The Impact of Intellectual Capital and Board Diversity on Financial Performance: Evidence from Jordanian Industrial Listed Companies

Almontaser Abdallah Mohammad Qadorah

College of Business, Amman Arab University, Amman, Jordan
Email: aqadorah@aau.edu.jo

Abstract

This research aims to examine the effect of intellectual capital (IC) and board diversity on the financial performance of Jordanian industrial listed firms. In this study, we utilize data from 28 firms listed in the Amman Stock Exchange for the years 2014-2023 to estimate IC and its parts using the MVAIC model. The results presented in this study indicate that overall IC has a significant positive relationship with firm financial performance, with CE and HC having the most significant positive effects, while SC has a positive but less significant impact. On the other hand, relational capital (RC) has no impact on financial performance. We also look at the moderating effect of board diversity in terms of gender, experience, professional background, and education. Our empirical analysis proves that gender diversity, professional background diversity and educational background supports the link between intellectual capital and firm value. However, experience diversity seems to have a slightly negative moderating influence on the relationship between intellectual capital and performance. These results extend the knowledge of IC and corporate governance in emerging markets and provide valuable information for managers and policymakers in Jordan and other similar economies about the role of IC management and board composition in improving the performance of firms.

Keywords: Intellectual capital, board diversity, financial performance, Jordanian industrial sector, emerging markets.

1. Introduction

Research also shows that in the contemporary business environment that is experiencing a whirl of technological developments and increasing competition at the global level, intangible assets help to create a solid foundation for organizational performance (Al-Smadi, 2020; Cabrilo et al., 2018; Xu and Li, 2019; Zhu et al., 2020; Zhang et al., 2021; Ali et al., 2022; Liu et al., 2022; Lehenchuk et al., 2023) Out of these ill-formed assets, structuring of intellectual capital (IC) has acquired strategic locus for firm performance and sustainable competitive superiority (Seetharaman et al., 2002; Edvinsson 1997). IC, which can be defined as the knowledge-based resources that are valuable, rare, inimitable, and organizationally embedded and can create value for the organization (Hall, 1992), includes HC, SC, and RC (Xu and Li, 2019; Xu et al., 2020;

Xu et al., 2021; Jin and Xu, 2022; Li et al., 2021; Zheng et al., 2022; Farooq and Ahmad, 2023; Javaid et al., 2023; Rana and Hossain, 2023).

The significance of IC is especially relevant in emerging economies where firms are in the process of moving from resource-based, traditional models to knowledge-based ones (Xu and Li, 2019; Xu and Wang, 2019). Jordan as a developing country with a relatively new industrial sector provides a suitable environment for investigating the role of IC on firm performance. The Jordanian industrial sector, which is one of the most important sectors in terms of contribution to the GDP and employment, has the twin tasks of increasing efficiency and promoting innovation to meet the competitive challenges of the global market (SDC, 2024).

At the same time, the importance of corporate governance in determining the performance of firms has attracted more attention from scholars and practitioners (Jiang, 2016). Board diversity as a component of corporate governance has been seen as being capable of improving decision making, better strategic direction and in the process contribute to better performance of the firm as pointed out by Thompson and Alleyne, 2023; Arora 2022. The characteristics of corporate boards such as gender, experience, professional and educational background can affect how firms manage their intellectual capital (Jackson et al., 2003; García-López et al., 2024).

While there is a burgeoning literature on IC and board diversity, some research questions are still unanswered regarding the relationship between the two and their effects on firm performance, especially in emerging economies. despite the fact that there is a vast literature on the link between IC and firm performance across different industries (Liu et al., 2022; Cisneros and Hernandez-Perlines, 2018; Xu and Wang, 2018; Xu and Liu, 2021; Çam and Özer, 2022; Skhvediani et al., 2023; Castro et al., 2021; Asare et al., 2022; Xu et al., 2022; Xu et al., 2023; Nguyen et al., 2023; Tiwari et al., 2023; Sharabati et al., 2010; Anghel et al., 2018; Ge and Xu, 2021; Zhang et al., 2021) the mediating effect of board diversity on the IC-performance link has not been explored to a great extent, particularly in non-western countries.

This study aims to address these gaps by investigating the impact of intellectual capital and board diversity on the financial performance of Jordanian industrial listed companies. Specifically, we seek to answer the following research questions:

1. How does intellectual capital and its components (human capital, structural capital, and relational capital) affect the financial performance of Jordanian industrial firms?

2. To what extent does board diversity moderate the relationship between intellectual capital and firm financial performance in the Jordanian industrial sector?

