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DO BOARD GOVERNANCE MECHANISMS INFLUENCE THE INTELLECTUAL CAPITAL–PERFORMANCE RELATIONSHIP? EVIDENCE FROM AN EMERGING ECONOMY

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Asia Khatun[1], Raihan Sobhan[2], Shafera Siddique Aapan[3]
[1]University of Dhaka, Department of Accounting, Dhaka, Bangladesh.
asia.khatun@du.ac.bd, ORCID: 0000-0002-6055-0368
[2]University of Dhaka, Department of Accounting, Dhaka, Bangladesh.
raihan.ais@du.ac.bd, ORCID: 0000-0003-2015-8035
[3]University of Dhaka, Department of Accounting, Dhaka, Bangladesh.
shafera.aapan@gmail.com, ORCID: 0009-0000-3106-1234

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ABSTRACT

Purpose- This study examines the influence of intellectual capital (IC) on firm performance and the moderating role of board governance mechanisms in the context of Bangladesh, an emerging economy.

Methodology- Using panel data from 100 non-financial firms listed on the Dhaka Stock Exchange over 2018–2023, IC efficiency is measured through the Modified Value-Added Intellectual Capital (MVAIC) model, while firm performance is assessed using return on assets and Tobin's Q.

Findings- The findings demonstrate that IC efficiency positively and significantly enhances firm performance, with human capital, structural capital, and capital employed efficiency being key drivers. Moreover, board characteristics, particularly board size, independence, and meeting frequency, significantly strengthen the IC–performance relationship. Earnings per share (EPS) and the price–earnings (P/E) ratio are additionally employed as alternative measures of firm performance to verify the robustness of the observed relationship.

Conclusion- The results highlight the importance of effective board governance in maximizing the benefits of IC. For managers and policymakers in emerging economies, strengthening board mechanisms and governance practices can enhance firm performance by ensuring better utilization of intangible assets. This is one of the pioneer studies to investigate the moderating role of board governance mechanisms in the IC–performance nexus within an emerging economy like Bangladesh. By employing the MVAIC model, it offers novel evidence on how board attributes shape the effectiveness of IC in an emerging economy context.

Keywords: Intellectual capital, firm performance, board characteristics, emerging economy, modified value added intellectual capital
JEL Codes: G34, L25, O34

1. INTRODUCTION

Global business is growing very fast, fueled by advances in technology, science and intense international rivalry (Soewarno & Tjahjadi, 2020). To have some comparative advantage, firms need to formulate unique strategic planning including their internal and external resources. Combination of tangible and intangible resources will make a firm more eligible for strategic advantage (Ruta, 2009). In resource based theory, it is observed that there is a link between intangible resources and corporate performance. Even, proper management of intangible asset like intellectual capital (IC) facilitates the increase in corporate performance (Soewarno & Tjahjadi, 2020; Tan et al., 2008; Vo & Tran, 2021).

IC is not recorded in conventional financial statements, as it lacks a physical or monetary form. Nevertheless, it encompasses key organizational capabilities such as human capital, internal systems, innovation, and external relational assets (Vo & Tran, 2021). A growing body of literature has attempted to evaluate the relationship between IC and firm performance, but the results remain inconclusive. While several studies report a positive and significant association (Demartini & Beretta, 2020; Mondal & Ghosh, 2012; Smriti & Das, 2018; Vo & Tran, 2021; Wang et al., 2021), others find a negative (Ting et al., 2020) or insignificant relationship (Bala et al., 2024; Shah et al., 2024). The inconsistency in these findings may be attributable to differences in IC measurement models and the economic contexts in which the studies were conducted (Nadeem et al., 2017).

To address these gaps, the present study adopts the Modified Value Added Intellectual Capital (MVAIC) model, an enhanced version of the traditional VAIC, to more comprehensively assess the efficiency of IC. To measure firm performance, two widely

accepted indicators are used: Return on Assets (ROA), which captures internal operational efficiency, and Tobin's Q, which reflects market valuation and investor expectations, including intangible value. This dual approach allows for a more robust and multidimensional understanding of performance.

This research is situated in the context of Bangladesh, a developing South Asian economy where the role and effectiveness of intangible assets, particularly IC, remain underexplored. Existing empirical studies on IC efficiency in Bangladesh are largely limited to the banking sector and primarily rely on traditional VAIC models (Faruq *et al.*, 2023; Majumder *et al.*, 2023; Mollah and Rouf, 2022; Nabi *et al.*, 2020;). Notably, Faruq *et al.* (2023) is one of the few exceptions that incorporates a modified measurement approach. In contrast, this study focuses on the manufacturing sector, which represents a significant and growing segment of Bangladesh's economy. By examining 100 publicly listed non-financial firms on the Dhaka Stock Exchange (DSE) over the period 2018 to 2023, this research seeks to fill a critical gap in the literature.

The first objective of this study is to investigate the association between IC efficiency, as measured by MVAIC, and firm performance. The second objective is to explore the moderating role of board characteristics in this relationship. Board characteristics including board size, independence, gender diversity, and meeting frequency serve as key governance mechanisms that may influence how effectively IC is managed and utilized (Bharathi Kamath, 2019; Rositha *et al.*, 2019). Therefore, the study seeks to answer the following research questions:

RQ1: Is there any relationship between MVAIC and firm performance?

RQ2: Does the board characteristics moderate the relationship between MVAIC and firm performance?

