ISSN 2303-4521
Periodicals of Engineering and Natural Sciences *Original Research*
Vol. 11, No. 4, July 2023, pp.40-52

Investigating and analyzing the impact of IC on the profitability of companies listed on the Iraqi stock exchange

Omar Adeeb Qassim [1], Mehdi ArabSalehi [2], Gholamhossein Kiani[3]
[1] PhD. Student, Department of Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Iran
[2] Associate Professor in Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Iran
[3] Associate Professor, Department of Economics, Faculty of Administrative Sciences and Economics, University of Isfahan, Iran

ABSTRACT

Companies need to follow a continual strategy of knowledge improvement and innovation to maintain their competitive advantage in the face of rapid technological advances and global competition. This method, known as intellectual capital (IC), aids businesses in keeping their edge in the market. Managers should pay attention to IC because of this reason. This study looked at how IC affected the bottom line of a company listed on the ISE in Iraq. The study studied data from a subset of the ISE-listed manufacturers throughout the span of ten years, from 2010 to 2019. Multivariate regression, as well as the F-Limer, Chow, and Hausman tests, were used to examine the data. It was shown that IC improved both ROA and ROE. The results also showed that the capital added value coefficient (COAV) positively impacted ROA but had no discernible impact on ROE. Moreover, ROA and ROE were found to be positively impacted by structural capital's coefficient of added value COAV. And while it had little impact on ROA, the added value coefficient (AVC) of human capital (HC) had a positive and large impact on ROE.

Keywords: Intellectual capital, Profitability, Performance, Added value coefficient of intellectual capital.

Corresponding Author:

Mehdi Arabsalehi
Faculty of Administrative Sciences and Economics
University of Isfahan, Isfahan, Iran
E-mail: Mehdi_arabsalehi@ase.ui.ac.ir

1. Introduction

IC is comprised of intangible assets like information, knowledge, intellectual property, and HC, which have garnered significant attention from researchers in recent decades, due to the prospect of increasing competitive advantage. A review of the literature on IC highlights the focus on its measurement, valuation, and reporting. The growth of intangible assets and IC has enabled organizations to achieve a sustainable competitive advantage in the modern knowledge-based economy. To remain competitive in the face of rapidly changing markets, products, technology, competitors, and regulations, organizations must continuously improve knowledge and innovation. The effective management of knowledge and IC is essential for improving performance and ensuring the success and sustainability of businesses.

Intangible assets, such as information, knowledge, intellectual property, research and development, HC, and innovation, make up IC. The current study analyzed the influence of IC on the profitability of companies listed on the ISE. The significance of IC on company profitability has been widely recognized by various researchers. IC and its applications are essential for the success of projects, as they help to establish a strong position that ensures the survival and continuity of projects in the current business environment. The progress of developed societies is dependent on thinkers, creators, and owners of productive ideas, and this is what management organizations aim to achieve. As a basic criterion for evaluating efficiency and effectiveness in resource usage and representing the net results of numerous policies and decisions, IC is viewed as an indicator of the performance of organizational management [1].

Although tangible assets were the dominant source of value in the early phases of a corporation, with intangible assets accounting for a smaller share, Fadur & Mironiuc (2013) reported that over 80% of corporate value is

derived from innovations and intangible assets. To produce new resources, boost output, and gain an edge in a knowledge-based economy, IC is employed [3]; IC consists of intangible assets that can be transformed into profit and value but are not shown in financial accounts. When the economy is booming, IC plays a crucial role in boosting company performance and keeping a company ahead of the competition [3-8]. As a result, businesses should put money into IC and figure out how to put it to good use so they can offer customers valuable goods and services [9]. The purpose of this study is to inquire into the connection between IC and profits. Previous studies (Firer & Williams, 2003) have investigated the link between IC and corporate profits and the correlation between IC effectiveness and openness of business processes. In addition, (Barney, 1991) suggested that since IC is an intangible notion, top organizations have begun viewing it as a strategic asset that generates long-term competitive advantages and maximum profits [10].

Tan, Plowman, and Hancock in 2007) explored the relationship between the profitability of 150 Singaporean companies traded publicly between 2000 and 2002 and IC [11]. The outcomes of this study presented a clear correlation between IC and the profitability of these Singaporean companies. Additionally, the growth rate of IC and the potential profitability of the companies were found to have a direct relationship with profitability, and the contribution of IC towards profitability varied by the industry. The authors of [12], considered IC to be a key factor in creating value within companies. He believes that the traditional view of managers creating value through physical assets has changed, and companies are increasingly turning to create value through IC. Thus, IC is one factor that can impact profitability [13]. Profitability refers to a company's ability to earn profit and is the end result of all the company's plans and financial decisions [14]. Additionally, profit can be influenced by various factors, such as company size [15-16], company age [17-20], and ownership structure [15, 21], found that there is a positive major correlation between the size of the European companies and profitability ratios.[22], also found in his research that large companies are more profitable than small companies. However,(Feeny, 2000) found that company size does not have a significant impact on profitability [16]. Another determinant that can impact profitability is the company's lifespan. Increasing the lifespan of the company can increase the experience of the company's human resources, leading to more efficient and cost-effective production processes, resulting in increased productivity and profitability [17, 18, 20], found no association between profitability and a company's lifespan. Ownership structure can also impact profitability. The author in [21] described the difficulty in predicting the association between ownership structure and company profitability, but it is expected that there is a negative relationship.