To address these questions, we draw on data from 28 industrial companies listed on the Amman Stock Exchange over the period 2014-2023, resulting in 280 firm-year observations. We employ the modified value-added intellectual coefficient (MVAIC) model (Xu and Li, 2019; Xu et al., 2021; Jin and Xu, 2022; Li et al., 2021; Zheng et al., 2022; Farooq and Ahmad, 2023; Javaid et al., 2023; Rana and Hossain, 2023) to measure IC and its components, and use multiple regression analysis to examine their impact on firm financial performance, as measured by return on assets (ROA). Furthermore, we investigate the moderating effects of board diversity, measured along dimensions of gender, experience, professional background, and educational

background, using Blau's index (Westphal and Zajac, 1995). This study contributes to the existing literature in several ways. First, it extends the research on IC and firm performance to the context of Jordanian industrial firms, providing insights into how IC operates in an emerging economy setting. Second, by examining the moderating role of board diversity, we shed light on the complex interplay between corporate governance mechanisms and intellectual capital in driving firm performance.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and develops our hypotheses. Section 3 describes our research methodology, including sample selection, variable measurement, and analytical approach. Section 4 presents the empirical results, while Section 5 discusses these findings and their implications. Finally, Section 6 concludes the paper, highlighting its contributions, limitations, and directions for future research.

2. Literature Review and Hypotheses Development

2.1 IC Definition and Classification

Intellectual Capital (IC) has emerged as a crucial strategic resource for organizations in the knowledge-based economy. Intellectual capital has been defined in various ways by different scholars. Edvinsson (1997) characterized it as knowledge that can be transformed into value. According to Seetharaman et al. (2002), IC represents the difference between a firm's market value and its book value. Hall (1992) conceptualized intellectual capital as a collection of intangible elements or factors that contribute to economic benefits.

The widely accepted structure of IC components comprises human capital (HC), structural capital (SC), and relational capital (RC) (Xu and Li, 2019; Xu et al., 2020; Xu et al., 2021; Jin and Xu, 2022; Li et al., 2021; Zheng et al., 2022; Farooq and Ahmad, 2023; Javaid et al., 2023; Rana and Hossain, 2023). Human capital (HC) involves the tacit knowledge, including knowledge, experience, and skills, ability, and attitude of employees that should serve an organization.(Lee and Kim, 2010) Structural Capital (SC) refers to tangible assets such as patents, licenses, trademarks, systems, and organizational culture (Roos et al., 1997; Wang and Chang, 2005). SC is thus considered as enabling capital that helps HC to operate efficiently (Mondal and Ghosh, 2012). Relational Capital (RC) is defined as business relationships with external stakeholders (Bontis et al., 2000) and includes both tacit and codified knowledge. Therefore, gaining knowledge on and managing IC in the Jordanian industrial companies may be strategic in the process of increasing competitiveness and achieving organic growth. The manufacturing sector in Jordan is one of the most important sectors in the country’s economy and therefore can greatly benefit from proper IC management.

2.2 The Relationship Between Intellectual Capital and Financial Performance

The relationship between intellectual capital and firm performance has been extensively debated over the past two decades, yielding diverse results. (Xu and Li, 2019; Li and Yu, 2018). Some of the previous research works have established positive correlation between IC and financial performance in different industries and countries.

For instance, Chen and Rahman (2023) established that IC, as estimated by VAIC model of Pulic (2000), has a significant and positive relationship with the financial performance of Chinese retail firms. In the same vein, Suherman et al. (2023) found that aggregated IC has a direct impact on the performance of state-owned enterprises. In the case of agricultural firms, which are somewhat like industrial firms in terms of tangible asset intensity, Xu and Wang (2019) established that IC has a positive impact on corporate financial performance in Chinese agricultural listed firms. However, the contribution of individual IC components to financial performance may not be equal. Xu and Wang (2019) and Jin and Xu (2022) revealed that among the IC components, only HC has a positive effect on the Chinese agricultural firms' financial performance, while SC and RC have no effect. On the other hand, Scafarto et al. (2016) highlighted the strong reliance of agribusiness on IC resources, where all the elements are critical.

In the industrial sector, Cisneros and Hernandez-Perlines (2018) argued that IC has a positive impact on organization performance in the Mexican manufacturing sector. Similarly, Xu and Wang (2018) found that IC investment significantly boosts firm profitability and productivity in the Korean manufacturing industry.

Based on these findings and considering the context of Jordanian industrial companies, we propose the following hypotheses:

Hypothesis 1 (H1). IC has a positive impact on firms' financial performance in the Jordanian industrial sector.

Hypothesis 1a (H1a). HC has a positive impact on firms' financial performance in the Jordanian industrial sector.

Hypothesis 1b (H1b). SC has a positive impact on firms' financial performance in the Jordanian industrial sector.

Hypothesis 1c (H1c). RC has a positive impact on firms' financial performance in the Jordanian industrial sector.

Hypothesis 1d (H1d). CE has a positive impact on firms' financial performance in the Jordanian industrial sector.

2.3 The Moderating Role of Board Diversity on Relationship Between IC and Financial Performance

Board diversity refers to the process of having people of different characteristics in a board of a specific company. This comprises of gender variations, experience, professionalism and education (Jackson et al., 2003). These differences can impact on the way a company functions, its investments, culture, decisions and resources.

There is no great debate that genders should be represented on boards. To elaborate Arora (2022) pointed out that the presence of more women on boards is useful for decision making as it involves other perspectives. Women are typically more planes and accumulate assets that make them sustainable in the future such as knowledge among its employees and advanced business

culture (Zheng and Wang, 2024). This may assist in increasing the efficiency of the company's financial statements (Mihail et al., 2021).