To test the proposed hypotheses, the study employs a random effects panel regression model using firm-year observations from 2018 to 2023. The results reveal that MVAIC has a significant positive relationship with firm performance. Component-wise analysis indicates that human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE) are positively associated with profitability, whereas relational capital efficiency (RCE) shows no significant effect. Furthermore, board characteristics like specifically board size, board independence, and board performance are found to significantly moderate the IC–performance relationship, underscoring the role of governance in enhancing the value derived from intangible assets.

The contribution of this study is threefold. First, it extends the literature on IC by shifting the focus beyond the commonly examined financial sector and applying the MVAIC model to the manufacturing sector of Bangladesh, an area that has received limited empirical attention. This broader sectoral coverage enriches our understanding of IC efficiency across diverse industries in an emerging market context. Second, the study provides disaggregated insights into the impact of individual components of IC namely HCE, SCE, RCE, and CEE on firm performance. Third, and most importantly, this study is among the pioneering empirical investigations to examine the moderating role of board characteristics (board size, independence, gender diversity, and board activity) in the relationship between IC and firm performance in a developing country context. While prior studies have largely focused on the direct effects of IC or board attributes, few have integrated governance mechanisms as moderators in the IC–performance nexus. By doing so, this study fills a critical gap in the literature and highlights the strategic importance of effective board governance in enhancing the value-generating potential of IC. These contributions not only advance theoretical understanding of how IC and governance interact to influence firm outcomes but also offer practical insights for corporate managers, boards, and policymakers aiming to improve firm performance through better IC management and governance alignment.

The remainder of the study is organized as follows: Section 2 and 3 explain the theoretical framework and previous literature with hypotheses. Section 4 demonstrates the research method of the study by discussing the sample, variables and models. Results of descriptive statistics, correlation and regression are discussed in section 5. Section 6 provides the detailed discussion of the findings. Lastly, section 7 draws the conclusion of the study by discussing the implications, limitations and areas of future research.

2. THEORETICAL FRAMEWORK

This study is grounded in the Resource-Based View (RBV) of the firm, a strategic management theory that emphasizes the role of internal resources and capabilities in achieving and sustaining competitive advantage. The RBV posits that not all resources contribute equally to competitive advantage; only those that are valuable, rare, inimitable, and non-substitutable (collectively referred to as the VRIN criteria) can lead to superior firm performance (Barney, 1991; Wernerfelt, 1984). According to this perspective, a firm's performance is not solely determined by external market conditions but is also shaped by its ability to strategically acquire, develop, and deploy internal resources (Ting et al., 2020). In the context of modern knowledge-driven economies, IC has emerged as one of the most critical intangible assets of a firm. Unlike tangible assets such as land, machinery, or physical inventory, IC is embedded in employees' expertise, organizational routines, internal processes, innovation capabilities, and external stakeholder relationships. Although IC is not directly reported on financial

statements, its strategic importance lies in its capacity to create, sustain, and transfer knowledge throughout the organization, ultimately enhancing value creation (Soewarno & Tjahjadi, 2020).

The RBV provides a compelling justification for why IC should be central to strategic management. As an intangible asset, IC fulfills all four VRIN attributes. It is valuable because it enables firms to improve efficiency and innovation; it is often rare, especially in firms with specialized knowledge or unique organizational cultures; it is difficult to imitate, due to its embeddedness in social and organizational contexts; and it is non-substitutable, as knowledge-based competencies cannot be easily replaced with other types of resources (Barney, 1991). Therefore, firms that can effectively manage and leverage their IC are more likely to achieve sustained competitive advantage and superior performance outcomes.

Furthermore, the effective utilization of IC requires not only its presence but also strategic alignment and managerial capability to harness its full potential. This is where the role of governance mechanisms, particularly the board of directors, becomes crucial. Boards are responsible for overseeing the strategic direction of the firm and ensuring that resources, including IC, are aligned with organizational goals. Prior studies suggest that board characteristics such as size, independence, gender diversity, and meeting frequency can influence how effectively IC is managed and integrated into strategic decision-making (Kamath, 2019; Rositha et al., 2019). Thus, the RBV framework supports the argument that the impact of IC on firm performance is not only direct but also contingent upon the quality and effectiveness of the governance structures that support it.

3. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

3.1. Intellectual Capital

IC and its composition have a different meaning towards the academician. IC is an intangible asset which increases the value of a firm and not reported in the financial report directly (Mondal & Ghosh, 2012; Xu & Liu, 2020). IC is one of the factors for production in a knowledge-based society, giving competitive advantages to the firms and enable them to increase profit from that facilities (Ozkan et al., 2017).

Although IC is classified differently by many researchers, IC is mainly the combination of human capital (HC), structural capital (SC) and relational capital (RC) (Stewart, 1997; Sveiby, 1997). Employees' education, proficiency, knowledge, intelligence and skills are the component of HC (Shahzad et al., 2023). SC denotes the internal capabilities of an organization which involves the corporate systems, procedures, innovation and structures (Vo & Tran, 2021). RC represents the collective value and insights gained through a company's external relationships, which are crucial for its strategic positioning and competitive advantage (Xu & Li, 2022). The measurement of IC has many methods and value added intellectual capital (VAIC) is extensively used in academia which measures the firm efficiency combining capital employed efficiency (CEE), HC efficiency (HCE) and SC efficiency (SCE) (Xu & Li, 2022). Thus, VAIC takes input from physical capital, HC and SC.