To assist users in making informed decisions financial reports ought to provide dependable relevant, comparable, and understandable information [23]. Recent events concerning scandals in the international financial community concerning accounting catalyzed discourse and concerns regarding the quality of financial reporting [24]. Quality financial reporting and disclosure are crucial, as they can lead to better predictions of a company's future cash flows for investors and other financial statement users. Investors and regulators both share a desire for financial reports of a high standard due to the assumed impacts such reports have on capital markets [25, 26]. Based on literature, the main research question is to determine whether IC has a connection with the profitability of companies listed on the ISE?

2. Method

This study is a post-event scientific correlational analysis based on actual financial data from ISE-listed companies. It can also be categorised as applied research because its results can be used to guide policymaking. The statistical population for this research consisted of businesses listed on the ISE between 2010 and 2019 that met the following criteria:

1) Profitability is significantly and favorably impacted by the coefficient of added value of physical capital.
2) Profitability is significantly and favorably impacted by the structural capital's coefficient of added value.

3) The profitability of an enterprise is significantly and favorably impacted by the value-added coefficient of human capital.

To test the hypotheses of the research, (Pulic, 2000) has been used as described in formula 1 to 8:

$$ROA = \beta_0 + \beta_1 VAIC + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (1)$$

$$ROE = \beta_0 + \beta_1 VAIC + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (2)$$

$$ROA = \beta_0 + \beta_1 VACA + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (3)$$

$$ROE = \beta_0 + \beta_1 VACA + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (4)$$

$$ROA = \beta_0 + \beta_1 VAHC + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (5)$$

$$ROE = \beta_0 + \beta_1 VAHC + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (6)$$

$$ROA = \beta_0 + \beta_1 SCVA + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (7)$$

$$ROE = \beta_0 + \beta_1 SCVA + \beta_2 Size + \beta_3 IQR + \beta_4 Liquidity + \beta_5 Grow + \beta_6 Board\ Size + \beta_7 Institutional\ Shareholding + \beta_8\ Age + \varepsilon \quad (8)$$

To the extent that the following variables are specified: rate of return on assets (ROA), rate of return on equity (ROE), value of added intellectual capital (VAIC), value of added physical capital (VACA), value of added human capital (VAHC), and value of added structural capital (SCVA).

2.1. Dependent variable

According to [2, 3], there are various ways to determine a company's profitability. Two commonly used indicators are:

1. ROA, which is calculated by dividing the net profit via the book value total assets.
2. ROE, which is calculated by dividing net profit by the total book value of equity shares.

2.2 Independent variable

In order to assess IC in this study, we used the AVC of IC (VAIC), a measure developed by [27]. This model calculates the added value derived from current resources using the formula (9):

$$VA = OP + EC + D + A \quad (9).$$

In this formula, OP represents operating profit, EC represents salary expenses, D represents the depreciation of fixed assets, and A represents the depreciation of intangible assets. To measure IC in this research, the AVC of IC (VAIC) proposed by Pulic was used [27]. According to this model, the added value obtained from current resources is calculated using the following formula: VAIC = OP - (EC + D + A). Pulic considers three criteria for measuring a company's IC: the added value factor of physical capital, the added value factor of HC, and the added value factor of SC.

2.2.1. The value-added factor of physical capital (VACA)

Rewording the text while maintaining all references mentioned: To measure the added value of physical capital, the following formula is used [27]: Physical capital (CE) divided by the added value (VA) equals the COAV of physical capital (VACA).

$$VACA = VA \div CE \quad (10)$$

The AVC of physical capital, as calculated by Pulic, can be determined by using the formula (10). This formula calculates the added value created by each unit of physical capital, which is represented by the ratio of physical capital (CE) to added value (VA). The result of this calculation is the COAV of physical capital (VACA). Physical capital, as defined by (Pulic, 2004), includes the net book value of total assets. If a company's physical capital produces higher returns per unit compared to another company, then the first company is deemed to have utilized physical capital more effectively, according to Palik's perspective in [27].

2.2.2. Value-added coefficient of HC (VAHC)

The value-added coefficient of HC (VAHC) indicates the amount of value added per unit of HC invested. It is calculated using formula 11, which represents the relationship between value-added and HC. This coefficient helps to understand how much-added value is generated from each expenditure on employees.

$$VAHC = VA \div HC \quad (11)$$

The value-added coefficient of HC (VAHC) measures the relationship between value-added and HC and is calculated using formula number 11. This coefficient indicates the amount of added value generated per unit of spending on employees, with HC including labor cost. By dividing the added value by employee salaries and benefits, this ratio demonstrates the contribution of human resources to the company's added value.

2.2.3. SC ratio (SCVA)

The AVC of SC is a measure of the contribution of SC in creating value. The value of SC divided by the value added is used to compute this metric. The lower the contribution of HC in value creation, the higher the contribution of SC. This ratio shows the amount of SC needed to generate added value. It is an indicator of the effectiveness of SC in the value creation process, which is represented by the following formula: SC AVC (SCVA) = SC (SC)/ Value Added (VA).

$$SCVA=SC\div VA \qquad (12)$$

SC's value added (SCVA) is a measure of how valuable SC is. Value added per employee is determined by dividing the company's SC by the total revenue. SC encompasses everything besides people and physical resources. This includes money, organizations, and technology. Using this coefficient, we may assess SC's contribution to the company's bottom line. A higher coefficient shows that the SC is responsible for a larger share of the value created by the company. Therefore, the following formul are used to assess VAIC:

$$VAIC=VACA+VAHC+SCVA \qquad (13)$$

2.3. Control variables

The natural logarithm of the total value of the company's assets is used as a proxy for the company's size [29].In this study, we used performance-adjusted discretionary accruals to evaluate financial reporting quality in accordance with the framework presented in [30]. Here is the calculation's formula:

$$TA_{i,t} = \beta_0 + \beta_1\left(\frac{1}{Assets_{i,t}}\right) + \beta_2\Delta Rev_{i,t} + \beta_3 PPE_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \qquad (14)$$

When:

TA represents the proportion of an organization's total accruals in year t relative to its assets at the beginning of the period.