Since the board members can come from different professions, one can ensure that a blend of different business competencies and information is employed (Hong, 2024). This can result in more benefits such as improved discussion and more creativity (Erhardt et al., 2003).

Board diversification with respect to education is also useful. According to Volberda and Karali (2015), diverse background leads to variety of resources being brought into the company. , Webber and Donahue (2001) discovered that this could enable the company to manage its intellectual capital efficiently ,hence increasing its performance.

In the case of experience diversity, the impact is ambiguous. Huang et al. (2023) acknowledge that IC can introduce new ideas into the organization; at the same time, it may lead to conflicts concerning the ways of utilizing such assets.

Based on, we suggest the following hypotheses:

Hypothesis 2 (H2). Board diversity moderates the relationship between IC and firms' financial performance.

Hypothesis 2a (H2a). Gender diversity moderates the relationship between IC on firms' financial performance.

Hypothesis 2b (H2b). Professional background diversity moderates the relationship between IC and firms' financial performance.

Hypothesis 2c (H2c). Educational background diversity moderates the relationship between IC and firms' financial performance.

Hypothesis 2d (H2d). Experience diversity moderates the relationship between IC and firms' financial performance.

3. Methodology

3.1. Sample Selection

The population for this study comprises industrial companies that are listed on the Amman Stock Exchange (ASE) for the period 2014 to 2023. This period is chosen as it is a crucial period where Jordanian industrial companies have been investing on technology, productivity and market development, all of which are areas that need support from IC.

The sample includes all industrial firms that are listed on the ASE. The final sample is 28 companies with 280 firm-year observations after eliminating companies with missing data, delisted firms, and firms with special treatment status. These companies are some of the best industrial firms in Jordan and therefore can be used to generalize the industrial sector in the country.

The data for this study is obtained from the annual reports of the selected companies, accessible through ASE database. These reports are used to hand-collect financial and corporate governance data. All statistical analyses are conducted using Stata Version 17.

3.2. Variables

3.2.1. Dependent Variable

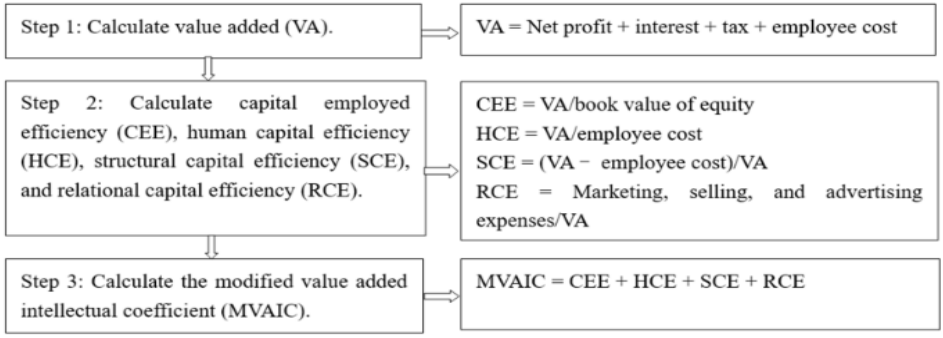
In line with prior studies (Xu and Li, 2019; Ali et al., 2022; Gupta et al., 2019; Anghel et al., 2018; Ge and Xu, 2021; Xu and Wang, 2019; Ivanovic et al., 2021; Jin and Xu, 2022; Zhang et al., 2021; Li et al., 2021; Muftiasa et al., 2023; Nguyen, 2023), this study employed return on assets (ROA) as a measure of financial performance.

3.2.2. Independent Variables

In order to measure IC, this study uses the MVAIC model which is commonly used in IC research (Xu and Li, 2019; Xu et al., 2021; Jin and Xu, 2022; Li et al., 2021; Zheng et al., 2022; Farooq and Ahmad, 2023; Javaid et al., 2023; Rana and Hossain, 2023; Al-Smadi and Al-Smadi, 2024), The MVAIC model as an extension of Pulic's VAIC model gives more exhaustive classification of IC. It is used because it provides a better explanation and prediction of corporate performance than the other models (Xu and Zhang, 2021).

The calculation process of the MVAIC model is as follows:

Figure 1: The Calculation Processes of IC



The MVAIC model categorizes enterprise resources into intangible capital and tangible capital. IC is sub-divided into Human Capital (HC), Structural Capital (SC), Relational Capital (RC) and Capital Employed (CE). The efficiency of each capital component is then determined, and the sum of these efficiencies combined with the efficiency of physical assets gives a measure of the value added by the enterprises through IC.

3.2.3. Moderators

Following Kang et al. (2021), we use board diversity in gender, experience, professional background, and educational background as measures of board diversity. These are measured using Blau's index (Westphal and Zajac, 1995):

$D = 1 - \sum P^2{}_i$ .... (1)

Where P is the proportion of individuals in a category and i is the number of categories. A value of 1 for D indicates perfect diversity, while 0 suggests perfect homogeneity.