3.2. Intellectual Capital and Firm Performance

Sustainable firm performance is dependent on intangible assets or IC and more importantly, modern economy keeps aside the physical assets for their competitive advantage (Mondal & Ghosh, 2012). IC influences the firm performance positively and creates firm value in long term. Smriti and Das (2018) showed a positive association between VAIC and firm performance of India. They added that HC has more impact on firm productivity while SCE and CEE both act as an equal contributor for growth in sales and market value. Mondal and Ghosh (2012) claimed relationship between the elements of VAIC and performance was changing over the time and SCE was less important for banks' profitability than HCE. Vo and Tran (2021) stated that IC increased the wealth of banking sector in Vietnam over the time. They added HCE and CEE both have the positive and significant impact on profitability while the effect of SCE is undetermined with the performance level of bank. As a mean of increasing the future value of a firm, three components of IC namely HC, SC and RC are directly associated with the innovation quality and speed of firm and consequently increases the financial and operational efficiency of that firm (Wang et al., 2021). Even, the corporate performance, knowledge management and core capabilities of small and medium enterprises (SME's) are influenced by IC (Demartini & Beretta, 2020). However, in 2020, Ting *et al.* (2020) found a negative impact of CEE with the profitability of a firm. Authors added that HCE and changes in level of IC efficiency positively affected the firm sales growth and efficacy. Consistency in all measurement method of IC is not found over the year. Soewarno and Tjahjadi (2020) felt there is a need for improvement in the measurement of IC. They found positive impact of IC on firms' profitability using VAIC and adjusted VAIC but not all elements in two methods are equally related with the performance of firm. Moreover, VAIC is positively influenced the profitability of firm but in element wise discussion, only HCE has an positive impact on performance not the CEE and SCE (Shah et al., 2024). However, Bala *et al.* (2024) claimed no significant relationship with the modified VAIC and firm profitability. Based on the above argument, following hypothesis is formed.

H_{1a}: MVAIC has a positive association with firm performance.

H_{1b}: CEE has a positive association with firm performance.

H_{1c}: HCE has a positive association with firm performance.

H_{1d}: SCE has a positive association with firm performance.

H_{1e}: RCE has a positive association with firm performance.

3.3. Moderating Effect of Board Characteristics

The main responsibility of the board of directors (BOD) is to oversee the management, keeping them focused and accountable to the stakeholders (Kamath, 2019). Activities of BOD has a direct impact on the management of IC and the high quality of BOD enhances the efficiency of IC in a firm (Rositha et al., 2019). Rositha *et al.* (2019) found a positive relationship between the board characteristics (namely size of the board, board independence, board gender diversity and frequency of board meeting) and IC. Kamath, (2019) explained a significant association between the board characteristics and IC efficiency. Author added board size and frequency of meeting has a negative relationship with IC while independence of has a positive impact on IC. However, Al-Musalli and Ismail (2012) stated a insignificant association between board size and IC while, board independence showed a significant association. Frequncy of board meeting and independence has a positive influence on IC disclosure ensure the effectiveness of corporate governance of a firm (Mubaraq & Ahmed Haji, 2014) and authors showed a positive association among them.

IC efficiency is lower in family firm (FFs) than non family firm (NFFs) and the relationship between the board characteristics (namely board size, board indepence and board gender diversity) and IC performance is opposite in FFs and NFFs firms (Scafarto et al., 2021). Moreover, Ebrahim *et al.* (2021) showed a significant association between the size of board and IC performance and they added board independence and size of the board are significantly correlated with IC efficiency. However, Adebayo *et al.* (2021) claimed that board characteristics and IC are negatively related and they took board size, board independence, and frequency of board meeting as board characteristics attributes. Smilarly Farooq and Ahmad (2023) claimed a negative relationship of IC performance with board independence and board gender diversity.

Effective board characteristics may helpful to increase the operational and financial efficiency of a firm. However, previous study showed positive and negative association between board characteristics and firm performance. Board size is the most significant for facilitating the firm performance as opinions, wisdom and versitality of larger board is positively impact on firm performance (Shah et al., 2024). Among the different board charectaristics, board independence is positively (Okon Akpan, 2014) and board gender diversity is negatively related with the firm performance (Farooq & Ahmad, 2023). Okon Akpan (2014) also found a negative relationship between board gender diversity and firm performance. Author added that inclusion of female in the board is a window dressing as their percentage in number is very low. Pavić Kramarić *et al.* (2018) claimed that board size and board gender diversity are inversely related with the firm performance. However, Kanakriyah (2021) showed a direct association between board characteristics (board size, board independence, board gender diversity and board performance) and corporate performance.

Based on the above discussion, following hypotheses are formulated.
H_2: Board characteristics modarates the relationship between IC and firm performance.
H_{2a} : Board size modarates the relationship between IC and firm performance.
H_{2b}: Board independence modarates the relationship between IC and firm performance.
H_{2c}: Board gender diversity modarates the relationship between IC and firm performance.
H_{2d}: Board performance modarates the relationship between IC and firm performance.

4. RESEARCH DESIGN

4.1. Sample and Data

For the purpose of the study, top 100 firms listed in Dhaka Stock Exchange (DSE) have been selected. From the 217 manufacturing companies listed on the DSE, firms were chosen based on their market capitalization, representing more than two-thirds of the total market value of the manufacturing sector on the DSE. The samples have been taken for the years 2018-2023 resulting in an initial sample size of 600 firm-years. However, due to the unavailability of some data, the final sample size has been narrowed down to 588 firm-years. The selection of 2018 as the starting year is justified by the introduction of the revised Corporate Governance Code during that period. Data for the study were manually extracted from companies' annual reports. Financial institutions were excluded due to their distinct governance frameworks and regulatory compliance requirements. Table 1 presents the distribution of the sample across industries, indicating that the engineering sector comprises the largest portion (20%), followed by the textile sector (17%).