Assets in year t represents the value of a corporation i's assets as of the beginning of the period. The ratio of the annual change in operating income to total assets at the beginning of the period is represented by ΔRev.

The ratio of gross property, machinery, and equipment at the beginning of the period of a company i in year t to the assets at the beginning of the period is represented by PPE.

ROA is the ratio of net profit to total assets for a company i in year t.

In this formula, the sum of accrual items is represented by TA and can be calculated using the following formula:$TA_{i,t} = \left(\Delta CA_{i,t} - \Delta CASH_{i,t} - \Delta CL_{i,t} + \Delta STDEBT_{i,t} - DEPN_{i,t}\right)$ (15)

When:

The ratio of total accruals of a company i in year t to assets at the beginning of the period is represented by TA.

The change in current assets of a company i in year t is represented by ΔCA.

The cash changes of a company i in year t are characterized by ΔCASH.

The changes in current liabilities of a company i in year t are represented by ΔCL.

The changes in short-term facilities or current share of a company i in year t are represented by ΔSTDEBT.

The depreciation cost of perceptible and imperceptible assets of a company i in year t is represented by DEPN. In this research, discretionary accruals, which are obtained through the residual of the regression, are employed to assess the quality of financial reporting, as suggested by [30]. The absolute value of these discretionary accrual items is multiplied by negative one, resulting in higher values indicating higher quality of financial reporting [30-31].

$$\left(FRQ - DisAccr_{i,t} = -\left|\varepsilon_{i,t}\right|\right) \qquad (16)$$

Current assets minus inventory as the base. This method is preferred over the traditional method of calculating liquidity, which includes inventory in current assets, as inventory has a low liquidation value [32].

$$QR = \frac{CA-I}{CL} \qquad (17)$$

When: (CL) is the Current liabilities, (CA) is the Current assets, and (I) is the Inventory of goods.

The growth of the company as a control variable is calculated according to the findings of [33] using formula number 18:

$$Assets\ Growth = (TA\ t - TA\ t - 1) \div TA\ t - 1 \quad (18)$$

TA: Total assets.

The research conducted by [34], identified the following corporate governance variables:

- Board Size: This refers to the number of members of the board of directors.
- Institutional shareholders: This represents the percentage of major shareholders who own at least 5% of the company's shares.

The use of a natural logarithm for the year number of commercial activity is suggested to calculate the age of a company [35].

Table 1. Research variable descriptions using descriptive statistics

	Mean	**Median**	**Maximum**	**Minimum**	**Standard deviation**	**Skewness**	**Kurtosis**
ROA	0.00369	0.016500	0.338000	-0.879	0.172485	-1.8729	8.620970
ROE	0.006919	0.04300	0.909000	-0.876	0.215370	-0.10127	6.281803
VAIC	2.09639	2.201000	8.99100	-3.827	2.465919	0.0335599	3.342147
VAHC	1.84460	1.237000	17.76500	-20.479	3.21677	0.761590	14.79758
VACA	0.14313	0.08500	2.796000	-0.828	0.248103	4.266562	42.21331
SCVA	0.43721	0.505000	3.970000	-4.057	1.429892	0.31817	4.782656
SIZE	20.8628	22.00000	27.0000	0.00000	5.701108	-3.16828	11.89903
IQR	0.02451	0.000000	0.75600	-0.929	0.220617	-0.57649	6.087321
LIQUIDITY	2.3175516	1.910500	8.930000	-0.96	1.908769	1.301903	4.584746
GROW	0.058386	0.023500	1.705000	-1	0.319174	0.51657	8.850692
BOARSIZE	6.78000	7.000000	11.00000	0.000000	1-21365	-1.38362	10.62531
INSSHAR	0.24428	0.160000	0.840000	0.000000	0.269709	0.790864	2.157725
AGE	3.39032	3.296000	4.29000	2.19700	0.43842	0.43817	2.97183

The descriptive statistics of the study variables are shown in Table 1. The mean, or average, is the most crucial central index since it shows where the distribution's weight is most evenly distributed. It's a good metric for illustrating how crucial the data is. The dispersion of the numbers can be seen in the standard deviation. The table's minimum and maximum values illustrate the extent of the data's fluctuation, while the median value stands for the data's midpoint.

3. Results of unit root test (durability check)

Table 2 illustrates the results of the unit root tests for all variables in the model which indicate that the statistical assumption of having a unit root in these variables can be rejected. This means that these variables are valid.