Gender diversity (D1) is measured by assigning a value of 1 for female board members and 2 for male members, then applying Blau's index.

Experience diversity (D2) is measured based on whether board members serve in shareholder companies, assigning 1 if they do and 0 otherwise, then applying Blau's index.

Professional background diversity (D3) is measured by classifying board members' majors into five areas: economics or finance, management, accounting, law, and others, with values of 1, 2, 3, 4, and 5 respectively. A value of 6 is assigned for missing data.

Educational background diversity (D4) is measured based on board members' graduation institutions, following Bernile et al. (2018).

3.2.4. Control Variables

Based on previous literature (Xu and Li, 2019; Xu and Wang, 2018; Xu and Wang, 2019; Xu et al., 2020; Al-Smadi, 2020b; Xu and Zhang, 2021), we include the following control variables:

- Company scale (SIZE): Natural logarithm of total assets

- Debt ratio (LEV): Total liabilities divided by total assets

- Gross domestic product growth rate (GDP)

Additionally, a year dummy (Year) is included in the regression models to control for time effects.

Table 1: Variables definitions

Variable	Symbol	Measurement
Return on assets	ROA	Net profit/average total assets
Return on equity	ROE	Net profit/average shareholders' equity
Modified value-added intellectual coefficient	MVAIC	CEE + HCE + SCE + RCE
Capital employed efficiency	CEE	VA/book value of equity
Human capital efficiency	HCE	VA/employee cost
Structural capital efficiency	SCE	(VA - employee cost)/VA
Relational capital efficiency	RCE	Marketing, selling, and advertising expenses/VA
Gender diversity	D1	$D1 = 1 - \sum p^2{}_i$
Experience diversity	D2	$D2 = 1 - \sum p^2{}_i$
Professional background diversity	D3	$D3 = 1 - \sum p^2{}_i$
Educational background diversity	D4	$D4 = 1 - \sum p^2{}_i$
Company scale	SIZE	Natural logarithm of total assets

3.3. Models

To establish the relationship between IC and its components and firms' financial performance, we use multivariate regression analysis. The basic model is as follows:

$ROA_{it} = \beta_0 + \beta_1 IC\_COMPONENTS_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 GDP_{it} + \sum Year + \varepsilon_{it}$........(2)

To test the moderating effect of board diversity on the relationship between IC and its components and firms' financial performance, we use the following model:

$$ROA_{it} = \beta_0 + \beta_1 \, IC\_COMPONENTS_{it} + \beta_2 DIVERSITY_{it} + \beta_3 IC\_COMPONENTS_{it} \times DIVERSITY_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 GDP_{it} + \sum Year + \varepsilon_{it} \quad \text{...(3)}$$

Where:

- IC_COMPONENTS include MVAIC, HCE, SCE, RCE and CEE

- DIVERSITY includes D1, D2, D3, and D4

- i represents the firm

- t represents the year

- ε is the error term

Throughout our analysis, we use Stata software to perform statistical tests and regressions. This methodological approach allows us to rigorously examine the impact of IC and board diversity on the financial performance of Jordanian industrial listed companies, contributing to the literature on IC and corporate governance in emerging markets.

4. Results

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics of the variables. ROA ranges from -0.226 to 0.315 (mean = 0.042, SD = 0.086), indicating significant variation in asset return rates. MVAIC ranges from -7.921 to 18.762 (mean = 2.453), aligning with findings on IC differences in emerging markets (Xu and Li, 2019; Xu and Wang, 2019). Among IC components, HC (mean HCE = 1.428) produces more wealth than SC (mean SCE = 0.089) and RC (mean RCE = 0.698), consistent with similar contexts (Xu and Wang, 2019; Xu et al., 2020; Ivanovic et al., 2021; Xu and Zhang, 2021; Jin and Xu, 2022). The combined mean of HCE, SCE, and RCE (2.215) exceeds CEE (0.238), suggesting intangibles dominate tangibles in Jordanian industrial firms. RC shows the highest standard deviation (4.236), indicating potential for development. Board diversity moderators have minimum values of 0, with low mean values for gender (D1 = 0.182) and experience diversity (D2 = 0.231), suggesting room for improvement. The mean company size (SIZE = 17.825) reflects the smaller scale of Jordanian firms compared to developed markets. The mean leverage (LEV = 0.486) indicates moderate levels typical for emerging markets.

Table 2: Descriptive statistics

Variable	N	Mean	Maximum	Minimum	Standard Deviation
ROA	280	0.042	0.315	-0.226	0.086
MVAIC	280	2.453	18.762	-7.921	3.215
CEE	280	0.238	2.754	-0.682	0.386
HCE	280	1.428	6.915	-5.237	1.623
SCE	280	0.089	12.476	-18.934	3.875

RCE	280	0.698	38.542	-4.829	4.236
D1	280	0.182	0.500	0.000	0.145
D2	280	0.231	0.500	0.000	0.178
D3	280	0.387	0.812	0.000	0.213
D4	280	0.312	0.876	0.000	0.256
SIZE	280	17.825	22.143	15.276	1.453
LEV	280	0.486	0.912	0.078	0.224
GDP	280	0.023	0.035	-0.018	0.012