Table 1: Sample Design by Industry

Industry	Sample Firms	% of Total Sample
Cement	6	6%
Ceramics	5	5%
Engineering	20	20%
Food & Allied	11	11%
Fuel & Power	10	10%
Paper & Printing	3	3%
Pharmaceuticals & Chemicals	16	16%
Tannery	4	4%
Textile	17	17%
Miscellaneous	8	8%
Total	100	100%

4.2. Definition of Variables

Dependent Variable- The dependent variable of the study, firm performance, is measured using both accounting-based and market-based indicators to ensure robustness and comprehensiveness. Return on Assets (ROA) is used as the primary accounting-based measure which is calculated as the ratio of profit before tax to total assets. This metric captures the internal operational efficiency of a firm in generating earnings from its asset base. Tobin's Q (TQ), on the other hand, represents the market-based measure of performance and is computed as the sum of the market value of equity and the book value of debt divided by total assets. This ratio reflects investor perceptions of a firm's future growth potential relative to its assets.

Independent Variable- The study employs the MVAIC model to quantify a firm's intellectual capital efficiency. The construction of MVAIC follows a structured three-step approach. In the first step, Value Added (VA) is calculated as the difference between a firm's total revenue (OUT) and its total operating expenses (IN), which include employee-related expenditures. This is expressed as:

$$VA = OUT - IN \quad (1)$$

In the second step, the Intellectual Capital Efficiency (ICE) is determined by aggregating three components: Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Relational Capital Efficiency (RCE). Specifically, HCE captures the value generated per unit of investment in human resources and is calculated as VA divided by total employee compensation (HC). SCE reflects the proportion of value added attributable to structural capital, measured as the difference between VA and HC divided by VA. RCE assesses the value created per unit of investment in external relational capital, proxied by marketing, selling, and advertising expenses (RC). The component formulas are as follows:

$$HCE = VA / HC \quad (2)$$

$$SCE = (VA - HC) / VA \quad (3)$$

$$RCE = RC / VA \quad (4)$$

Thus, ICE is defined as the sum of these three components:

$$ICE = HCE + SCE + RCE \quad (5)$$

In the final step, Capital Employed Efficiency (CEE) is computed to capture the efficiency of physical and financial capital. CEE is measured by dividing VA by capital employed (CE), where CE represents the difference between total assets and total equity:

$$CEE = VA / CE \quad (6)$$

Combining the ICE and CEE components yields the final MVAIC measure, which represents the overall efficiency of value creation through both intellectual and physical capital. Formally, it is expressed as:

$$MVAIC = HCE + SCE + RCE + CEE \quad (7)$$

A higher MVAIC value indicates greater effectiveness in utilizing intellectual and physical resources to generate corporate value, thereby reflecting superior organizational efficiency in managing intangible assets.

Moderating Variables- To explore the moderating effect of board, four board-related characteristics are incorporated into the analysis as moderating variables. Board Size (BSIZE) is measured as the total number of board members, based on the

notion that larger boards may provide broader expertise and better oversight. Board Independence (BIND) is defined as the proportion of independent directors to the total number of board members, reflecting the board's ability to monitor management objectively. Board Gender Diversity (BGD), representing diversity and inclusiveness in board composition, is measured as the ratio of female directors to total board members. Board Performance (BPERFORM), proxied by the frequency of board meetings held during the year, serves as an indicator of board diligence and engagement in the strategic affairs of the firm.

Control Variables- In addition to the key variables, a number of control variables are included to account for firm-specific and governance-related factors that may influence performance outcomes. Audit Committee Size (ACSIZE) is measured by the number of members in the audit committee, which is expected to strengthen financial oversight. Audit Quality (BIG4) is represented as a dummy variable, coded 1 if the firm is audited by one of the Big Four audit firms, and 0 otherwise, reflecting the credibility and reliability of financial reporting. Leverage (LEV), calculated as the ratio of total liabilities to total assets, captures the firm's financial risk, while Liquidity (LIQ), defined as the ratio of current assets to current liabilities, reflects short-term financial solvency. Firm Size (FSIZE), measured as the natural logarithm of total assets, serves as a proxy for the firm's scale and resource capacity. Finally, Firm Age (FAGE) is calculated as the natural logarithm of the number of years since the firm's establishment, indicating the maturity and experience level of the organization. Table 2 shows the definition of variables used in the study.