Table 2. Results of unit root test for research variables

Variable name	Rate of ROA	Rate of ROE	COAV of IC	COAV of HC	COAV of physical capital	SC ratio	Size of the company	Financial reporting quality
Symbol	ROA	R0E	VAIC	VAHC	VACA	SCVA	SIZE	IQR
Value of the statistic	-11.1526	-8.02993	-9.13196	-25.8158	-37.9192	-19.1509	-4.22877	-61.9886
Probability value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Result	Durability 's confirmation							

Variable name	Liquidity	Company's growth	Board size	Institutional shareholders	Company age
Symbol	OUIDITY	GROW	BODARSIZE	INSSHAR	AGE
Value of the statistic	-14.2675	-39.2289	-0.46303	-6.71101	-112.945
Probability value	0.000	0.000	0.000	0.000	0.000
Result	Durability 's confirmation				

Table 3. Non-collinearity test between explanatory variables

Variable	VAIC	VAHC	VACA	SCVA	SIZE	IQR
Coefficient of variance	37502.13	465.2937	1.659699	2553.257	104.1395	212.1955
Variance inflation factor	1.338323	1.127393	1.071408	1.410379	1.453887	1.137347
Variable	LIQUIDITY	GROW	BOARSIZE	INSSHAR	AGE	
Coefficient of variance	17410.49	70151.84	34635.49	196.6118	16390.21	
Variance inflation factor	1.278347	1.076526	1.236389	1.054133	1.203791	

The results of this test in Table III show that the amount of variance inflation of the independent and control variables is within the permissible limit.

Table 4. The result of F-Limer model test

Test type					F. Limer			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Value of the t statistic	4.742932	1.925567	5.364812	3.006147	6.183976	2.189104	5.188277	2.365521
Probability value	0.0000	0.0021	0.0000	0.0000	0.0000	0.0003	0.0000	0.0001
Result	Models have mixed data							

The Limer test probability is below 0.05, as shown in Table IV. This evidence contradicts the no-effects (null) hypothesis of the pooled regression model. This indicates that, rather than using a pooled or aggregated model, fixed effects or random effects models are more appropriate for estimating the model under investigation.
To decide between fixed effects and random effects for estimate, the Hausman test can be utilized if the F-limer test indicates that panel data is adequate [36]. When a panel model with effects is being considered, the Hausman test must be conducted. Here are the outcomes of the examination:

Table 5. The result of the Hausman test

Test type	Haussmann							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Chi-square statistic value	11.21345	13.193717	54.326211	10.576273	62.144490	11.463145	52.778167	20.753656
Probability value	0.2176	0.1054	0.0000	0.2269	0.0000	0.1768	0.0000	0.9978

According to Table 5, the probability value of the Hausman test indicates that some models have random effects, and some have fixed effects on the sections (in this case, the sections are companies).

Table 6. The first regression model

Variable name	**Regression coefficient**	**Standard error**	**T statistic**	**Probability value**
VAIC	0.013410	0.003429	3.910656	0.0001
SIZE	0.003343	0.001046	3.195213	0.0015
IQR	0.276500	0.059585	4.640459	0.0000
LIQUIDITY	0.007212	0.002512	2.870722	0.0044
GROW	0.09.212	0.023217	3.885604	0.0001
BOARSIZE	0.005278	0.005105	1.034021	0.3019
INSSHAR	0.010566	0.041505	0.254579	0.7992
AGE	0..283375	0.034256	1.913858	0.0565
C		0.116143	2.439886	0.0152
Coefficient of determination (COD)	0.338.78	Durbin-Watson statistics	1.892221	Significance of the whole model
The adjusted COD	0.322549	Value of the F statistic	21.77080	0.00000

Regression model outcomes are displayed in Table 6. Overall, the model's F statistic is 0.000, and the probability value is 21.77. The model's COD of 0.33 indicates that it gives a sufficient fit. Using the ROA rate as the

dependent variable, the corrected R-squared coefficient comes to 32%, suggesting that the model adequately explains 32% of the variations in profitability.

Table 7. The second regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
VAIC	0.037720	0.004434	8.507401	0.0000
SIZE	0.000355	0.000757	0.468659	0.6396
IQR	0.038897-	0.062879	0.618603	0.5366
LIQUIDITY	0.011169-	0.003761	2.969975	0.0032
GROW	0.079670	0.026837	0.168327	0.0032
BOARSIZE	0.001034-	0.006142	0.168327	0.8664
INSSHAR	0.029226	0.065344	0.447267	0.6550
AGE	0.026976-	0.039291	0.686578	0.4928
C	0.108611	0.13228	0.821396	0.4120
COD	0.203138	Durbin-Watson statistics	1.802026	Significance of the whole model
The adjusted COD	0.184443	Value of the F statistic	10.86607	0.00000

Both the F statistic value and the probability value for the entire model are 0.000, which indicates that the model does have a statistically significant influence. The probability value for the model is 10.86. The coefficient of determination (COD) is 0.20, which indicates that it offers a satisfactory fit. The coefficient of determination after adjustments is 0.18, which indicates that the model explains 18% of the variations in profitability (as measured by return on equity).

4. Results of hypothesis tests

4.1. The first hypothesis test

The return on assets rate is being positively and significantly impacted by IC's actions. The results of the hypothesis test indicate that there is likely to be a coefficient of 0.037 for the link between the rate of return on equity and intellectual capital. This value represents a positive characteristic of the relationship. This result demonstrates that there is a one-to-one relationship between the independent variable and the dependent variable. It means that IC results in a large increase in the rate of return on assets. The rate of return on equity sees a large boost as a result of the inclusion of IC. According to the results of the hypothesis test, the relationship between IC and the rate of return on equity has a coefficient of 0.037, which is a positive value. This suggests that the relationship is a positive one. This coefficient demonstrates that the independent variable has an immediate impact on the variable that is being studied (the dependent variable). Therefore, the findings of the study provided evidence in support of the null hypothesis, which states that the rate of return on equity was considerably influenced by the amount of intellectual capital.