4.2. Correlation Analysis

Table 3 presents the correlation matrix. IC (MVAIC) shows a significant positive correlation with financial performance (ROA) ($r = 0.342$, $p < 0.01$), supporting the proposition that IC enhances financial performance in Jordanian industrial firms. ROA is positively correlated with HC ($r = 0.638$, $p < 0.01$) and SC ($r = 0.187$, $p < 0.05$), but not with RC. Professional background diversity (D3) is positively correlated with ROA ($r = 0.156$, $p < 0.05$), while gender diversity (D1) shows a weak positive correlation ($r = 0.103$, $p < 0.1$). Experience diversity (D2) and educational background diversity (D4) are not significantly correlated with ROA. All VIF values are below 3, indicating no serious multicollinearity issues.

Table 3: Correlation matrix and Variance Inflation Factor (VIF) values

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	VIF
(1) ROA	1.000													-
(2) MVAIC	0.342***	1.000												1.45
(3) CEE	0.275***	0.183***	1.000											1.32
(4) HCE	0.638***	0.421***	0.258***	1.000										2.14
(5) SCE	0.187**	-0.266***	0.019	0.076	1.000									1.78
(6) RCE	-0.039	0.631***	-0.021	-0.058	-0.850***	1.000								2.31
(7) D1	0.103*	-0.042	0.019	-0.007	0.171***	-0.141**	1.000							1.23
(8) D2	-0.085	-0.035	0.019	-0.071	-0.088	0.052	0.019	1.000						1.18
(9) D3	0.156**	-0.059	-0.065	0.122*	0.103	-0.138**	0.112	-0.065	1.000					1.56
(10) D4	0.062	-0.063	-0.036	0.049	0.096	-0.119*	0.240***	0.167***	0.662***	1.000				1.87
(11) SIZE	0.268***	0.096	0.089	0.211***	0.081	-0.056	0.031	-0.025	0.185***	0.367***	1.000			1.42
(12) LEV	-0.278***	-0.102	0.230***	-0.101	0.097	-0.116*	-0.101	0.058	-0.067	0.022	0.140**	1.000		1.35
(13) GDP	-0.057	0.076	-0.127**	0.016	-0.014	0.046	-0.040	0.023	0.020	-0.050	-0.035	0.020	1.000	1.09

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. VIF = Variance Inflation Factor.

4.3. Regression Results

Table 4 presents the regression analysis findings of IC and firm financial performance. In column (1), the coefficient of IC (MVAIC) on firm financial performance is 0.007 ($p < 0.01$), confirming that IC has a positive influence on a company's financial performance and validating H1. To

examine the moderating effect of board diversity on the relationship between IC and firm financial performance, we introduce gender diversity (D1), experience diversity (D2), professional background diversity (D3), and educational background diversity (D4) as moderating variables.

Table 4: Regression results (independent variable: MVAIC)

Variable	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Constant	-0.425*** (-3.85)	-0.388*** (-3.52)	-0.417*** (-3.79)	-0.363*** (-3.29)	-0.402*** (-3.64)
MVAIC	0.007*** -4.26	0.002 -0.95	0.014*** -4.68	0.001 -0.86	0.004** -2.41
D1		-0.136*** (-3.18)			
D2			0.008 -0.19		
D3				-0.011 (-0.41)	
D4					-0.034* (-1.68)
MVAIC × D1		0.038** -5.22			
MVAIC × D2			-0.021* (-1.95)		
MVAIC × D3				0.029*** -4.83	
MVAIC × D4					0.015** -2.39
SIZE	0.026*** -4.68	0.023*** -4.19	0.025*** -4.51	0.021*** -3.79	0.025*** -4.23
LEV	-0.156*** (-4.87)	-0.178*** (-5.62)	-0.139*** (-4.50)	-0.156*** (-5.20)	-0.169*** (-5.27)
GDP	-0.386 (-1.27)	-0.421 (-1.48)	-0.327 (-1.15)	-0.522* (-1.77)	-0.494 (-1.59)
Year	Included	Included	Included	Included	Included
N	280	280	280	280	280
Adj. R^2	0.2645	0.3299	0.2837	0.3245	0.2833
F	20.12***	19.58***	16.51***	19.07***	14.12***

Notes: * $p < 0.1$, ** $p < 0.1$, *** $p < 0.01$. t-values are in parentheses.

The regression results in columns (2) to (5) reveal varying effects of board diversity on the relationship between IC and firm financial performance. In column (2), the interaction MVAIC × D1 shows a coefficient of 0.038 ($p < 0.05$), suggesting that gender diversity enhances the promoting effect of IC on firm financial performance. Conversely, column (3) indicates that board members' experience diversity slightly inhibits this effect, with MVAIC × D2 having a coefficient of -0.021 ($p < 0.1$). Professional diversity, as shown in column (4), significantly enhances the positive effect of IC on firm financial performance, with MVAIC × D3 having a coefficient of 0.029 ($p < 0.01$). Lastly, column (5) demonstrates that educational background diversity also enhances this positive effect, with MVAIC × D4 showing a coefficient of 0.015 ($p < 0.05$). These regression results validate H2, concluding that board diversity plays a moderating role in shaping the relationship between IC and firm financial performance in Jordanian industrial companies. Tables 5, 6, 7 and 8 present the regression results for the individual components of IC (HC, SC, RC and CE respectively) and their interactions with board diversity measures.

