian companies the significant impact after the moderating effect was on ROE for both SCE1 and CEE1.

There is a variation in the results between the two markets. The Palestinian market is more sensitive for the moderating impact of the firm size. The results can be interpreted by the capital volume invested in the Jordanian industrial firms and the number of the industrial firms listed in the exchange markets.

## **8 Conclusions**

The current study investigates the moderating role of firm size on the relationship between “intellectual capital” and firm performance among industrial companies on Palestine Exchange and Amman Stock Exchange. Firstly, there is a negative impact of HCE on ATO, but there is no effect of HCE on ROA, ROE, and EPS. In the presence of control variables represented in firm age and financial leverage, the results display there is no-significant impact of HCE on ROA for industrial companies on “PEX and ASE”. The control variables don’t play a role on the impact of HCE on ROA. But there is a positive effect of HCE on ROE for industrial companies on PEX. The control variables play a significant role on the impact of HCE on ROE. Those findings agreed with the resources based theory that explain that the spending on employees are considered as investment to improve financial performance [3, 4].

**Table 12** Impact of firm size on the impact of IC on “ROA, ROE, ATO, and EPS”

IV	Palestine				Jordan			
	B Coefficients	Sig before	Sig after	Conclusions	B Coefficients	Sig before	Sig after	Conclusions
<i>ROA</i>								
HCE1	0.001	0.821	0.028	Moderating Positive impact	1.122E-5	0.786	0.456	No Moderating impact
SCE1	- 0.002	0.226	0.167	No Moderating impact	0.000	0.328	0.776	No Moderating impact
CEE1	0.008	0.499	0.106	No Moderating impact	2.584E-5	0.000	0.006	No Moderating impact
<i>ROE</i>								
HCE1	0.001	0.183	0.000	Moderating Positive impact	0.000	0.906	0.685	No Moderating impact
SCE1	- 0.005	0.904	0.002	Moderating Negative impact	- 0.037	0.835	0.005	Moderating Negative impact
CEE1	0.013	0.413	0.037	No Moderating effect	9.004E-5	0.001	0.760	Moderating Positive impact
<i>ATO</i>								
HCE1	- 0.003	0.000	0.000	No Moderating impact	- 0.003	0.000	0.000	No Moderating impact
SCE1	0.011	0.041	0.012	No Moderating effect	0.003	0.640	0.136	No Moderating impact
CEE1	0.023	0.020	0.144	Moderating Positive impact	0.056	0.000	0.000	No Moderating impact
<i>EPS</i>								
HCE1	0.121	0.877	0.014	Moderating Positive impact	1.149E-5	0.998	0.912	No Moderating impact
SCE1	- 0.297	0.081	0.277	No Moderating impact	0.003	0.633	0.240	No Moderating impact
CEE1	4.708	0.000	0.000	No Moderating impact	0.001	0.000	0.000	No Moderating impact

Whereas no effect of HCE on ROE for industrial companies on ASE. The control variables don't play a significant role on the impact of HCE on ROE. The current study found a negative impact of HCE on ATO. The control variables play a negative role on impact of HCE on ATO for industrial companies on "PEX and ASE". The control variables don't play a significant role on the impact of HCE on ATO. There is no any impact of HCE on EPS for industrial companies on "PEX and ASE". The control variables don't play a significant role on the impact of HCE on EPS.

Findings show that the SCE has a positive impact on EPS for industrial companies on PEX, and there is no impact of SCE on ROA, ROE, and ATO for industrial companies on "PEX and ASE". In the presence of control variables, a positive impact of SCE on ATO for industrial companies on PEX, findings are in the line with [10] who display that the company develop internal resources to increase the knowledge and innovation of their employees. Whereas, we don't find any impact of SCE on ROA, ROE, and EPS for industrial companies on PEX, and ASE. The control variables don't play a significant role on the impact of HCE on ROA, ROE, and EPS. This study support the results of [1, 4].

The research indicates that while CEE affects ATO and EPS, its effect on ROA and ROE for industrial businesses listed on PEX is not statistically significant. Conversely, for industrial companies on ASE, CEE has a positive effect on all firm performance measures. In the presence of the control variables, CEE had no effect on ROA and ROE and it had a positive impact on ATO and EPS. For industrial companies on ASE, the control variable has a negative impact on the impact of CEE on ROE. This study support the result of [3, 4]. According to [15] revealed a significant positive impact of CEE on the ATO in Italian industrial companies; because management focus on CEE to maximize their productivity.

### **Recommendations**

- To enable investors to take an appropriate investment decision, industrial businesses on "PEX and ASE" are required to clearly disclose in their annual reports all elements of IC represented in HCE, SCE, and CEE.
- Policy makers have to be interested about developing IAS 38 to be able to measure intangible assets in adequate way.
- Managers have to realize the significant role of IC in developing the company's performance in the long—term by providing training courses for employees, rewards and promotions, improving information system, and developing the relationship with their employees and customers.
- In order to ascertain whether "intellectual capital" has the same effect on company performance, future research future research should employ the updated VAICTM model.

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