Table 8. The third regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
VACA	0.234150	0.105836	2.212384	0.0277
SIZE	0.005726-	0.001035	5.530778	0.0000
IQR	0.119952	0.039663	3.024272	0.0027
LIQUIDITY	0.003638	0.001742	2.088542	0.0376
GROW	0.056407	0.012208	4.620432	0.0000
BOARSIZE	0.014057	0.002578	4.151439	0.0000
INSSHAR	0.013428	0.036338	0.386858	0.6991
AGE	0.048064-	0.022134	0.606672	0.5445
C		0.090621	0.530388	0.5962
Coefficient of determination	0.699575	Durbin-Watson statistics	1.81689	significance of the whole model
The adjusted COD	0.658475	Value of the F statistic	17.02110	0.000000

The F statistic value and probability value of the overall model are 0.000 and 17.02, respectively. The model's coefficient of determination is 0.69, indicating that it provides a good fit. The adjusted coefficient of determination is 0.65, hence, the model explains 65% of the changes in profitability (as measured by the rate of return on assets).

Table 9. The fourth regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
VACA	0.145032	0.089698	1.616889	0.1068
SIZE	0.01919-	0.001036	1.852208	0.0649
IQR	0.026582-	0.054192	0.490510	0.6241
PPE	0.069510	0.070070	0.992013	0.3219
GROW	0.115652	0.031444	3.678051	0.0003
BOARSIZE	0.009580	0.007146	1.340501	0.1810
INSSHAR	0.940497	0.063425	-0.638505	0.5236
AGE	0.026223-	0.047730	-0.549407	0.5831
C	0.100854	0.166821	0.604565	0.5459
Coefficient of determination	0.067992	Durbin-Watson statistics	1.676804	Significance of the whole model
The adjusted COD	0.046126	Value of the F statistic	3.109562	0.002105

Both the F statistic value and the probability value for the entire model are 0.000, which indicates that the model is statistically sound. Additionally, the probability value is 3.10. The model's coefficient of determination is 0.067, which indicates that it does not offer an accurate representation of the data. The coefficient of determination after adjustments comes in at 0.04, which indicates that the model is able to explain 4% of the variations in profitability (as measured by return on equity).

4.2. The second hypothesis test

This hypothesis can be further broken down into two sections, which are as follows: Profitability is positively affected in a way that is statistically significant, and this effect is caused by the coefficient of the added value of physical capital. Physical capital has a strong impact on the coefficient of the added value of the return rate of assets, which in turn has a major positive effect. The test of the hypothesis showed that the coefficient of the influence of the added value of physical capital on the rate of return on assets is 0.23, which is a positive number. This indicates that the hypothesis is supported. The value demonstrates that there is a one-to-one correspondence between the two variables (independent and dependent). This indicates that the added value coefficient of physical capital carries a significant weight in determining the rate of return on assets.

Table 10. The fifth regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
VAHC	0.017833	0.001832	9.732628	0.0000
SIZE	0.005488-	0.000894	6.140154	0.0000
IQR	0.101740	0.0.016564	0.518965	0.0000
LIQUIDITY	0.000877	0.001690	4.514874	0.6042
GROW	0.039946	0.008848	0.671274	0.0000
BOARSIZE	0.008374	0.001406	0.062792	0.0000
INSSHAR	0.023148	0.034483		0.5026
AGE	0.002616	0.020169		0.8969
C	0.004744	0.075543		0.9500
Coefficient of determination	0.756084	Durbin-Watson statistics	1.863888	Significance of the whole model
The adjusted COD	0.722715	Value of the F statistic	22.65788	0.00000

The f statistic value and probability value for the entire model are 0.000 and 22.65, respectively, which demonstrates statistical significance. The coefficient of determination for the model is 0.75, indicating that it provides a good fit. The adjusted coefficient of determination is 0.72, meaning that the model explains 72% of the changes in profitability (as measured by the rate of return on assets).

Table 11. Sixth regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
VAHC	0.022477	0.002576	8.726813	0.0000
SIZE	0.001058	0.000568	1.864695	0.0631
IQR	0.050805-	0.050192	1.012208	0.3122
LIQUIDITY	0.011706-	0.003748	3.123734	0.0019

Variable name	Regression coefficient	Standard error	T statistic	Probability value
GROW	0.090534	0.030207	2.997139	0.0029
BOARSIZE	0.000888-	0.004867	0.182451	0.8553
INSSHAR	0.030136	0.055965	0.538474	0.5906
AGE	0.022877-	0.041391	0.552694	0.5808
C	0.117195	0.138416	0.846689	0.3978
Coefficient of determination	0.129673	Durbin-Watson statistics	1.651159	Significance of the whole model
The adjusted COD	0.109255	Value of the F statistic	6.350848	0.00000

The f statistic value and probability value for the entire model are 0.000 and 6.35, respectively, demonstrating statistical significance. The coefficient of determination for the model is 0.12, indicating a poor fit. The adjusted coefficient of determination is 0.10, meaning that the model explains 10% of the changes in profitability (as measured by return on equity).