Table 5: Regression results (independent variable: HCE)

Variable	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Constant	-0.278*** (-3.26)	-0.289*** (-3.34)	-0.287*** (-3.96)	-0.264*** (-3.00)	-0.357*** (-4.13)
HCE	0.038*** -17.3	0.042*** -8.89	0.060*** -15.95	0.035*** -5.15	0.048*** -12.21
D1		0.022 -0.65			
D2			0.095*** -3.52		
D3				0.003 -0.14	
D4					0.023 -1.23
HCE × D1		-0.011 (-0.90)			
HCE × D2			-0.086*** (-6.98)		
HCE × D3				0.004 -0.31	
HCE × D4					-0.023*** (-3.51)
SIZE	0.014*** -3.74	0.014*** -3.72	0.012*** -3.77	0.014*** -3.46	0.017*** -4.28
LEV	-0.128*** (-5.99)	-0.124*** (-5.67)	-0.089*** (-4.84)	-0.127*** (-5.88)	-0.110*** (-5.22)
GDP	-0.422** (-1.98)	-0.418** (-1.95)	-0.268 (-1.43)	-0.426** (-1.99)	-0.382* (-1.86)
Year	Included	Included	Included	Included	Included
N	280	280	280	280	280
Adj. R^2	0.6593	0.6579	0.7376	0.6573	0.6783
F	110.30***	76.62***	112.05***	76.37***	85.73***

Notes: * $p < 0.1$, ** $p < 0.1$, *** $p < 0.01$. t-values are in parentheses.

The results of multiple regression analysis between Human Capital (HC) and firm financial performance are presented in Table 5. In column (1), the coefficient of HCE on firm financial performance is 0.038, which is statistically significant at the 1% level ($p < 0.01$). This finding supports H1a and suggests that human resources have a positive impact on a company's financial performance in Jordanian industrial firms. Examining the findings in columns (2) to (5), we observe varied effects of board diversity on the HC-performance relationship. The interaction term HCE × D2 (experience diversity) shows a significant negative influence on firm financial performance ($\beta = -0.086$, $p < 0.01$), indicating that board members' diversity in experience may hinder the enhancing effect of HC. Similarly, the interaction term HCE × D4 (educational background diversity) also demonstrates a negative effect ($\beta = -0.023$, $p < 0.01$), suggesting that diversity in educational background might also impede the positive impact of HC on financial performance. However, no significant impact on firm financial performance is found for the interaction terms HCE × D1 (gender diversity) and HCE × D3 (professional diversity). This suggests that gender diversity and professional diversity do not significantly moderate the relationship between HC and firm financial performance in the context of Jordanian industrial companies. These results provide nuanced insights into how different aspects of board diversity interact with human capital to influence firm financial performance in the Jordanian industrial sector.

Table 6: Regression results (independent variable: SCE)

Variable	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Constant	-0.528*** (-4.05)	-0.529*** (-4.06)	-0.490*** (-3.85)	-0.510*** (-3.88)	-0.585*** (-4.26)
SCE	0.004** -2.04	0.005** -2.49	-0.001 (-0.68)	0.003 -1.46	0.004* -1.98
D1		-0.017 (-0.42)			
D2			-0.085*** (-2.57)		
D3				0.029 -1.08	
D4					-0.027 (-1.17)
SCE × D1		-0.01 (-1.24)			
SCE × D2			0.011 -1.24		
SCE × D3				-0.0001 (-0.03)	
SCE × D4					-0.001 (-0.29)
SIZE	0.030*** -5.01	0.030*** -5.07	0.029*** -4.99	0.029*** -4.64	0.034*** -5.13
LEV	-0.195*** (-5.35)	-0.198*** (-5.38)	-0.188*** (-5.23)	-0.190*** (-5.15)	-0.197*** (-5.40)
GDP	-0.249 (-0.69)	-0.215 (-0.60)	-0.216 (-0.61)	-0.256 (-0.70)	-0.243 (-0.67)
Year	Included	Included	Included	Included	Included
N	280	280	280	280	280
Adj. R^2	0.1729	0.176	0.2015	0.1705	0.1727
F	11.66***	8.61***	10.06***	8.32***	8.43***

Notes: * $p < 0.1$, ** $p < 0.1$, *** $p < 0.01$. t-values are in parentheses.