Table 2: Definition of Variables

Variable Name	Symbol	Measurement	References
Panel A: Dependent Variable			
Return on Asset	ROA	Ratio of Profit Before Tax to Total Assets	(Nadeem *et al.*, 2017; Smriti and Das, 2018; Xu and Liu, 2020)
Tobin's Q	TQ	(Market Value of Equity + Book Value of Debt) / Total Assets	(Sobhan *et al.*, 2025; Wu and Li, 2023)
Panel B: Independent Variable			
Modified Value-Added Intellectual Capital	MVAIC	CEE + HCE + SCE + RCE	(Faruq *et al.*, 2023; Ulum *et al.*, 2014; Vishnu and Gupta, 2014; Xu and Liu, 2020)
Capital Employed Efficiency	CEE	VA / CE, where CE is the difference between total asset and total equity	
Human capital efficiency	HCE	VA / HC, where HC is total salaries and wages of employees	
Structural capital efficiency	SCE	(VA - HC) /VA	
Relational capital efficiency	RCE	RC / VA, where RC is total marketing, selling and advertising expense	
Panel C: Moderating Variables			
Board size	SIZE	Number of Members in a Board	(Farooq and Ahmad, 2023; Kamath, 2019; Rositha *et al.*, 2019)
Board independence	IND	Ratio of Independent Directors to Board Size	(Farooq and Ahmad, 2023; Kamath, 2019; Rositha *et al.*, 2019)
Gender diversity	GD	Ratio of Female Directors to Board Size	(Farooq and Ahmad, 2023; Kamath, 2019; Rositha *et al.*, 2019)
Board performance	BPER	Number of Board Meetings Held During a Year	(Mubaraq and Ahmed Haji, 2014)
Panel D: Control Variables			
Audit Committee Size	ACSIZE	Number of Members in an Audit Committee	(Li *et al.*, 2012)
Audit Quality	BIG4	A Dummy Variable with an Assigned Value of 1 if a Big 4 Audit Firm audits the Client; otherwise, 0.	(Li *et al.*, 2012)
Leverage	LEV	Ratio of Total Liabilities to Total Assets	(Vo and Tran, 2021; Xu and Liu, 2020)

Liquidity	LIQ	Ratio of Current Assets to Current Liabilities	(Chatterjee *et al.*, 2022; Whiting and Woodcock, 2011)
Firm size	FSIZE	Natural logarithm of total assets	(Vo and Tran, 2021; Xu and Liu, 2020)
Firm Age	FAGE	Natural Logarithm of Number of Years Elapsed since Establishment	(Chatterjee *et al.*, 2022; Whiting and Woodcock, 2011)

4.3. Research Model

To investigate the moderating effect of board characteristics on association between IC and firm performance, the following regression models have been developed:

$$ROA_{it} = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 BSIZE_{it} + \beta_3 MVAIC_{it} \times BSIZE_{it} + \beta_4 BIND_{it} + \beta_5 MVAIC_{it} \times BIND_{it} + \beta_6 BGD_{it} + \beta_7 MVAIC_{it} \times BGD_{it} + \beta_8 BPERFORM_{it} + \beta_9 MVAIC_{it} \times BPERFORM_{it} + \beta_{10} ACSIZE_{it} + \beta_{11} BIG4_{it} + \beta_{12} LEV_{it} + \beta_{13} LIQ_{it} + \beta_{14} FSIZE_{it} + \beta_{15} FAGE_{it} + \varepsilon_{it} \quad (8)$$

$$TQ_{it} = \beta_0 + \beta_1 MVAIC_{it} + \beta_2 BSIZE_{it} + \beta_3 MVAIC_{it} \times BSIZE_{it} + \beta_4 BIND_{it} + \beta_5 MVAIC_{it} \times BIND_{it} + \beta_6 BGD_{it} + \beta_7 MVAIC_{it} \times BGD_{it} + \beta_8 BPERFORM_{it} + \beta_9 MVAIC_{it} \times BPERFORM_{it} + \beta_{10} ACSIZE_{it} + \beta_{11} BIG4_{it} + \beta_{12} LEV_{it} + \beta_{13} LIQ_{it} + \beta_{14} FSIZE_{it} + \beta_{15} FAGE_{it} + \varepsilon_{it} \quad (9)$$

5. FINDINGS AND DISCUSSION

5.1. Descriptive Statistics

Table 3 presents the descriptive statistics for the variables used in the study, based on a sample of 588 observations. The dependent variables include ROA with a mean of 0.04 and a standard deviation of 0.08, ranging from -0.29 to 0.53, indicating variability in firm profitability. TQ has a mean of 11.82 and a standard deviation of 18.83, with a range from 0.31 to 131.09, reflecting diverse market valuations. The independent variable, MVAIC, has a mean of 269.59 and a standard deviation of 49.65, ranging from -105.82 to 487.42, suggesting significant variation in IC efficiency. Moderating variables include BSIZE with a mean of 7.62 members, BIND with a mean ratio of 0.26, BGD with a mean ratio of 0.17, and BPERFORM with a mean of 8.40 meetings per year. Control variables include ACSIZE with a mean of 3.81 members, BIG4 with 30% of firms audited by Big 4 firms, LEV with a mean of 0.49, LIQ with a mean of 3.45, FSIZE with a mean of 119.41 million USD, and FAGE with a mean of almost 36 years.