4.3. The third hypothesis test

The findings of the experiment designed to test this hypothesis revealed that the added value coefficient of structural capital has a material influence that is in the affirmative, and that this influence is on the rate of return on assets. The value of the effect coefficient, which is equal to 0.017, indicates that there is a direct effect of the independent variable on the dependent variable. This is indicated by the fact that the value of the effect coefficient is positive. The findings of the experiment that was conducted to test this hypothesis revealed that the added value coefficient of structural capital has a considerable influence, in a favorable direction, on the rate of return on equity. The value of the effect coefficient, which is equal to 0.22, is positive, which indicates that the independent variable had an effect on the variable that was being studied, which was the dependent variable. This indicates that a major contribution to a rise in the rate of return on equity is made by the added value coefficient of structural capital.

Table 12. Seventh regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
SCVA	0.002227	0.003061	0.727597	0.4674
SIZE	0.005931-	0.001177	5.037920	0.0000
IQR	0.190389	0.022251	8.556430	0.0000
LIQUIDITY	0.073680	0.002005	1.817301	0.701
GROW	0.012150	0.015209	4.844627	0.0000
BOARSIZE	0.023709	0.003328	3.650649	0.0003
INSSHAR	0.006157	0.039876	0.594576	0.5526
AGE	0.006157-	0.019094	0.322428	0.7473
C	0.043703	0.077038	0.56793	0.5709
Coefficient of determination	0.656623	Durbin-Watson statistics	1.894355	Significance of the whole model
The adjusted COD	0.609646	Value of the F statistic	13.97762	0.00000

The f statistic value for the complete model is 0.000, and the probability value is 13.97, which demonstrates that the model is statistically significant (given that the probability value is lower than 0.05). The model's coefficient of determination is 0.65, indicating that it provides a satisfactory fit. As a result, the model is chosen. The model is able to explain 60% of the variations in profitability (as assessed by the rate of return on assets), as indicated by the model's adjusted coefficient of determination, which is 0.60.

Table 13. The eighth regression model

Variable name	Regression coefficient	Standard error	T statistic	Probability value
SCVA	0.025754	0.005948	4.329920	0.0000
SIZE	0.002422-	0.001633	1.483432	0.1390
IQR	0.123018	0.013532	9.091015	0.0000
LIQUIDITY	0.001393	0.001667	0.835619	0.4040
GROW	0.095298	0.014332	6.649107	0.0000
BOARSIZE	0.007551	0.006284	1.201617	0.2304

Variable name	Regression coefficient	Standard error	T statistic	Probability value
INSSHAR	0.032906	0.044252	0.398681	0.6904
AGE	0.055762-	0.037393	0.880027	0.3795
C		0.158356	0.352134	0.7250
Coefficient of determination	0.520832	Durbin-Watson statistics	1.788065	Significance of the whole model
The adjusted COD	0.455279	Value of the F statistic	7.945106	0.000000

Table 13 shows that the value of the f statistic for the entire model is 0.000, and the value of the probability for the model as a whole is 7.94. The model's coefficient of determination is 0.52, which demonstrates that it provides a satisfactory fit to the data. The model is able to explain 45% of the variations in profitability, as indicated by the model's adjusted coefficient of determination, which is 0.45.

4.4. The fourth hypothesis test

The proportion of the consequence of the supplementary worth of human resources on the yield on assets was discovered to be 0.002, a positive value that signifies a direct correlation between the independent and dependent factors. This proposes that the supplementary worth proportion of human resources does not significantly influence the yield on assets. The fourth postulation of the investigation proposes that the supplementary worth proportion of human resources significantly and positively impacts profitability. The examination outcomes for this part indicated that the proportion of the consequence of the supplementary worth of human resources on the yield on equity is 0.025, a positive value giving a direct effect for an independent variable on the dependent variable. This implies that the supplementary worth proportion of human resources significantly and positively impacts the yield on equity.

5. Discussion

The findings of this study are consistent with the findings of previous research, such as those presented in [15], which investigated the relationships between a variety of factors, including return on assets, return on equity, employee productivity, and the percentage of market value to book value of each share. The findings of this study support the findings of [15]. The findings are also in line with those of [11], who investigated the relationship between financial performance and IC in Singapore-listed businesses [37]. [11]'s findings may be seen here.Additionally, it was shown that IC indicators can be used to explain the efficiency of firms, which is consistent with the fact that intellectual capital is responsible for the creation of value. The results of this investigation are consistent with those found in [38]. According to the results of the third test of the hypothesis, the influence of human capital on the profitability of businesses is both certain and substantial according to the statistics. To put it another way, when businesses invest more in their human capital, they see a rise in their overall profitability. This conclusion is in line with the findings of earlier research such as [15, 38], for example. The results of the fourth test of the hypothesis demonstrated that IC has a beneficial and statistically significant impact on the profitability of businesses. To put it another way, an increase in the amount of IC leads to an increase in the amount of profit that corporations make. This conclusion is in agreement with the findings of earlier research such as [11, 37], which also discovered that IC has an influence that is encouraging on the performance of corporations. This conclusion lends credence to the idea that IC is capable of producing value and calls attention to the significance of managing and making use of IC in businesses in an efficient manner. A positive and statistically significant association between an organization's human capital and its level of profitability has been found, according to the findings of the fourth test of the hypothesis. This finding is consistent with the findings of other studies, such as [39] and [29] in the Iranian insurance industry and financial markets, respectively, which discovered that human capital demonstrates a significant role in the profitability of organizations. The enhancements of IC on the profitability of companies listed on the Iraqi stock exchange can be done by internet of things (IoT), cloud computing, and e-government as future trends [40-44].