The results of multiple regression analysis presented in Table 6 illustrate the relationship between Structural Capital (SC) and firm financial performance in Jordanian industrial companies. In column (1), the coefficient of SCE on firm financial performance is 0.004, which is statistically significant at the 5% level ($p < 0.05$). This finding partially supports H1b, suggesting that structural capital has a positive, albeit weak, impact on a company's financial performance. The results in columns (2) to (5) provide insights into the moderating effects of board diversity on the SC-performance relationship. Interestingly, none of the interaction terms (SCE × D1, SCE × D2, SCE × D3, SCE × D4) show statistical significance at conventional levels. This indicates that board diversity, whether in terms of gender, experience, professional background, or educational background, does not significantly moderate the relationship between structural capital and firm financial performance in Jordanian industrial firms. The control variables consistently show significant effects across all models, with firm size (SIZE) positively influencing financial performance ($\beta \approx 0.03$, $p < 0.01$) and leverage (LEV) negatively affecting it ($\beta \approx -0.19$, $p < 0.01$). The GDP growth rate does not show a significant impact on firm performance in any of the models. These findings suggest that while structural capital has a marginal positive effect on firm performance in Jordanian industrial companies, this relationship is not significantly influenced by the diversity of the board of directors. This contrasts with the

results for human capital and highlights the complex nature of how different components of intellectual capital interact with corporate governance characteristics to affect firm performance.

Table 7: Regression results (independent variable: RCE)

Variable	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Constant	-0.532*** (-4.09)	-0.542*** (-4.14)	-0.501*** (-3.92)	-0.516*** (-3.91)	-0.590*** (-4.31)
RCE	-0.001 (-0.80)	-0.001 (-1.03)	0.003 -0.57	-0.001 (-0.61)	-0.001 (-1.02)
D1		-0.024 (-0.57)			
D2			-0.075** (-2.25)		
D3				0.028 -1.02	
D4					-0.029 (-1.22)
RCE × D1		0.018 -1.13			
RCE × D2			-0.011 (-0.72)		
RCE × D3				0.001 -0.09	
RCE × D4					0.007 -0.66
SIZE	0.030*** -5.05	0.031*** -5.14	0.030*** -5.03	0.029*** -4.68	0.034*** -5.18
LEV	-0.196*** (-5.37)	-0.197*** (-5.32)	-0.187*** (-5.19)	-0.191*** (-5.16)	-0.197*** (-5.37)
GDP	-0.227 (-0.63)	-0.22 (-0.61)	-0.209 (-0.60)	-0.239 (-0.66)	-0.231 (-0.64)
Year	Included	Included	Included	Included	Included
N	280	280	280	280	280
Adj. R^2	0.1733	0.1731	0.1961	0.1706	0.1745
F	11.70***	8.46***	9.74***	8.32***	8.53***

Notes: * $p < 0.1$, ** $p < 0.1$, *** $p < 0.01$. t-values are in parentheses.

The results of multiple regression analysis presented in Table 7 illustrate the relationship between Relational Capital (RC) and firm financial performance in Jordanian industrial companies. In column (1), the coefficient of RCE on firm financial performance is -0.001, but it fails to reach statistical significance. This finding does not support H1c, indicating that relational capital does not exert a significant influence on firm financial performance in the context of Jordanian industrial firms. Examining the results in columns (2) to (5), we observe that none of the interaction terms (RCE × D1, RCE × D2, RCE × D3, RCE × D4) demonstrate statistical significance at conventional levels. This suggests that board diversity, whether in terms of gender, experience, professional background, or educational background, does not play a moderating role in the relationship between relational capital and financial performance. The control variables maintain consistent effects across all models, with firm size (SIZE) showing a positive influence on financial performance ($\beta \approx 0.03$, $p < 0.01$) and leverage (LEV) demonstrating a negative effect ($\beta \approx -0.19$, $p < 0.01$). The GDP growth rate does not exhibit a significant impact on firm performance in any of the models. These findings indicate that, unlike human capital and structural capital, relational capital does not significantly contribute to financial performance in Jordanian industrial companies, and this lack of relationship is not

moderated by board diversity. This result highlights the varying impacts of different intellectual capital components on firm performance and underscores the importance of considering each component separately in the context of emerging markets like Jordan.

Table 8: Regression results (independent variable: CEE)

Variable	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Constant	-0.516***	-0.517***	-0.318***	-0.066	-0.224**
	(-4.27)	(-4.30)	(-3.75)	(-1.46)	(-2.31)
CEE	0.072***	0.146***	0.438***	0.019*	0.044***
	-5.9	-3.25	-12.36	-1.79	-3.28
D1		0.02			
		-0.45			
D2			0.115***		
			-3.96		
D3				-0.085***	
				(-4.54)	
D4					-0.116***
					(-5.32)
CEE × D1		0.235**			
		-1.71			
CEE × D2			-0.325**		
			(-10.63)		
CEE × D3				0.456***	
				-14.56	
CEE × D4					0.124
					-1.45
SIZE	0.028***	0.028***	0.015***	0.007***	0.016***
	-5.19	-5.18	-3.91	-2.46	-3.42
LEV	-0.241***	-0.242***	-0.154***	-0.193***	-0.245***
	(-7.03)	(-7.05)	(-5.81)	(-8.48)	(-8.60)
GDP	0.017	-0.032	-0.008	-0.065	-0.168
	-0.05	(-0.09)	(-0.03)	(-0.22)	(-0.50)
Year	Included	Included	Included	Included	Included
N	280	280	280	280	280
Adj. R^2	0.2952	0.3008	0.5884	0.6739	0.4988
F	23.40***	16.69***	53.90***	79.09***	37.10***

Notes: * $p < 0.1$, ** $p < 0.1$, *** $p < 0.01$. t-values are in parentheses.