Table 3: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
ROA	588	0.04	0.08	-0.29	0.53
TQ	588	11.82	18.83	0.31	131.09
MVAIC	588	269.59	49.65	-105.82	487.42
BSIZE	588	7.62	2.42	5.00	18.00
BIND	588	0.26	0.09	0.20	0.67
BGD	588	0.17	0.15	0.00	0.60
BPERFORM	588	8.40	4.85	2.00	41.00
ACSIZE	588	3.81	0.78	3.00	7.00
BIG4	588	0.30	0.46	0.00	1.00
LEV	588	0.49	0.23	0.01	1.00
LIQ	588	3.45	13.99	0.06	319.55
FSIZE (in million USD)	588	119.41	341.60	1.06	4459.84
FAGE	588	35.31633	17.00642	12	114

5.2. Bivariate Analysis

Table 4 presents the Pearson correlation coefficients among the study's variables. The dependent variables, ROA and TQ, show a significant positive correlation (0.206), suggesting that higher profitability is associated with higher market valuations. MVAIC is positively correlated with ROA (0.156) but not significantly with TQ, indicating a stronger relationship with accounting-based performance. BSIZE is significantly correlated with ROA (0.087), TQ (0.174), and BIND (0.232), suggesting larger boards may influence performance and governance structures. BIND shows no significant correlation with ROA or TQ but is positively correlated with ACSIZE (0.093). BGD is negatively correlated with BSIZE (-0.110) and LEV (-0.105). BPERFORM is positively correlated with TQ (0.108) and LEV (0.151). Since none of the correlation coefficients exceed the threshold of 0.80, there is no evidence of severe multicollinearity among the independent variables (Gujarati, 2003). Additionally, the average Variance Inflation Factor (VIF) was found to be 1.89 (not tabulated), which is well below the commonly accepted cut-off value of 10 (Wooldridge, 2016), further confirming that multicollinearity is not a concern in this study.

Table 4: Pearson Correlation Matrix

	roa	tq	mvaic	bsize	bind	bgd	bperform	acsize	big4	lev	liq	fsize	fage
roa	1												
tq	0.206**	1											
mvaic	0.156**	0.016	1										
bsize	0.087*	0.174**	-0.004	1									
bind	0.011	0.050	-0.029	0.232**	1								
bgd	-0.035	0.024	0.080	-0.110**	-0.055	1							
bperform	0.044	0.108**	0.037	0.156**	0.003	-0.070	1						
acsize	0.245**	0.230**	0.046	0.137**	0.093**	-0.228**	0.037	1					
big4	0.205**	0.213**	0.145**	0.206**	0.115*	-0.059	0.009	0.125**	1				
lev	-0.150**	-0.075	-0.063	0.020	0.043	-0.105*	0.151**	-0.021	-0.245*	1			
liq	-0.033	-0.013	0.002	-0.043	0.079	-0.041	0.043	0.011	-0.065	-0.171**	1		
fsize	0.112**	0.408**	0.031	0.021	0.046	-0.120**	0.321**	-0.093*	0.030	0.168**	-0.005	1	
fage	0.076	0.143**	0.213**	0.185**	-0.148**	0.117**	0.055	-0.013	0.225**	0.217**	-0.103*	0.091*	1

*p < 0.05; **p < 0.01

5.3. Multivariate Analysis

Table 5 presents the results of the random effects regression models examining the association between IC, as measured by MVAIC, and firm performance, proxied by ROA in Model 1 and TQ in Model 2. The appropriateness of the random effects model was confirmed based on the results of the Hausman specification test.

In Model 1 (ROA), MVAIC exhibits a significant positive association with firm performance (coefficient = 2.1602, p < 0.01), indicating that higher IC enhances profitability. The interaction terms MVAIC × BSIZE (coefficient = 0.7647, p < 0.05) and MVAIC × BIND (coefficient = 0.9351, p < 0.01) are statistically significant, suggesting that larger board sizes and higher board independence amplify the positive effect of IC on ROA. Similarly, the interaction term MVAIC × BPERFORM (coefficient = 1.0942, p < 0.01) indicates that more frequent board meetings strengthen this relationship. In Model 2 (TQ), MVAIC is also positively associated with firm performance (coefficient = 3.5031, p < 0.01). The interaction terms MVAIC × BSIZE (coefficient = 0.8668, p < 0.01) and MVAIC × BIND (coefficient = 1.2228, p < 0.01) remain significant, reinforcing the moderating role of board size and independence. The interaction term MVAIC × BPERFORM (coefficient = 1.9351, p < 0.05) further underscores the positive moderating effect of board performance. However, board gender diversity did not exhibit a statistically significant moderating effect on the relationship between IC and firm performance.

Among the control variables, FSIZE and BIG4 show significant and positive effects on firm performance (Li et al., 2012; Vo & Tran, 2021; Xu & Liu, 2020), while LEV is negatively associated with both ROA and TQ (Vo & Tran, 2021). The overall explanatory power of the models is satisfactory, with R-squared values of 0.2728 for ROA and 0.4456 for TQ.

Table 5: Regression Result Using Random Effects Model

Variable	Model 1 (ROA)		Model 2 (TQ)	
	Coeff.	SE	Coeff.	SE
MVAIC	2.1602***	(0.2501)	3.5031***	(0.5093)
BSIZE	-0.1013	(0.8013)	0.1306	(0.1120)
MVAIC × BSIZE	0.7647**	(0.1046)	0.8668***	(0.8758)
BIND	-0.2117	(0.5263)	-0.5043	(1.1623)
MVAIC × BIND	0.9351***	(0.1702)	1.2228***	(0.9175)
BGD	-0.0190	(0.6220)	-0.2536	(1.0092)
MVAIC × BGD	0.0201	(0.7803)	0.0082	(0.8158)
BPERFORM	0.6017*	(0.6006)	0.7167	(0.0563)
MVAIC × BPERFORM	1.0942***	(0.4175)	1.9351**	(0.2006)
ACSIZE	0.2087*	(0.3038)	0.9696	(0.4142)
BIG4	0.0174**	(0.8065)	0.8107***	(0.6778)
LEV	-0.0723***	(0.2114)	-0.1641***	(1.0274)
LIQ	0.0019	(0.9659)	0.1002	(0.0811)