6. Conclusions and suggestions for future works

According to the results of the research, there is a robust and unmistakable connection between the IC of Iraqi listed firms and the profitability of those companies. This suggests that the Iraqi financial market has been able to revitalize its human resources through the establishment of newly minted enterprises and expand its sales network through the recruitment of newly appointed representatives. The expertise of an organization's workers can be utilized in a methodical fashion by more advanced businesses. This can be linked to the fact that the improvement of structural capital happens through factors such as product diversity or augmentation, both of

which require an appropriate skill base among the sales network and improved awareness of the benefits of the product among consumers and potential applications. A sales network that is highly skilled leads to a greater level of awareness among consumers, which in turn leads to the sale of a wider variety of products on the market. The findings of the research indicate, in general, that the IC of Iraqi listed businesses has grown increasingly essential as a result of the rise in the level of competitiveness between companies and the improvement in the level of investor awareness. The following is a list of proposals that are based on the findings of the investigation:

1. Companies establish dedicated units to measure and manage their IC in order to leverage this intangible asset and achieve higher financial returns.
2. The Iraqi Stock Exchange requires member companies to produce an annual IC report in order to provide information for the decisions of shareholders and investors.
3. Managers should properly manage intellectual capital. Accountants should take steps to measure and report on intellectual capital. Investors should select companies with stable values. Governments should identify and evaluate companies with high levels of intellectual capital.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

Funding information

No funding was received from any financial organization to conduct this research.

References

[1] O. H. Majeed, "The impacte of investing IC in the profitability of business organizations-applied research in Zain Iraq for Communications," *ENTERPRENEURSHIP JOURNAL FOR FINANCE AND BUSINESS*, vol. 3, no. 1, 2022.

[2] C. Fadur and M. Mironiuc, "Study on the perception of accounting professionals concerning intangible assets and intangible capital," *Theoretical and applied economics*, vol. 6, pp. 77–98, 2013.

[3] D. V. Ovechkin, G. F. Romashkina, and V. A. Davydenko, "The impact of IC on the profitability of Russian agricultural firms," *Agronomy*, vol. 11, no. 2, 2021.

[4] T. Andreeva and T. Garanina, "Do all elements of IC matter for organizational performance? Evidence from Russian context," *Journal of intellectual capital*, 2016.

[5] G. B. Kamath, "IC and corporate performance in Indian pharmaceutical industry," *Journal of intellectual capital*, 2008.

[6] M. Khalique and P. O. Pablos, "IC and performance of electrical and electronics SMEs in Malaysia," *International Journal of Learning and Intellectual Capital*, vol. 12, no. 3, pp. 251–269, 2015.

[7] J. Xu and B. Wang, "IC and financial performance of Chinese agricultural listed companies," *Custos e Agronegocio On Line*, vol. 15, no. 1, pp. 273–290, 2019.

[8] S. G. Yaseen, D. Dajani, and Y. Hasan, "The impact of IC on the competitive advantage: Applied study in Jordanian telecommunication companies," *Computers in Human Behavior*, 2016.

[9] J. Xu and J. Li, "The interrelationship between IC and firm performance: evidence from China's manufacturing sector," *Journal of intellectual capital*, 2020.

[10] J. Barney, "Firm resources and sustained competitive advantage," *J. Manage.*, vol. 17, no. 1, pp. 99–120, 1991.

[11] H. Pew Tan, D. Plowman, and P. Hancock, "Intellectual capital and financial returns of companies," *J. Intellect. Cap.*, vol. 8, no. 1, pp. 76–95, 2007.

[12] D. Maditinos, D. Chatzoudes, C. Tsairidis, and G. Theriou, "The impact of IC on firms' market value and financial performance," *Journal of intellectual capital*, 2011.

[13] S. A. Ghafouri Ibrahim and A. Ali, "Investigating the relationship between IC and financial performance based on the mediating role of knowledge sharing," *specialized scientific quarterly of new research approaches in management and Accounting Research Monthly*, pp. 1–14, 2019.

[14] J. F. Mohammadi Nodeh Fazel, "Investigating the effect of financial leverage on the profitability of companies listed on the Tehran Stock Exchange," *Research in Accounting and Economic Sciences*, vol. 3, no. 10, pp. 25–36, 2018.

[15] C. S. Cinca, C. M. Molinero, and J. G. Larraz, "Country and size effects in financial ratios: A European perspective," *Global Finance Journal*, vol. 16, no. 1, pp. 26–47, 2005.