The results of multiple regression analysis presented in Table 8 illustrate the relationship between Capital Employed (CE) and firm financial performance in Jordanian industrial companies. In column (1), the coefficient of CEE on firm financial performance is 0.072, which is statistically significant at the 1% level ($p < 0.01$). This finding strongly supports Hypothesis 1d (H1d), indicating that capital employed has a positive and significant impact on firms' financial performance in the Jordanian industrial sector. The positive coefficient suggests that for every unit increase in capital employed efficiency, there is a corresponding 0.072 unit increase in return on assets, holding other factors constant. Examining the results in columns (2) to (5), we observe varying moderating effects of board diversity on the CE-performance relationship. Gender diversity (CEE × D1) and professional background diversity (CEE × D3) enhance the positive effect of CE on financial performance, with coefficients of 0.235 ($p < 0.05$) and 0.456 ($p < 0.01$) respectively. Conversely, experience diversity (CEE × D2) shows a negative moderating effect (-0.325, $p < 0.05$), while educational background diversity (CEE × D4) does not demonstrate a statistically significant moderating effect. The control variables maintain consistent effects across all models, with firm size (SIZE) showing a positive influence on financial performance

($\beta \approx 0.028$, $p < 0.01$) and leverage (LEV) demonstrating a negative effect ($\beta \approx -0.241$, $p < 0.01$). The GDP growth rate does not exhibit a significant impact on firm performance in any of the models. These findings not only support H1d but also highlight the importance of capital employed in driving financial performance in Jordanian industrial firms. Furthermore, they underscore the complex interplay between capital employed, board diversity, and firm performance, suggesting that the impact of CE on financial performance can be moderated by certain aspects of board diversity.

5. Conclusions

The purpose of this research was to investigate the relationship between IC and its subdimensions and firm financial performance of the industrial listed firms in Jordan during 2014–2023. Furthermore, we explored the moderating effect of board diversity on the link between IC and firm financial performance. Thus, the results of the study contribute to the development of the IC and corporate governance literature in emerging markets, especially in the industrial sector.

The findings of this research indicate that the total IC, as captured by the MVAIC model, has a significant and positive relationship with the FFP of the Jordanian industrial companies. This result is consistent with prior studies in other settings (Al-Smadi and Malkawi, 2020; Xu and Li, 2019; Xu and Wang, 2019; Xu and Zhang, 2021; Jin and Xu, 2022) and highlights the significance of intangible assets in achieving organizational performance in emerging economies. In the case of IC components, we established that CE has the most significant positive effect on FFP, while HC also has a positive effect on FFP but with less intensity than CE, and SC has a positive effect on FFP but with less intensity than HC. On the other hand, relational capital (RC) was not found to have a significant impact on financial performance. These findings underscore the importance of capital employed, human resources and organizational structures in the value creation process of Jordanian industrial firms and indicate areas of customer and stakeholder management that may require further attention. The findings of our study on the moderating role of board diversity are as follows. The results of the study also showed that gender diversity, professional background diversity, and educational background diversity had a positive moderation effect on the relationship between IC and financial performance. This implies that diverse boards can increase the efficiency of the use of intellectual capital, possibly through better decision-making and more extensive strategic viewpoints (Arora, 2022; Mihail et al., 2021; Hong, 2024; Webber and Donahue, 2001). On the other hand, experience diversity had a slightly negative moderating effect on the IC-performance relationship. This could be an interesting discovery that may suggest some difficulties in relating various experiences to IC management in the Jordanian industrial setting and, therefore, requires further research.

The implications of these findings in Jordan and other emerging economies. First, they emphasize the importance of paying more attention to the creation and utilization of intellectual capital, especially capital employed, human capital, and structural capital as the critical sources of firm performance. Managers should invest in their employees' secondment and training, as well as organizational factors and procedures that might facilitate the effectiveness of IC.

Second, our findings underscore the role of board diversity in improving the relationship between IC and firm performance. It is recommended that companies should attempt to enhance the board diversity in terms of gender, professional experience, and education to enhance their capability to harness IC.

The implications of our study for policymakers are that they should support policies that foster investment in IC and increase board diversity in industrial firms. This could include tax credits for organizations that provide training and development for their employees and for those that encourage innovation, or rules or recommendations that encourage the diversification of boards.

This research adds to the existing literature by examining the relationship between IC and board diversity in the context of Jordanian industrial firms and the findings of this study offer understanding of how these factors work in an emerging economy context. However, it also has limitations which among them provides areas for further study. The study is confined to the listed industrial companies which may reduce the generalizability of the study to other sectors or unlisted firms. Further research could have employed this study in other sectors within Jordan or compare data with other emerging countries. Furthermore, our study relied on the quantitative proxies of IC and board diversity, and future research could employ the qualitative data to gain a better understanding of how IC and board diversity affect firm performance.

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