FSIZE	0.4063***	(0.6417)	2.4254***	(0.2795)
FAGE	0.0186	(0.8141)	1.3615*	(1.5158)
CONSTANT	0.1770	(0.9605)	9.3150	(5.9848)
Observations	588		588	
R-squared	0.2728		0.4456	
Wald chi^2	42.08***		31.10***	

*p < 0.10; **p < 0.05; ***p < 0.01

5.4 Robustness Test

To ensure the robustness of the baseline results, Table 6 employs alternative performance measures namely earnings per share (EPS) and price-earnings ratio (PE) as dependent variables. The coefficient of MVAIC remains positive and statistically significant across both models (β = 0.8803, p < 0.05 for EPS; β = 0.7440, p < 0.01 for PE) and thus, reaffirms the robustness of the IC–performance relationship. Consistent with prior findings, board size positively moderates this relationship. Similarly, the interactions between MVAIC and board independence are significant at the 1% level in both models. While board gender diversity remains insignificant, board performance exhibits a marginally significant moderating effect in the EPS model and a statistically significant effect in the PE model. These findings further validate the role of IC and board mechanisms in shaping financial outcomes.

Table 6: Robustness Test

Variable	Model 3 (EPS)		Model 4 (PE)	
	Coeff.	SE	Coeff.	SE
MVAIC	0.8803**	(0.2139)	0.7440***	(0.8910)
BSIZE	-0.1167	(0.4658)	-1.3753	(2.1944)
MVAIC × BSIZE	0.4013***	(0.5011)	1.6034**	(0.3154)
BIND	0.7197	(1.2892)	-0.3851	(2.3435)
MVAIC × BIND	0.9118***	(0.4269)	2.1143**	(0.4024)
BGD	-0.1548	(2.9081)	1.3343	(0.9762)
MVAIC × BGD	0.0030	(0.2238)	0.1052	(0.3247)
BPERFORM	-0.1332	(0.8823)	0.6716	(1.0404)
MVAIC × BPERFORM	0.4708*	(0.6489)	0.8831**	(0.0128)
ACSIZE	1.2899*	(0.5492)	1.0427	(1.6564)
BIG4	1.3647**	(0.9181)	1.4089***	(0.6489)
LEV	-1.3525**	(1.5017)	-2.5284*	(1.8734)
LIQ	-0.1660	(0.1197)	-1.7459*	(1.5943)
FSIZE	0.2308***	(0.3150)	2.8919***	(1.7015)
FAGE	2.5622	(1.7768)	1.5509	(1.6697)
CONSTANT	6.2896	(9.8162)	5.2280	(1.4058)
Observations	588		588	
R-squared	0.3821		0.2942	
Wald chi^2	23.96***		28.27***	

*p < 0.10; **p < 0.05; ***p < 0.01

5.5. Component-Wise Regression Analysis

Table 7 disaggregates MVAIC into its individual components namely HCE, SCE, RCE and CEE to explore their distinct impacts on firm performance. The results indicate that HCE and SCE are significantly and positively associated with both ROA and TQ which suggests that investments in employees and internal structures are critical drivers of value in emerging market firms. While RCE is not significant in the ROA model, it becomes positively significant in the TQ model, indicating a market-based recognition of external relational efforts. CEE also exhibits positive and statistically significant effects across both models which signifies the efficient use of capital resources as a determinant of firm success. Among the controls, firm size remains

consistently significant and positive, and audit quality exerts a favorable influence on market-based performance. Leverage continues to have a negative association with both performance measures.

Table 7: Component-wise Regression Results

Variable	Model 5 (ROA)		Model 6 (TQ)	
	Coeff.	SE	Coeff.	SE
HCE	0.4521***	(0.4261)	0.4041***	(0.2027)
SCE	0.7882**	(0.3436)	0.3368***	(0.6092)
RCE	0.3268	(0.7242)	1.0886*	(0.9933)
CCE	0.2110***	(0.2024)	0.4114**	(0.2217)
ACSIZE	0.1087*	(0.4736)	1.0752**	(0.4017)
BIG4	0.0153**	(0.7263)	0.8513*	(0.6754)
LEV	-0.1057***	(0.2132)	-0.9752***	(1.2343)
LIQ	0.5020	(0.8409)	0.1002	(0.0795)
FSIZE	0.9241***	(0.1220)	1.6456***	(0.2904)
FAGE	0.0205	(0.9197)	0.5689*	(0.4739)
CONSTANT	0.4333	(0.7618)	3.3459	(1.4616)
Observations	588		588	
R-squared	0.339		0.4443	
Wald chi^2	17.87***		29.22***	

*p < 0.10; **p < 0.05; ***p < 0.01

6. DISCUSSION

Based on the RBV, this study investigates the association between IC and firm performance, and examines how board characteristics moderate this relationship in the context of an emerging economy, Bangladesh. The findings provide strong support for the central proposition that IC serves as a critical intangible asset contributing to superior firm performance (Mondal & Ghosh, 2012; Smriti & Das, 2018; Vo & Tran, 2021).

The results from the random effects regression model demonstrate that MVAIC is positively and significantly associated with both accounting-based (ROA) and market-based (Tobin's Q) performance indicators. This supports Hypothesis H1a and aligns with the theoretical predictions of the RBV, affirming the strategic value of IC in enhancing firms' competitive positioning and financial outcomes (Ozkan et al., 2017; Xu & Liu, 2020). The robustness of this finding is further reinforced through alternative performance measures such as EPS and PE ratio which also exhibit significant positive relationships with MVAIC.