[16] S. Feeny, *Determinants of profitability: an empirical investigation using Australian tax entities*. Melbourne Institute of Applied Economic and Social Research, 2000.
[17] M. Weiner and J. Bhagwati, "India in transition: Freeing the economy," *Foreign Aff.*, vol. 72, no. 5, p. 182, 1993.
[18] S. Bhoothalingam, *Reflections on an Era: Memoirs of a Civil Servant: Bhoothalingam Family*. Bhoothalingam Family, 2009.
[19] S. K. Majumdar, "The impact of size and age on firm-level performance: some evidence from India," *Review of industrial organization*, vol. 12, no. 2, pp. 231–241, 1997.
[20] P. Rietveld and Y. Schipper, *Explaining Employment Growth in Small Industrial Enterprises: Does Policy Matter? A Case Study for Central Java*. 1997.
[21] E. Menicucci, "The influence of firm characteristics on profitability: Evidence from Italian hospitality industry," *International Journal of Contemporary Hospitality Management*, vol. 30, no. 8, pp. 2845–2868, 2018.
[22] W. G. Shepherd, "On the core concepts of industrial economics," in *Mainstreams in industrial organization*, Springer, 1986, pp. 23–67.
[23] N. C. Hunt, M. B. Curtis, and J. M. Rixom, *Financial priming, psychological distance, and recognizing financial misreporting as an ethical issue: The role of financial reporting responsibility. Accounting, Organizations and Society*. 2022.
[24] D. Dobija, A. Hryckiewicz, M. Zaman, and K. Puławska, "Critical mass and voice: Board gender diversity and financial reporting quality," *Eur. Manag. J.*, vol. 40, no. 1, pp. 29–44, 2022.
[25] A. M. K. Afshar, "Investigating the effect of company characteristics on the quality of financial reporting," *Accounting Reviews*, vol. 1, no. 4, pp. 1–22, 2013.
[26] M. Clarke, D. Seng, and R. H. Whiting, "Intellectual capital and firm performance in Australia," *J. Intellect. Cap.*, vol. 12, no. 4, pp. 505–530, 2011.
[27] A. Pulic, *Intellectual capital-does it create or destroy value? Measuring business excellence*. 2004.
[28] B. A. G. Bani Mahd, "The relationship between intellectual capital, company size, profitability and capital structure in companies listed on the Tehran Stock Exchange," *Journal of Financial Knowledge of Securities Analysis*, vol. 4, no. 3, pp. 163–186, 2013.
[29] N. Asare, A. L. Alhassan, M. E. Asamoah, and M. Ntow-Gyamfi, "IC and profitability in an emerging insurance market," *Journal of Economic and Administrative Sciences*, 2017.
[30] S. P. Kothari, A. J. Leone, and C. E. Wasley, "Performance matched discretionary accrual measures," *J. Account. Econ.*, vol. 39, no. 1, pp. 163–197, 2005.
[31] K. A. Z. Taghizadeh, "The role of financial reporting quality in reducing the limiting effects of profit sharing on companies investment in the life cycle stages," *Accounting and Auditing Reviews*, vol. 22, no. 2, pp. 161–182, 2014.
[32] K. Qadri, S. Qadri, S. Qadri, and S. Qaderzadeh, "Examining the effect of liquidity on the profitability of companies using the bank test (case study of Iran Khodro Company)," *Scientific Research Quarterly of Management Accounting and Auditing Knowledge*, vol. 3, no. 9, pp. 111–113, 2013.
[33] J. Fitzsimmons, P. Steffens, and E. Douglas, "Growth and profitability in small and medium sized Australian firms," *SSRN Electron. J.*, 2005.
[34] R. U. Ahmed and M. I. Hossain, "Corporate Governance, Capital Structure and Profitability: A Study on the Banking Sector of Bangladesh," *Journal of Business*, vol. 40, no. 2, 2019.
[35] K. R. Mule, M. S. Mukras, and O. M. Nzioka, *Corporate size, profitability and market value: An econometric panel analysis of listed firms in Kenya*. 2015.
[36] A. R. A. A. Moradi Shahdadi Khosrow, "Explaining the role of IC in the liquidity of assets and the liquidity of company shares: Evidence from Tehran Stock Exchange," *Financial Engineering and Securities Management Quarterly*, vol. 10, no. 38, pp. 274–305, 2018.
[37] I. Noravesh and H. Zakeri, "Investigation of Income Smoothing Through Asset Sales," *Journal of Financial Accounting Research*, vol. 3, no. 2, pp. 51–62, 2011.
[38] M. J. Hashim, I. Osman, and S. M. Alhabshi, "Effect of IC on organizational performance," *Procedia-Social and Behavioral Sciences*, vol. 211, pp. 207–214, 2015.
[39] V. Mojtahedzadeh, T. Alavi, and M. Mehdizadeh, "The relationship between human intellectual capital, customer and structure and the performance of the insurance industry (from the point of view of managers)," *Accounting and Auditing Reviews*, vol. 17, no. 60, pp. 109–119, 2009.
[40] A. A H. Mohamad, Y. S. Mezaal, and S. F. Abdulkareem, "Computerized power transformer monitoring based on internet of things," *Int. J. Eng. Technol.*, vol. 7, no. 4, p. 2773, 2018.

[41] T. Abd, et al., “Iraqi e-government and cloud computing development based on unified citizen identification,” *Periodicals of Engineering and Natural Sciences*, vol. 7, no. 4, pp. 1776 - 1793, 2019.
[42] J. Q. Kadhim, I. A. Aljazaery, and H. T. S. ALRikabi, "Enhancement of online education in engineering college based on mobile wireless communication networks and IoT," International Journal of Emerging Technologies in Learning (Online), vol. 18, no. 1, p. 176, 2023.
[43] A. H. M. Alaidi, M. Roa’a, H. ALRikabi, I. A. Aljazaery, and S. H. Abbood, "Dark web illegal activities crawling and classifying using data mining techniques," iJIM, vol. 16, no. 10, p. 123, 2022.
[44] Y. S. Mezaal, L. N. Yousif, Z. J. Abdulkareem, H. A. Hussein, S. K. Khaleel, “Review about effects of IOT and Nano-technology techniques in the development of IONT in wireless systems,” International Journal of Engineering and Technology (UAE), vol. 7, no. 4, 2018.