When disaggregating MVAIC into its core components, the study finds that HCE, SCE, and CEE are all significantly and positively related to firm performance, thus confirming Hypotheses H1b, H1c, and H1d. These results emphasize the multi-dimensional nature of IC and suggest that organizations benefit not only from the knowledge and skills of their employees (HCE) but also from the effectiveness of their internal systems (SCE) and the efficient utilization of physical and financial resources (CEE) (Shah et al., 2024; Ting et al., 2020; Wang et al., 2021). Although Relational Capital Efficiency (RCE) does not show a significant impact on accounting-based performance, its positive association with market-based measures suggests that investors and external stakeholders place value on firms' relationships and external engagement, thus partially supporting Hypothesis H1e.

Consistent with the second hypothesis, the results reveal that board characteristics significantly moderate the relationship between IC and firm performance. Specifically, the interaction terms between MVAIC and board size, board independence, and board performance are all positive and statistically significant. These findings suggest that effective governance mechanisms enhance the firm's ability to leverage its IC for performance gains (Kamath, 2019; Rositha et al., 2019). Larger boards may bring diverse expertise and oversight capabilities that strengthen the strategic deployment of IC. Similarly, independent directors may offer critical judgment and monitoring functions, ensuring that IC resources are managed efficiently and strategically (Al-Musalli & Ismail, 2012). The frequency of board meetings, as a proxy for board diligence and engagement, also strengthens the positive IC–performance link, supporting the view that more active boards contribute to better strategic alignment and decision-making regarding intangible assets (Mubaraq & Ahmed Haji, 2014).

Interestingly, the moderating effect of board gender diversity was not statistically significant in any of the models. This finding, which fails to support Hypothesis H2c, is in line with prior studies suggesting that gender diversity in many emerging market contexts may be symbolic or constrained by tokenism (Farooq & Ahmad, 2023; Okon Akpan, 2014). In Bangladesh, the low representation of women on boards may limit their ability to influence strategic outcomes such as IC utilization. While diversity remains an important goal for inclusive governance, its effectiveness as a moderating mechanism may depend on the depth of integration and participation of female directors in decision-making processes.

7. CONCLUSION

This study explores the relationship between intellectual capital (IC) and firm performance in the context of an emerging economy, with a particular focus on the moderating role of board characteristics. Grounded in the Resource-Based View (RBV), the study argues that IC, as a strategic intangible asset, contributes to sustained competitive advantage and superior performance of firms when effectively managed and supported by sound corporate governance mechanisms.

The empirical results, derived from a panel dataset of listed non-financial firms indicate a positive and significant association between IC and firm performance. Component-wise analysis reveals that human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE) all significantly enhance both accounting- and market-based performance, while relational capital efficiency (RCE) exhibits a limited effect. Furthermore, board characteristics namely board size, board independence, and board performance, positively moderate the IC–performance relationship. This highlights the role of governance structures in enhancing the effectiveness of IC deployment. However, no significant moderating effect is found for board gender diversity.

Theoretically, this study contributes to the IC and corporate governance literature by integrating the RBV framework into an emerging market context. It advances understanding of how intangible assets interact with internal governance mechanisms to influence firm outcomes. The findings emphasize the importance of viewing IC not as a stand-alone asset, but as a resource whose value is contingent on effective strategic and oversight mechanisms.

From a practical standpoint, the study offers valuable insights for a range of stakeholders. For corporate managers, the findings emphasize the importance of developing and managing IC particularly through investments in employee skills, innovation infrastructure, and efficient resource utilization, as a strategic priority to drive both financial and market performance. Firms are encouraged to embed IC considerations into strategic planning and performance evaluation frameworks. For corporate boards, the study highlights the need to play a more proactive role in overseeing IC development and alignment with organizational goals. Enhancing board independence, maintaining an optimal board size, and ensuring frequent, meaningful board engagements can strengthen IC-related decision-making and accountability. The insignificant moderating effect of board gender diversity suggests a need for policies to enhance the substantive participation of female directors, potentially through training or regulatory mandates

For policymakers and regulators, the results suggest the need for capacity-building initiatives that support firms in effectively measuring, reporting, and leveraging IC. Encouraging transparent IC disclosure and promoting board diversity, independence, and competence through governance reforms may strengthen overall firm competitiveness and investor confidence, particularly in emerging economies. Moreover, the findings are also relevant for investors and analysts who assess firm value and risk. Given the observed impact of IC on firm performance, especially when supported by robust governance, IC indicators could be incorporated into valuation models and investment screening processes.

Despite these contributions, the study is not without limitations. First, the use of MVAIC as a proxy for IC, while widely adopted, may not fully capture the complexity of intellectual resources, particularly in relation to innovation, knowledge processes, and dynamic capabilities. Second, the study relies on secondary data from a single country, which may limit the generalizability of the findings. Third, the analysis does not differentiate between industry sectors, which may exhibit varying levels of IC utilization and governance maturity.

Future research may address these limitations by exploring alternative measures of IC, such as green IC or innovation-based proxies. Longitudinal or qualitative studies may provide deeper insights into the dynamic processes through which IC is developed and leveraged over time. Additionally, comparative studies across countries or industry sectors could enrich understanding of the contextual factors that influence the IC–performance nexus.

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